SUMMARY TABLES OF PARTICLE PROPERTIES

Extracted from the Particle Listings of the
Review of Particle Physics
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GAUGE AND HIGGS BOSONS

γ

$I(J^{PC}) = 0,1(1^{--})$

Mass $m < 1 \times 10^{-18}$ eV
Charge $q < 1 \times 10^{-35}$ e
Mean life τ = Stable

g or gluon

$I(J^{P}) = 0(1^{-})$

Mass $m = 0$ [a]
SU(3) color octet

graviton

$J = 2$

Mass $m < 6 \times 10^{-32}$ eV

W

$J = 1$

Charge $= \pm 1$ e
Mass $m = 80.385 \pm 0.015$ GeV
$m_Z - m_W = 10.4 \pm 1.6$ GeV
$m_{W^+} - m_{W^-} = -0.2 \pm 0.6$ GeV
Full width $\Gamma = 2.085 \pm 0.042$ GeV
$\langle N_{\pi^\pm} \rangle = 15.70 \pm 0.35$
$\langle N_{K^\pm} \rangle = 2.20 \pm 0.19$
$\langle N_p \rangle = 0.92 \pm 0.14$
$\langle N_{\text{charged}} \rangle = 19.39 \pm 0.08$

W^- modes are charge conjugates of the modes below.

W^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\ell^+\nu$	[b]	(10.86 ± 0.09) %		–
$e^+\nu$		(10.71 ± 0.16) %		40192
$\mu^+\nu$		(10.63 ± 0.15) %		40192
$\tau^+\nu$		(11.38 ± 0.21) %		40173
hadrons		(67.41 ± 0.27) %		–

$\pi^+\gamma$		< 7	$\times 10^{-5}$	95%	40192
$D_s^+\gamma$		< 1.3	$\times 10^{-3}$	95%	40168
cX		(33.3 ± 2.6) %			–
$c\overline{s}$		(31 $^{+13}_{-11}$) %			–
invisible	[c]	(1.4 ± 2.9) %			–

Z

$J = 1$

Charge = 0
Mass $m = 91.1876 \pm 0.0021$ GeV [d]
Full width $\Gamma = 2.4952 \pm 0.0023$ GeV
$\Gamma(\ell^+\ell^-) = 83.984 \pm 0.086$ MeV [b]
$\Gamma(\text{invisible}) = 499.0 \pm 1.5$ MeV [e]
$\Gamma(\text{hadrons}) = 1744.4 \pm 2.0$ MeV
$\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-) = 1.0009 \pm 0.0028$
$\Gamma(\tau^+\tau^-)/\Gamma(e^+e^-) = 1.0019 \pm 0.0032$ [f]

Average charged multiplicity

$\langle N_{charged} \rangle = 20.76 \pm 0.16$ (S = 2.1)

Couplings to quarks and leptons

$g_V^\ell = -0.03783 \pm 0.00041$
$g_V^u = 0.25^{+0.07}_{-0.06}$
$g_V^d = -0.33^{+0.05}_{-0.06}$
$g_A^\ell = -0.50123 \pm 0.00026$
$g_A^u = 0.50^{+0.04}_{-0.06}$
$g_A^d = -0.523^{+0.050}_{-0.029}$
$g^{\nu_\ell} = 0.5008 \pm 0.0008$
$g^{\nu_e} = 0.53 \pm 0.09$
$g^{\nu_\mu} = 0.502 \pm 0.017$

Asymmetry parameters [g]

$A_e = 0.1515 \pm 0.0019$
$A_\mu = 0.142 \pm 0.015$
$A_\tau = 0.143 \pm 0.004$
$A_s = 0.90 \pm 0.09$
$A_c = 0.670 \pm 0.027$
$A_b = 0.923 \pm 0.020$

Charge asymmetry (%) at Z pole

$A_{FB}^{(0\ell)} = 1.71 \pm 0.10$
$A_{FB}^{(0u)} = 4 \pm 7$
$A_{FB}^{(0s)} = 9.8 \pm 1.1$
$A_{FB}^{(0c)} = 7.07 \pm 0.35$
$A_{FB}^{(0b)} = 9.92 \pm 0.16$

Z DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
e^+e^-		(3.363 ±0.004) %		45594
$\mu^+\mu^-$		(3.366 ±0.007) %		45594
$\tau^+\tau^-$		(3.370 ±0.008) %		45559
$\ell^+\ell^-$	[b]	(3.3658±0.0023) %		–

$\ell^+\ell^-\ell^+\ell^-$		[h]	(4.2	$^{+0.9}_{-0.8}$	) $\times 10^{-6}$		45594
invisible			(20.00	±0.06	) %		–
hadrons			(69.91	±0.06	) %		–
$(u\overline{u}+c\overline{c})/2$			(11.6	±0.6	) %		–
$(d\overline{d}+s\overline{s}+b\overline{b})/3$			(15.6	±0.4	) %		–
$c\overline{c}$			(12.03	±0.21	) %		–
$b\overline{b}$			(15.12	±0.05	) %		–
$b\overline{b}b\overline{b}$			(3.6	±1.3	) $\times 10^{-4}$		–
ggg			< 1.1		%	CL=95%	–
$\pi^0\gamma$			< 5.2		$\times 10^{-5}$	CL=95%	45594
$\eta\gamma$			< 5.1		$\times 10^{-5}$	CL=95%	45592
$\omega\gamma$			< 6.5		$\times 10^{-4}$	CL=95%	45590
$\eta'(958)\gamma$			< 4.2		$\times 10^{-5}$	CL=95%	45589
$\gamma\gamma$			< 5.2		$\times 10^{-5}$	CL=95%	45594
$\gamma\gamma\gamma$			< 1.0		$\times 10^{-5}$	CL=95%	45594
$\pi^\pm W^\mp$		[i]	< 7		$\times 10^{-5}$	CL=95%	10162
$\rho^\pm W^\mp$		[i]	< 8.3		$\times 10^{-5}$	CL=95%	10136
$J/\psi(1S)$X			(3.51	$^{+0.23}_{-0.25}$	) $\times 10^{-3}$	S=1.1	–
$\psi(2S)$X			(1.60	±0.29	) $\times 10^{-3}$		–
$\chi_{c1}(1P)$X			(2.9	±0.7	) $\times 10^{-3}$		–
$\chi_{c2}(1P)$X			< 3.2		$\times 10^{-3}$	CL=90%	–
$\Upsilon(1S)$ X + $\Upsilon(2S)$ X + $\Upsilon(3S)$ X			(1.0	±0.5	) $\times 10^{-4}$		–
$\Upsilon(1S)$X			< 4.4		$\times 10^{-5}$	CL=95%	–
$\Upsilon(2S)$X			< 1.39		$\times 10^{-4}$	CL=95%	–
$\Upsilon(3S)$X			< 9.4		$\times 10^{-5}$	CL=95%	–
$(D^0/\overline{D}^0)$ X			(20.7	±2.0	) %		–
$D^\pm$X			(12.2	±1.7	) %		–
$D^*(2010)^\pm$X		[i]	(11.4	±1.3	) %		–
$D_{s1}(2536)^\pm$X			(3.6	±0.8	) $\times 10^{-3}$		–
$D_{sJ}(2573)^\pm$X			(5.8	±2.2	) $\times 10^{-3}$		–
$D^{*\prime}(2629)^\pm$X			searched for				–
B^+X		[j]	(6.08	±0.13	) %		–
B^0_sX		[j]	(1.59	±0.13	) %		–
B^+_cX			searched for				–
Λ^+_cX			(1.54	±0.33	) %		–
Ξ^0_cX			seen				–
Ξ_bX			seen				–
b-baryon X		[j]	(1.38	±0.22	) %		–
anomalous γ+ hadrons		[k]	< 3.2		$\times 10^{-3}$	CL=95%	–
$e^+e^-\gamma$		[k]	< 5.2		$\times 10^{-4}$	CL=95%	45594
$\mu^+\mu^-\gamma$		[k]	< 5.6		$\times 10^{-4}$	CL=95%	45594
$\tau^+\tau^-\gamma$		[k]	< 7.3		$\times 10^{-4}$	CL=95%	45559
$\ell^+\ell^-\gamma\gamma$		[l]	< 6.8		$\times 10^{-6}$	CL=95%	–
$q\overline{q}\gamma\gamma$		[l]	< 5.5		$\times 10^{-6}$	CL=95%	–
$\nu\overline{\nu}\gamma\gamma$		[l]	< 3.1		$\times 10^{-6}$	CL=95%	45594
$e^\pm\mu^\mp$	LF	[i]	< 1.7		$\times 10^{-6}$	CL=95%	45594
$e^\pm\tau^\mp$	LF	[i]	< 9.8		$\times 10^{-6}$	CL=95%	45576
$\mu^\pm\tau^\mp$	LF	[i]	< 1.2		$\times 10^{-5}$	CL=95%	45576
pe	L,B		< 1.8		$\times 10^{-6}$	CL=95%	45589
$p\mu$	L,B		< 1.8		$\times 10^{-6}$	CL=95%	45589

H^0 $J = 0$

Mass $m = 125.7 \pm 0.4$ GeV

H^0 Signal Strengths in Different Channels

Combined Final States $= 1.17 \pm 0.17$ (S = 1.2)
$WW^* = 0.87^{+0.24}_{-0.22}$
$ZZ^* = 1.11^{+0.34}_{-0.28}$ (S = 1.3)
$\gamma\gamma = 1.58^{+0.27}_{-0.23}$
$b\overline{b} = 1.1 \pm 0.5$
$\tau^+\tau^- = 0.4 \pm 0.6$
$Z\gamma <$ 9.5, CL = 95%

Neutral Higgs Bosons, Searches for

Searches for a Higgs Boson with Standard Model Couplings

Mass $m >$ 122 and none 128–710 GeV, CL = 95%

The limits for H_1^0 and A^0 in supersymmetric models refer to the $m_h^{\max}$ benchmark scenario for the supersymmetric parameters.

H_1^0 in Supersymmetric Models ($m_{H_1^0} < m_{H_2^0}$)

Mass $m >$ 92.8 GeV, CL = 95%

A^0 Pseudoscalar Higgs Boson in Supersymmetric Models [n]

Mass $m >$ 93.4 GeV, CL = 95% $\tan\beta > 0.4$

Charged Higgs Bosons ($H^\pm$ and $H^{\pm\pm}$), Searches for

$H^\pm$ Mass $m >$ 80 GeV, CL = 95%

New Heavy Bosons (W', Z', leptoquarks, etc.), Searches for

Additional W Bosons

W' with standard couplings
Mass $m > 2.900 \times 10^3$ GeV, CL = 95% ($p\,p$ direct search)
W_R (Right-handed W Boson)
Mass $m >$ 715 GeV, CL = 90% (electroweak fit)

Additional Z Bosons

Z'_{SM} with standard couplings

Mass $m > 2.590 \times 10^3$ GeV, CL = 95% (pp direct search)

Mass $m > 1.500 \times 10^3$ GeV, CL = 95% (electroweak fit)

Z_{LR} of $SU(2)_L \times SU(2)_R \times U(1)$ (with $g_L = g_R$)

Mass $m > 630$ GeV, CL = 95% ($p\overline{p}$ direct search)

Mass $m > 1162$ GeV, CL = 95% (electroweak fit)

Z_χ of $SO(10) \rightarrow SU(5) \times U(1)_\chi$ (with $g_\chi = e/\cos\theta_W$)

Mass $m > 1.970 \times 10^3$ GeV, CL = 95% (pp direct search)

Mass $m > 1.141 \times 10^3$ GeV, CL = 95% (electroweak fit)

Z_ψ of $E_6 \rightarrow SO(10) \times U(1)_\psi$ (with $g_\psi = e/\cos\theta_W$)

Mass $m > 2.260 \times 10^3$ GeV, CL = 95% (pp direct search)

Mass $m > 476$ GeV, CL = 95% (electroweak fit)

Z_η of $E_6 \rightarrow SU(3) \times SU(2) \times U(1) \times U(1)_\eta$ (with $g_\eta = e/\cos\theta_W$)

Mass $m > 1.870 \times 10^3$ GeV, CL = 95% (pp direct search)

Mass $m > 619$ GeV, CL = 95% (electroweak fit)

Scalar Leptoquarks

Mass $m > 830$ GeV, CL = 95% (1st generation, pair prod.)

Mass $m > 304$ GeV, CL = 95% (1st gener., single prod.)

Mass $m > 840$ GeV, CL = 95% (2nd gener., pair prod.)

Mass $m > 73$ GeV, CL = 95% (2nd gener., single prod.)

Mass $m > 525$ GeV, CL = 95% (3rd gener., pair prod.)

(See the Particle Listings in the Full *Review of Particle Physics* for assumptions on leptoquark quantum numbers and branching fractions.)

Diquarks

Mass $m > 3.750 \times 10^3$ GeV, CL = 95%

Axigluon

Mass $m > 3.360 \times 10^3$ GeV, CL = 95%

Axions (A^0) and Other Very Light Bosons, Searches for

The standard Peccei-Quinn axion is ruled out. Variants with reduced couplings or much smaller masses are constrained by various data. The Particle Listings in the full *Review* contain a Note discussing axion searches.

The best limit for the half-life of neutrinoless double beta decay with Majoron emission is $> 7.2 \times 10^{24}$ years (CL = 90%).

NOTES

In this Summary Table:

When a quantity has "(S = ...)" to its right, the error on the quantity has been enlarged by the "scale factor" S, defined as $S = \sqrt{\chi^2/(N-1)}$, where N is the number of measurements used in calculating the quantity. We do this when $S > 1$, which often indicates that the measurements are inconsistent. When $S > 1.25$, we also show in the Particle Listings an ideogram of the measurements. For more about S, see the Introduction.

A decay momentum p is given for each decay mode. For a 2-body decay, p is the momentum of each decay product in the rest frame of the decaying particle. For a 3-or-more-body decay, p is the largest momentum any of the products can have in this frame.

[*a*] Theoretical value. A mass as large as a few MeV may not be precluded.

[*b*] ℓ indicates each type of lepton (e, μ, and τ), not sum over them.

[*c*] This represents the width for the decay of the W boson into a charged particle with momentum below detectability, p< 200 MeV.

[*d*] The Z-boson mass listed here corresponds to a Breit-Wigner resonance parameter. It lies approximately 34 MeV above the real part of the position of the pole (in the energy-squared plane) in the Z-boson propagator.

[*e*] This partial width takes into account Z decays into $\nu\overline{\nu}$ and any other possible undetected modes.

[*f*] This ratio has not been corrected for the τ mass.

[*g*] Here $A \equiv 2g_Vg_A/(g_V^2+g_A^2)$.

[*h*] Here ℓ indicates e or μ.

[*i*] The value is for the sum of the charge states or particle/antiparticle states indicated.

[*j*] This value is updated using the product of (i) the $Z \to b\overline{b}$ fraction from this listing and (ii) the b-hadron fraction in an unbiased sample of weakly decaying b-hadrons produced in Z-decays provided by the Heavy Flavor Averaging Group (HFAG, http://www.slac.stanford.edu/xorg/hfag/osc/PDG_2009/#FRACZ).

[*k*] See the Z Particle Listings in the Full *Review of Particle Physics* for the γ energy range used in this measurement.

[*l*] For $m_{\gamma\gamma} = (60 \pm 5)$ GeV.

[*n*] The limits assume no invisible decays.

LEPTONS

e

$J = \frac{1}{2}$

Mass $m = (548.57990946 \pm 0.00000022) \times 10^{-6}$ u
Mass $m = 0.510998928 \pm 0.000000011$ MeV
$|m_{e^+} - m_{e^-}|/m < 8 \times 10^{-9}$, CL = 90%
$|q_{e^+} + q_{e^-}|/e < 4 \times 10^{-8}$
Magnetic moment anomaly
$(g-2)/2 = (1159.65218076 \pm 0.00000027) \times 10^{-6}$
$(g_{e^+} - g_{e^-}) / g_{\text{average}} = (-0.5 \pm 2.1) \times 10^{-12}$
Electric dipole moment $d < 10.5 \times 10^{-28}$ e cm, CL = 90%
Mean life $\tau > 4.6 \times 10^{26}$ yr, CL = 90% [a]

μ

$J = \frac{1}{2}$

Mass $m = 0.1134289267 \pm 0.0000000029$ u
Mass $m = 105.6583715 \pm 0.0000035$ MeV
Mean life $\tau = (2.1969811 \pm 0.0000022) \times 10^{-6}$ s
$\tau_{\mu^+}/\tau_{\mu^-} = 1.00002 \pm 0.00008$
$c\tau = 658.6384$ m
Magnetic moment anomaly $(g-2)/2 = (11659209 \pm 6) \times 10^{-10}$
$(g_{\mu^+} - g_{\mu^-}) / g_{\text{average}} = (-0.11 \pm 0.12) \times 10^{-8}$
Electric dipole moment $d = (-0.1 \pm 0.9) \times 10^{-19}$ e cm

Decay parameters [b]

$\rho = 0.74979 \pm 0.00026$
$\eta = 0.057 \pm 0.034$
$\delta = 0.75047 \pm 0.00034$
$\xi P_\mu = 1.0009^{+0.0016}_{-0.0007}$ [c]
$\xi P_\mu \delta/\rho = 1.0018^{+0.0016}_{-0.0007}$ [c]
$\xi' = 1.00 \pm 0.04$
$\xi'' = 0.7 \pm 0.4$
$\alpha/A = (0 \pm 4) \times 10^{-3}$
$\alpha'/A = (-10 \pm 20) \times 10^{-3}$
$\beta/A = (4 \pm 6) \times 10^{-3}$
$\beta'/A = (2 \pm 7) \times 10^{-3}$
$\overline{\eta} = 0.02 \pm 0.08$

μ^+ modes are charge conjugates of the modes below.

μ^- DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^- \overline{\nu}_e \nu_\mu$		$\approx 100\%$		53
$e^- \overline{\nu}_e \nu_\mu \gamma$		[d] (1.4±0.4) %		53
$e^- \overline{\nu}_e \nu_\mu e^+ e^-$		[e] $(3.4 \pm 0.4) \times 10^{-5}$		53
Lepton Family number (LF) violating modes				
$e^- \nu_e \overline{\nu}_\mu$	LF	[f] < 1.2 %	90%	53
$e^- \gamma$	LF	$< 5.7 \times 10^{-13}$	90%	53
$e^- e^+ e^-$	LF	$< 1.0 \times 10^{-12}$	90%	53
$e^- 2\gamma$	LF	$< 7.2 \times 10^{-11}$	90%	53

τ

$J = \frac{1}{2}$

Mass $m = 1776.82 \pm 0.16$ MeV
$(m_{\tau^+} - m_{\tau^-})/m_{\text{average}} < 2.8 \times 10^{-4}$, CL = 90%
Mean life $\tau = (290.3 \pm 0.5) \times 10^{-15}$ s
$c\tau = 87.03$ μm
Magnetic moment anomaly > -0.052 and < 0.013, CL = 95%
$\text{Re}(d_\tau) = -0.220$ to 0.45×10^{-16} e cm, CL = 95%
$\text{Im}(d_\tau) = -0.250$ to 0.0080×10^{-16} e cm, CL = 95%

Weak dipole moment

$\text{Re}(d_\tau^w) < 0.50 \times 10^{-17}$ e cm, CL = 95%
$\text{Im}(d_\tau^w) < 1.1 \times 10^{-17}$ e cm, CL = 95%

Weak anomalous magnetic dipole moment

$\text{Re}(\alpha_\tau^w) < 1.1 \times 10^{-3}$, CL = 95%
$\text{Im}(\alpha_\tau^w) < 2.7 \times 10^{-3}$, CL = 95%
$\tau^\pm \to \pi^\pm K_S^0 \nu_\tau$ (RATE DIFFERENCE) / (RATE SUM) = (-0.36 ± 0.25)%

Decay parameters

See the τ Particle Listings in the Full *Review of Particle Physics* for a note concerning τ-decay parameters.

$\rho(e \text{ or } \mu) = 0.745 \pm 0.008$
$\rho(e) = 0.747 \pm 0.010$
$\rho(\mu) = 0.763 \pm 0.020$
$\xi(e \text{ or } \mu) = 0.985 \pm 0.030$
$\xi(e) = 0.994 \pm 0.040$
$\xi(\mu) = 1.030 \pm 0.059$
$\eta(e \text{ or } \mu) = 0.013 \pm 0.020$
$\eta(\mu) = 0.094 \pm 0.073$
$(\delta\xi)(e \text{ or } \mu) = 0.746 \pm 0.021$
$(\delta\xi)(e) = 0.734 \pm 0.028$
$(\delta\xi)(\mu) = 0.778 \pm 0.037$
$\xi(\pi) = 0.993 \pm 0.022$
$\xi(\rho) = 0.994 \pm 0.008$
$\xi(a_1) = 1.001 \pm 0.027$
$\xi(\text{all hadronic modes}) = 0.995 \pm 0.007$

τ^+ modes are charge conjugates of the modes below. "$h^\pm$" stands for $\pi^\pm$ or $K^\pm$. "ℓ" stands for e or μ. "Neutrals" stands for γ's and/or π^0's.

τ^- DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Modes with one charged particle				
particle$^- \geq 0$ neutrals $\geq 0 K^0 \nu_\tau$ ("1-prong")		(85.35 $\pm$0.07) %	S=1.3	–
particle$^- \geq 0$ neutrals $\geq 0 K_L^0 \nu_\tau$		(84.71 $\pm$0.08) %	S=1.3	–
$\mu^- \overline{\nu}_\mu \nu_\tau$	[g]	(17.41 $\pm$0.04) %	S=1.1	885
$\mu^- \overline{\nu}_\mu \nu_\tau \gamma$	[e]	(3.6 $\pm$0.4) $\times 10^{-3}$		885
$e^- \overline{\nu}_e \nu_\tau$	[g]	(17.83 $\pm$0.04) %		888
$e^- \overline{\nu}_e \nu_\tau \gamma$	[e]	(1.75 $\pm$0.18) %		888
$h^- \geq 0 K_L^0 \nu_\tau$		(12.06 $\pm$0.06) %	S=1.2	883
$h^- \nu_\tau$		(11.53 $\pm$0.06) %	S=1.2	883

$\pi^- \nu_\tau$	[g]	(10.83 ±0.06) %		S=1.2	883
$K^- \nu_\tau$	[g]	(7.00 ±0.10) $\times 10^{-3}$		S=1.1	820
$h^- \geq 1$ neutrals ν_τ		(37.10 ±0.10) %		S=1.2	–
$h^- \geq 1\pi^0 \nu_\tau$ (ex. K^0)		(36.58 ±0.10) %		S=1.2	–
$h^- \pi^0 \nu_\tau$		(25.95 ±0.09) %		S=1.1	878
$\pi^- \pi^0 \nu_\tau$	[g]	(25.52 ±0.09) %		S=1.1	878
$\pi^- \pi^0$ non-$\rho(770) \nu_\tau$		(3.0 ±3.2) $\times 10^{-3}$			878
$K^- \pi^0 \nu_\tau$	[g]	(4.29 ±0.15) $\times 10^{-3}$			814
$h^- \geq 2\pi^0 \nu_\tau$		(10.87 ±0.11) %		S=1.2	–
$h^- 2\pi^0 \nu_\tau$		(9.52 ±0.11) %		S=1.1	862
$h^- 2\pi^0 \nu_\tau$ (ex. K^0)		(9.36 ±0.11) %		S=1.2	862
$\pi^- 2\pi^0 \nu_\tau$ (ex. K^0)	[g]	(9.30 ±0.11) %		S=1.2	862
$\pi^- 2\pi^0 \nu_\tau$ (ex. K^0), scalar		< 9	$\times 10^{-3}$	CL=95%	862
$\pi^- 2\pi^0 \nu_\tau$ (ex. K^0), vector		< 7	$\times 10^{-3}$	CL=95%	862
$K^- 2\pi^0 \nu_\tau$ (ex. K^0)	[g]	(6.5 ±2.3) $\times 10^{-4}$			796
$h^- \geq 3\pi^0 \nu_\tau$		(1.35 ±0.07) %		S=1.1	–
$h^- \geq 3\pi^0 \nu_\tau$ (ex. K^0)		(1.26 ±0.07) %		S=1.1	–
$h^- 3\pi^0 \nu_\tau$		(1.19 ±0.07) %			836
$\pi^- 3\pi^0 \nu_\tau$ (ex. K^0)	[g]	(1.05 ±0.07) %			836
$K^- 3\pi^0 \nu_\tau$ (ex. K^0, η)	[g]	(4.8 ±2.2) $\times 10^{-4}$			765
$h^- 4\pi^0 \nu_\tau$ (ex. K^0)		(1.6 ±0.4) $\times 10^{-3}$			800
$h^- 4\pi^0 \nu_\tau$ (ex. K^0, η)	[g]	(1.1 ±0.4) $\times 10^{-3}$			800
$K^- \geq 0\pi^0 \geq 0K^0 \geq 0\gamma \nu_\tau$		(1.572±0.033) %		S=1.1	820
$K^- \geq 1$ (π^0 or K^0 or γ) ν_τ		(8.72 ±0.32) $\times 10^{-3}$		S=1.1	–
Modes with K^0's					
K^0_S (particles)$^- \nu_\tau$		(9.2 ±0.4) $\times 10^{-3}$		S=1.5	–
$h^- \overline{K}^0 \nu_\tau$		(1.00 ±0.05) %		S=1.8	812
$\pi^- \overline{K}^0 \nu_\tau$	[g]	(8.4 ±0.4) $\times 10^{-3}$		S=2.1	812
$\pi^- \overline{K}^0$ (non-$K^*(892)^-$) ν_τ		(5.4 ±2.1) $\times 10^{-4}$			812
$K^- K^0 \nu_\tau$	[g]	(1.59 ±0.16) $\times 10^{-3}$			737
$K^- K^0 \geq 0\pi^0 \nu_\tau$		(3.18 ±0.23) $\times 10^{-3}$			737
$h^- \overline{K}^0 \pi^0 \nu_\tau$		(5.6 ±0.4) $\times 10^{-3}$			794
$\pi^- \overline{K}^0 \pi^0 \nu_\tau$	[g]	(4.0 ±0.4) $\times 10^{-3}$			794
$\overline{K}^0 \rho^- \nu_\tau$		(2.2 ±0.5) $\times 10^{-3}$			612
$K^- K^0 \pi^0 \nu_\tau$	[g]	(1.59 ±0.20) $\times 10^{-3}$			685
$\pi^- \overline{K}^0 \geq 1\pi^0 \nu_\tau$		(3.2 ±1.0) $\times 10^{-3}$			–
$\pi^- \overline{K}^0 \pi^0 \pi^0 \nu_\tau$		(2.6 ±2.4) $\times 10^{-4}$			763
$K^- K^0 \pi^0 \pi^0 \nu_\tau$		< 1.6	$\times 10^{-4}$	CL=95%	619
$\pi^- K^0 \overline{K}^0 \nu_\tau$		(1.7 ±0.4) $\times 10^{-3}$		S=1.8	682
$\pi^- K^0_S K^0_S \nu_\tau$	[g]	(2.31 ±0.17) $\times 10^{-4}$		S=1.9	682
$\pi^- K^0_S K^0_L \nu_\tau$	[g]	(1.2 ±0.4) $\times 10^{-3}$		S=1.8	682
$\pi^- K^0 \overline{K}^0 \pi^0 \nu_\tau$		(3.1 ±2.3) $\times 10^{-4}$			614
$\pi^- K^0_S K^0_S \pi^0 \nu_\tau$		(1.60 ±0.30) $\times 10^{-4}$			614
$\pi^- K^0_S K^0_L \pi^0 \nu_\tau$		(3.1 ±1.2) $\times 10^{-4}$			614
$K^- K^0_S K^0_S \nu_\tau$		< 6.3	$\times 10^{-7}$	CL=90%	466
$K^- K^0_S K^0_S \pi^0 \nu_\tau$		< 4.0	$\times 10^{-7}$	CL=90%	337
$K^0 h^+ h^- h^- \geq 0$ neutrals ν_τ		< 1.7	$\times 10^{-3}$	CL=95%	760
$K^0 h^+ h^- h^- \nu_\tau$		(2.3 ±2.0) $\times 10^{-4}$			760

Modes with three charged particles

$h^-h^-h^+ \geq 0$ neutrals $\geq 0K^0_L\nu_\tau$		(15.20 ±0.08) %		S=1.3	861
$h^-h^-h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^+\pi^-$) ("3-prong")		(14.57 ±0.07) %		S=1.3	861
$h^-h^-h^+\nu_\tau$		(9.80 ±0.07) %		S=1.2	861
$h^-h^-h^+\nu_\tau$ (ex.K^0)		(9.46 ±0.06) %		S=1.2	861
$h^-h^-h^+\nu_\tau$ (ex.K^0,ω)		(9.42 ±0.06) %		S=1.2	861
$\pi^-\pi^+\pi^-\nu_\tau$		(9.31 ±0.06) %		S=1.2	861
$\pi^-\pi^+\pi^-\nu_\tau$ (ex.K^0)		(9.02 ±0.06) %		S=1.1	861
$\pi^-\pi^+\pi^-\nu_\tau$ (ex.K^0), non-axial vector		< 2.4	%	CL=95%	861
$\pi^-\pi^+\pi^-\nu_\tau$ (ex.K^0,ω)	[g]	(8.99 ±0.06) %		S=1.1	861
$h^-h^-h^+ \geq 1$ neutrals ν_τ		(5.39 ±0.07) %		S=1.2	–
$h^-h^-h^+ \geq 1\pi^0\nu_\tau$ (ex. K^0)		(5.09 ±0.06) %		S=1.2	–
$h^-h^-h^+\pi^0\nu_\tau$		(4.76 ±0.06) %		S=1.2	834
$h^-h^-h^+\pi^0\nu_\tau$ (ex.K^0)		(4.57 ±0.06) %		S=1.2	834
$h^-h^-h^+\pi^0\nu_\tau$ (ex. K^0, ω)		(2.79 ±0.08) %		S=1.2	834
$\pi^-\pi^+\pi^-\pi^0\nu_\tau$		(4.62 ±0.06) %		S=1.2	834
$\pi^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0)		(4.48 ±0.06) %		S=1.2	834
$\pi^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0,ω)	[g]	(2.70 ±0.08) %		S=1.2	834
$h^-h^-h^+ \geq 2\pi^0\nu_\tau$ (ex. K^0)		(5.21 ±0.32)	$\times 10^{-3}$		–
$h^-h^-h^+2\pi^0\nu_\tau$		(5.08 ±0.32)	$\times 10^{-3}$		797
$h^-h^-h^+2\pi^0\nu_\tau$ (ex.K^0)		(4.98 ±0.32)	$\times 10^{-3}$		797
$h^-h^-h^+2\pi^0\nu_\tau$ (ex.K^0,ω,η)	[g]	(1.0 ±0.4)	$\times 10^{-3}$		797
$h^-h^-h^+3\pi^0\nu_\tau$	[g]	(2.3 ±0.6)	$\times 10^{-4}$	S=1.2	749
$2\pi^-\pi^+3\pi^0\nu_\tau$ (ex.K^0)		(2.1 ±0.4)	$\times 10^{-4}$		749
$2\pi^-\pi^+3\pi^0\nu_\tau$ (ex.K^0, η, $f_1(1285)$)		(1.7 ±0.4)	$\times 10^{-4}$		–
$2\pi^-\pi^+3\pi^0\nu_\tau$ (ex.K^0, η, ω, $f_1(1285)$)		< 5.8	$\times 10^{-5}$	CL=90%	–
$K^-h^+h^- \geq 0$ neutrals ν_τ		(6.35 ±0.24)	$\times 10^{-3}$	S=1.5	794
$K^-h^+\pi^-\nu_\tau$ (ex.K^0)		(4.38 ±0.19)	$\times 10^{-3}$	S=2.7	794
$K^-h^+\pi^-\pi^0\nu_\tau$ (ex.K^0)		(8.7 ±1.2)	$\times 10^{-4}$	S=1.1	763
$K^-\pi^+\pi^- \geq 0$ neutrals ν_τ		(4.85 ±0.21)	$\times 10^{-3}$	S=1.4	794
$K^-\pi^+\pi^- \geq 0\pi^0\nu_\tau$ (ex.K^0)		(3.75 ±0.19)	$\times 10^{-3}$	S=1.5	794
$K^-\pi^+\pi^-\nu_\tau$		(3.49 ±0.16)	$\times 10^{-3}$	S=1.9	794
$K^-\pi^+\pi^-\nu_\tau$ (ex.K^0)	[g]	(2.94 ±0.15)	$\times 10^{-3}$	S=2.2	794
$K^-\rho^0\nu_\tau \to K^-\pi^+\pi^-\nu_\tau$		(1.4 ±0.5)	$\times 10^{-3}$		–
$K^-\pi^+\pi^-\pi^0\nu_\tau$		(1.35 ±0.14)	$\times 10^{-3}$		763
$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0)		(8.1 ±1.2)	$\times 10^{-4}$		763
$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0,η)	[g]	(7.8 ±1.2)	$\times 10^{-4}$		763
$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex.K^0,ω)		(3.7 ±0.9)	$\times 10^{-4}$		763
$K^-\pi^+K^- \geq 0$ neut. ν_τ		< 9	$\times 10^{-4}$	CL=95%	685
$K^-K^+\pi^- \geq 0$ neut. ν_τ		(1.50 ±0.06)	$\times 10^{-3}$	S=1.8	685
$K^-K^+\pi^-\nu_\tau$	[g]	(1.44 ±0.05)	$\times 10^{-3}$	S=1.9	685
$K^-K^+\pi^-\pi^0\nu_\tau$	[g]	(6.1 ±2.5)	$\times 10^{-5}$	S=1.4	618
$K^-K^+K^-\nu_\tau$		(2.1 ±0.8)	$\times 10^{-5}$	S=5.4	471
$K^-K^+K^-\nu_\tau$ (ex. ϕ)		< 2.5	$\times 10^{-6}$	CL=90%	–
$K^-K^+K^-\pi^0\nu_\tau$		< 4.8	$\times 10^{-6}$	CL=90%	345
$\pi^-K^+\pi^- \geq 0$ neut. ν_τ		< 2.5	$\times 10^{-3}$	CL=95%	794
$e^-e^-e^+\overline{\nu}_e\nu_\tau$		(2.8 ±1.5)	$\times 10^{-5}$		888
$\mu^-e^-e^+\overline{\nu}_\mu\nu_\tau$		< 3.6	$\times 10^{-5}$	CL=90%	885

Modes with five charged particles

$3h^-2h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^-\pi^+$) ("5-prong")		$(1.02 \pm 0.04) \times 10^{-3}$		S=1.1	794
$3h^-2h^+\nu_\tau$ (ex.K^0)	[g]	$(8.39 \pm 0.35) \times 10^{-4}$		S=1.1	794
$3\pi^-2\pi^+\nu_\tau$ (ex.K^0, ω)		$(8.3 \pm 0.4) \times 10^{-4}$			794
$3\pi^-2\pi^+\nu_\tau$ (ex.K^0, ω, $f_1(1285)$)		$(7.7 \pm 0.4) \times 10^{-4}$			–
$K^-2\pi^-2\pi^+\nu_\tau$		$< 2.4 \times 10^{-6}$		CL=90%	715
$K^+3\pi^-\pi^+\nu_\tau$		$< 5.0 \times 10^{-6}$		CL=90%	715
$K^+K^-2\pi^-\pi^+\nu_\tau$		$< 4.5 \times 10^{-7}$		CL=90%	528
$3h^-2h^+\pi^0\nu_\tau$ (ex.K^0)	[g]	$(1.78 \pm 0.27) \times 10^{-4}$			746
$3\pi^-2\pi^+\pi^0\nu_\tau$ (ex.K^0)		$(1.65 \pm 0.10) \times 10^{-4}$			746
$3\pi^-2\pi^+\pi^0\nu_\tau$ (ex.K^0, η, $f_1(1285)$)		$(1.11 \pm 0.10) \times 10^{-4}$			–
$3\pi^-2\pi^+\pi^0\nu_\tau$ (ex.K^0, η, ω, $f_1(1285)$)		$(3.6 \pm 0.9) \times 10^{-5}$			–
$K^-2\pi^-2\pi^+\pi^0\nu_\tau$		$< 1.9 \times 10^{-6}$		CL=90%	657
$K^+3\pi^-\pi^+\pi^0\nu_\tau$		$< 8 \times 10^{-7}$		CL=90%	657
$3h^-2h^+2\pi^0\nu_\tau$		$< 3.4 \times 10^{-6}$		CL=90%	687

Miscellaneous other allowed modes

$(5\pi)^-\nu_\tau$		$(7.6 \pm 0.5) \times 10^{-3}$			800
$4h^-3h^+ \geq 0$ neutrals ν_τ ("7-prong")		$< 3.0 \times 10^{-7}$		CL=90%	682
$4h^-3h^+\nu_\tau$		$< 4.3 \times 10^{-7}$		CL=90%	682
$4h^-3h^+\pi^0\nu_\tau$		$< 2.5 \times 10^{-7}$		CL=90%	612
$X^-(S=-1)\nu_\tau$		(2.87 ± 0.07) %		S=1.3	–
$K^*(892)^- \geq 0$ neutrals $\geq 0K^0_L\nu_\tau$		(1.42 ± 0.18) %		S=1.4	665
$K^*(892)^-\nu_\tau$		(1.20 ± 0.07) %		S=1.8	665
$K^*(892)^-\nu_\tau \to \pi^-\overline{K}^0\nu_\tau$		$(7.9 \pm 0.5) \times 10^{-3}$			–
$K^*(892)^0K^- \geq 0$ neutrals ν_τ		$(3.2 \pm 1.4) \times 10^{-3}$			542
$K^*(892)^0K^-\nu_\tau$		$(2.1 \pm 0.4) \times 10^{-3}$			542
$\overline{K}^*(892)^0\pi^- \geq 0$ neutrals ν_τ		$(3.8 \pm 1.7) \times 10^{-3}$			655
$\overline{K}^*(892)^0\pi^-\nu_\tau$		$(2.2 \pm 0.5) \times 10^{-3}$			655
$(\overline{K}^*(892)\pi)^-\nu_\tau \to \pi^-\overline{K}^0\pi^0\nu_\tau$		$(1.0 \pm 0.4) \times 10^{-3}$			–
$K_1(1270)^-\nu_\tau$		$(4.7 \pm 1.1) \times 10^{-3}$			433
$K_1(1400)^-\nu_\tau$		$(1.7 \pm 2.6) \times 10^{-3}$		S=1.7	335
$K^*(1410)^-\nu_\tau$		$(1.5\ ^{+1.4}_{-1.0}) \times 10^{-3}$			326
$K^*_0(1430)^-\nu_\tau$		$< 5 \times 10^{-4}$		CL=95%	317
$K^*_2(1430)^-\nu_\tau$		$< 3 \times 10^{-3}$		CL=95%	316
$\eta\pi^-\nu_\tau$		$< 9.9 \times 10^{-5}$		CL=95%	797
$\eta\pi^-\pi^0\nu_\tau$	[g]	$(1.39 \pm 0.10) \times 10^{-3}$		S=1.4	778
$\eta\pi^-\pi^0\pi^0\nu_\tau$		$(1.81 \pm 0.31) \times 10^{-4}$			746
$\eta K^-\nu_\tau$	[g]	$(1.52 \pm 0.08) \times 10^{-4}$			719
$\eta K^*(892)^-\nu_\tau$		$(1.38 \pm 0.15) \times 10^{-4}$			511
$\eta K^-\pi^0\nu_\tau$		$(4.8 \pm 1.2) \times 10^{-5}$			665
$\eta K^-\pi^0$ (non-$K^*(892)$)ν_τ		$< 3.5 \times 10^{-5}$		CL=90%	–
$\eta\overline{K}^0\pi^-\nu_\tau$		$(9.3 \pm 1.5) \times 10^{-5}$			661
$\eta\overline{K}^0\pi^-\pi^0\nu_\tau$		$< 5.0 \times 10^{-5}$		CL=90%	590
$\eta K^-K^0\nu_\tau$		$< 9.0 \times 10^{-6}$		CL=90%	430
$\eta\pi^+\pi^-\pi^- \geq 0$ neutrals ν_τ		$< 3 \times 10^{-3}$		CL=90%	743
$\eta\pi^-\pi^+\pi^-\nu_\tau$ (ex.K^0)		$(2.25 \pm 0.13) \times 10^{-4}$			743

$\eta\pi^-\pi^+\pi^-\nu_\tau$ (ex. K^0, $f_1(1285)$)		(9.9	± 1.6)	$\times 10^{-5}$		–
$\eta a_1(1260)^-\nu_\tau \to \eta\pi^-\rho^0\nu_\tau$		$<$ 3.9		$\times 10^{-4}$	CL=90%	–
$\eta\eta\pi^-\nu_\tau$		$<$ 7.4		$\times 10^{-6}$	CL=90%	637
$\eta\eta\pi^-\pi^0\nu_\tau$		$<$ 2.0		$\times 10^{-4}$	CL=95%	559
$\eta\eta K^-\nu_\tau$		$<$ 3.0		$\times 10^{-6}$	CL=90%	382
$\eta'(958)\pi^-\nu_\tau$		$<$ 4.0		$\times 10^{-6}$	CL=90%	620
$\eta'(958)\pi^-\pi^0\nu_\tau$		$<$ 1.2		$\times 10^{-5}$	CL=90%	591
$\eta'(958)K^-\nu_\tau$		$<$ 2.4		$\times 10^{-6}$	CL=90%	495
$\phi\pi^-\nu_\tau$		(3.4	± 0.6)	$\times 10^{-5}$		585
$\phi K^-\nu_\tau$		(3.70	± 0.33)	$\times 10^{-5}$	S=1.3	445
$f_1(1285)\pi^-\nu_\tau$		(3.9	± 0.5)	$\times 10^{-4}$	S=1.9	408
$f_1(1285)\pi^-\nu_\tau \to \eta\pi^-\pi^+\pi^-\nu_\tau$		(1.18	± 0.07)	$\times 10^{-4}$	S=1.3	–
$f_1(1285)\pi^-\nu_\tau \to 3\pi^-2\pi^+\nu_\tau$		(5.2	± 0.5)	$\times 10^{-5}$		–
$\pi(1300)^-\nu_\tau \to (\rho\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau$		$<$ 1.0		$\times 10^{-4}$	CL=90%	–
$\pi(1300)^-\nu_\tau \to ((\pi\pi)_{S-\text{wave}}\,\pi)^-\nu_\tau \to (3\pi)^-\nu_\tau$		$<$ 1.9		$\times 10^{-4}$	CL=90%	–
$h^-\omega \geq 0$ neutrals ν_τ		(2.41	± 0.09) %		S=1.2	708
$h^-\omega\nu_\tau$	[g]	(2.00	± 0.08) %		S=1.3	708
$K^-\omega\nu_\tau$		(4.1	± 0.9)	$\times 10^{-4}$		610
$h^-\omega\pi^0\nu_\tau$	[g]	(4.1	± 0.4)	$\times 10^{-3}$		684
$h^-\omega 2\pi^0\nu_\tau$		(1.4	± 0.5)	$\times 10^{-4}$		644
$\pi^-\omega 2\pi^0\nu_\tau$		(7.3	± 1.7)	$\times 10^{-5}$		644
$h^-2\omega\nu_\tau$		$<$ 5.4		$\times 10^{-7}$	CL=90%	249
$2h^-h^+\omega\nu_\tau$		(1.20	± 0.22)	$\times 10^{-4}$		641
$2\pi^-\pi^+\omega\nu_\tau$		(8.4	± 0.7)	$\times 10^{-5}$		641

Lepton Family number (*LF*), Lepton number (*L*), or Baryon number (*B*) violating modes

L means lepton number violation (*e.g.* $\tau^- \to e^+\pi^-\pi^-$). Following common usage, *LF* means lepton family violation *and not* lepton number violation (*e.g.* $\tau^- \to e^-\pi^+\pi^-$). *B* means baryon number violation.

$e^-\gamma$	*LF*	$<$ 3.3		$\times 10^{-8}$	CL=90%	888
$\mu^-\gamma$	*LF*	$<$ 4.4		$\times 10^{-8}$	CL=90%	885
$e^-\pi^0$	*LF*	$<$ 8.0		$\times 10^{-8}$	CL=90%	883
$\mu^-\pi^0$	*LF*	$<$ 1.1		$\times 10^{-7}$	CL=90%	880
$e^-K_S^0$	*LF*	$<$ 2.6		$\times 10^{-8}$	CL=90%	819
$\mu^-K_S^0$	*LF*	$<$ 2.3		$\times 10^{-8}$	CL=90%	815
$e^-\eta$	*LF*	$<$ 9.2		$\times 10^{-8}$	CL=90%	804
$\mu^-\eta$	*LF*	$<$ 6.5		$\times 10^{-8}$	CL=90%	800
$e^-\rho^0$	*LF*	$<$ 1.8		$\times 10^{-8}$	CL=90%	719
$\mu^-\rho^0$	*LF*	$<$ 1.2		$\times 10^{-8}$	CL=90%	715
$e^-\omega$	*LF*	$<$ 4.8		$\times 10^{-8}$	CL=90%	716
$\mu^-\omega$	*LF*	$<$ 4.7		$\times 10^{-8}$	CL=90%	711
$e^-K^*(892)^0$	*LF*	$<$ 3.2		$\times 10^{-8}$	CL=90%	665
$\mu^-K^*(892)^0$	*LF*	$<$ 5.9		$\times 10^{-8}$	CL=90%	659
$e^-\overline{K}^*(892)^0$	*LF*	$<$ 3.4		$\times 10^{-8}$	CL=90%	665
$\mu^-\overline{K}^*(892)^0$	*LF*	$<$ 7.0		$\times 10^{-8}$	CL=90%	659
$e^-\eta'(958)$	*LF*	$<$ 1.6		$\times 10^{-7}$	CL=90%	630
$\mu^-\eta'(958)$	*LF*	$<$ 1.3		$\times 10^{-7}$	CL=90%	625
$e^-f_0(980) \to e^-\pi^+\pi^-$	*LF*	$<$ 3.2		$\times 10^{-8}$	CL=90%	–
$\mu^-f_0(980) \to \mu^-\pi^+\pi^-$	*LF*	$<$ 3.4		$\times 10^{-8}$	CL=90%	–
$e^-\phi$	*LF*	$<$ 3.1		$\times 10^{-8}$	CL=90%	596

$\mu^- \phi$	*LF*	$<$	8.4	$\times 10^{-8}$	CL=90%	590
$e^- e^+ e^-$	*LF*	$<$	2.7	$\times 10^{-8}$	CL=90%	888
$e^- \mu^+ \mu^-$	*LF*	$<$	2.7	$\times 10^{-8}$	CL=90%	882
$e^+ \mu^- \mu^-$	*LF*	$<$	1.7	$\times 10^{-8}$	CL=90%	882
$\mu^- e^+ e^-$	*LF*	$<$	1.8	$\times 10^{-8}$	CL=90%	885
$\mu^+ e^- e^-$	*LF*	$<$	1.5	$\times 10^{-8}$	CL=90%	885
$\mu^- \mu^+ \mu^-$	*LF*	$<$	2.1	$\times 10^{-8}$	CL=90%	873
$e^- \pi^+ \pi^-$	*LF*	$<$	2.3	$\times 10^{-8}$	CL=90%	877
$e^+ \pi^- \pi^-$	*L*	$<$	2.0	$\times 10^{-8}$	CL=90%	877
$\mu^- \pi^+ \pi^-$	*LF*	$<$	2.1	$\times 10^{-8}$	CL=90%	866
$\mu^+ \pi^- \pi^-$	*L*	$<$	3.9	$\times 10^{-8}$	CL=90%	866
$e^- \pi^+ K^-$	*LF*	$<$	3.7	$\times 10^{-8}$	CL=90%	813
$e^- \pi^- K^+$	*LF*	$<$	3.1	$\times 10^{-8}$	CL=90%	813
$e^+ \pi^- K^-$	*L*	$<$	3.2	$\times 10^{-8}$	CL=90%	813
$e^- K^0_S K^0_S$	*LF*	$<$	7.1	$\times 10^{-8}$	CL=90%	736
$e^- K^+ K^-$	*LF*	$<$	3.4	$\times 10^{-8}$	CL=90%	738
$e^+ K^- K^-$	*L*	$<$	3.3	$\times 10^{-8}$	CL=90%	738
$\mu^- \pi^+ K^-$	*LF*	$<$	8.6	$\times 10^{-8}$	CL=90%	800
$\mu^- \pi^- K^+$	*LF*	$<$	4.5	$\times 10^{-8}$	CL=90%	800
$\mu^+ \pi^- K^-$	*L*	$<$	4.8	$\times 10^{-8}$	CL=90%	800
$\mu^- K^0_S K^0_S$	*LF*	$<$	8.0	$\times 10^{-8}$	CL=90%	696
$\mu^- K^+ K^-$	*LF*	$<$	4.4	$\times 10^{-8}$	CL=90%	699
$\mu^+ K^- K^-$	*L*	$<$	4.7	$\times 10^{-8}$	CL=90%	699
$e^- \pi^0 \pi^0$	*LF*	$<$	6.5	$\times 10^{-6}$	CL=90%	878
$\mu^- \pi^0 \pi^0$	*LF*	$<$	1.4	$\times 10^{-5}$	CL=90%	867
$e^- \eta \eta$	*LF*	$<$	3.5	$\times 10^{-5}$	CL=90%	699
$\mu^- \eta \eta$	*LF*	$<$	6.0	$\times 10^{-5}$	CL=90%	653
$e^- \pi^0 \eta$	*LF*	$<$	2.4	$\times 10^{-5}$	CL=90%	798
$\mu^- \pi^0 \eta$	*LF*	$<$	2.2	$\times 10^{-5}$	CL=90%	784
$p \mu^- \mu^-$	*L,B*	$<$	4.4	$\times 10^{-7}$	CL=90%	618
$\overline{p} \mu^+ \mu^-$	*L,B*	$<$	3.3	$\times 10^{-7}$	CL=90%	618
$\overline{p} \gamma$	*L,B*	$<$	3.5	$\times 10^{-6}$	CL=90%	641
$\overline{p} \pi^0$	*L,B*	$<$	1.5	$\times 10^{-5}$	CL=90%	632
$\overline{p} 2\pi^0$	*L,B*	$<$	3.3	$\times 10^{-5}$	CL=90%	604
$\overline{p} \eta$	*L,B*	$<$	8.9	$\times 10^{-6}$	CL=90%	475
$\overline{p} \pi^0 \eta$	*L,B*	$<$	2.7	$\times 10^{-5}$	CL=90%	360
$\Lambda \pi^-$	*L,B*	$<$	7.2	$\times 10^{-8}$	CL=90%	525
$\overline{\Lambda} \pi^-$	*L,B*	$<$	1.4	$\times 10^{-7}$	CL=90%	525
e^- light boson	*LF*	$<$	2.7	$\times 10^{-3}$	CL=95%	–
μ^- light boson	*LF*	$<$	5	$\times 10^{-3}$	CL=95%	–

Heavy Charged Lepton Searches

$L^{\pm}$ – charged lepton

Mass $m > 100.8$ GeV, CL = 95% [h] Decay to νW.

$L^{\pm}$ – stable charged heavy lepton

Mass $m > 102.6$ GeV, CL = 95%

Neutrino Properties

See the note on "Neutrino properties listings" in the Particle Listings.

Mass $m < 2$ eV (tritium decay)
Mean life/mass, $\tau/m > 300$ s/eV, CL = 90% (reactor)
Mean life/mass, $\tau/m > 7 \times 10^9$ s/eV (solar)
Mean life/mass, $\tau/m > 15.4$ s/eV, CL = 90% (accelerator)
Magnetic moment $\mu < 0.29 \times 10^{-10}\ \mu_B$, CL = 90% (reactor)

Number of Neutrino Types

Number $N = 2.984 \pm 0.008$ (Standard Model fits to LEP data)
Number $N = 2.92 \pm 0.05$ (S = 1.2) (Direct measurement of invisible Z width)

Neutrino Mixing

The following values are obtained through data analyses based on the 3-neutrino mixing scheme described in the review "Neutrino Mass, Mixing, and Oscillations" by K. Nakamura and S.T. Petcov in this *Review*.

$\sin^2(2\theta_{12}) = 0.846 \pm 0.021$
$\Delta m^2_{21} = (7.53 \pm 0.18) \times 10^{-5}$ eV^2
$\sin^2(2\theta_{23}) = 0.999^{+0.001}_{-0.018}$ (normal mass hierarchy)
$\sin^2(2\theta_{23}) = 1.000^{+0.000}_{-0.017}$ (inverted mass hierarchy)
$\Delta m^2_{32} = (2.44 \pm 0.06) \times 10^{-3}$ eV^2 [i] (normal mass hierarchy)
$\Delta m^2_{32} = (2.52 \pm 0.07) \times 10^{-3}$ eV^2 [i] (inverted mass hierarchy)
$\sin^2(2\theta_{13}) = (9.3 \pm 0.8) \times 10^{-2}$

Stable Neutral Heavy Lepton Mass Limits

Mass $m > 45.0$ GeV, CL = 95% (Dirac)
Mass $m > 39.5$ GeV, CL = 95% (Majorana)

Neutral Heavy Lepton Mass Limits

Mass $m > 90.3$ GeV, CL = 95%
(Dirac ν_L coupling to e, μ, τ; conservative case(τ))
Mass $m > 80.5$ GeV, CL = 95%
(Majorana ν_L coupling to e, μ, τ; conservative case(τ))

NOTES

In this Summary Table:

When a quantity has "(S = ...)" to its right, the error on the quantity has been enlarged by the "scale factor" S, defined as $S = \sqrt{\chi^2/(N-1)}$, where N is the number of measurements used in calculating the quantity. We do this when $S > 1$, which often indicates that the measurements are inconsistent. When $S > 1.25$, we also show in the Particle Listings an ideogram of the measurements. For more about S, see the Introduction.

A decay momentum p is given for each decay mode. For a 2-body decay, p is the momentum of each decay product in the rest frame of the decaying particle. For a 3-or-more-body decay, p is the largest momentum any of the products can have in this frame.

[*a*] This is the best limit for the mode $e^- \to \nu\gamma$. The best limit for "electron disappearance" is 6.4×10^{24} yr.

[*b*] See the "Note on Muon Decay Parameters" in the μ Particle Listings in the Full *Review of Particle Physics* for definitions and details.

[*c*] P_μ is the longitudinal polarization of the muon from pion decay. In standard $V-A$ theory, $P_\mu = 1$ and $\rho = \delta = 3/4$.

[*d*] This only includes events with the γ energy > 10 MeV. Since the $e^- \overline{\nu}_e \nu_\mu$ and $e^- \overline{\nu}_e \nu_\mu \gamma$ modes cannot be clearly separated, we regard the latter mode as a subset of the former.

[*e*] See the relevant Particle Listings in the Full *Review of Particle Physics* for the energy limits used in this measurement.

[*f*] A test of additive vs. multiplicative lepton family number conservation.

[*g*] Basis mode for the τ.

[*h*] $L^\pm$ mass limit depends on decay assumptions; see the Full Listings.

[*i*] The sign of Δm^2_{32} is not known at this time. The range quoted is for the absolute value.

QUARKS

The u-, d-, and s-quark masses are estimates of so-called "current-quark masses," in a mass-independent subtraction scheme such as $\overline{\text{MS}}$ at a scale $\mu \approx 2$ GeV. The c- and b-quark masses are the "running" masses in the $\overline{\text{MS}}$ scheme. For the b-quark we also quote the 1S mass. These can be different from the heavy quark masses obtained in potential models.

u

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

$m_u = 2.3^{+0.7}_{-0.5}$ MeV Charge $= \frac{2}{3}\ e$ $I_z = +\frac{1}{2}$
$m_u/m_d = 0.38$–0.58

d

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

$m_d = 4.8^{+0.5}_{-0.3}$ MeV Charge $= -\frac{1}{3}\ e$ $I_z = -\frac{1}{2}$
$m_s/m_d = 17$–22
$\overline{m} = (m_u + m_d)/2 = 3.5^{+0.7}_{-0.2}$ MeV

s

$I(J^P) = 0(\frac{1}{2}^+)$

$m_s = 95 \pm 5$ MeV Charge $= -\frac{1}{3}\ e$ Strangeness $= -1$
$m_s\ /\ ((m_u + m_d)/2) = 27.5 \pm 1.0$

c

$I(J^P) = 0(\frac{1}{2}^+)$

$m_c = 1.275 \pm 0.025$ GeV Charge $= \frac{2}{3}\ e$ Charm $= +1$

b

$I(J^P) = 0(\frac{1}{2}^+)$

Charge $= -\frac{1}{3}\ e$ Bottom $= -1$

$m_b(\overline{\text{MS}}) = 4.18 \pm 0.03$ GeV
$m_b(1\text{S}) = 4.66 \pm 0.03$ GeV

t

$I(J^P) = 0(\frac{1}{2}^+)$

Charge $= \frac{2}{3}\ e$ Top $= +1$

Mass (direct measurements) $m = 173.21 \pm 0.51 \pm 0.71$ GeV [a,b]
Mass ($\overline{\text{MS}}$ from cross-section measurements) $m = 160^{+5}_{-4}$ GeV [a]
Mass (Pole from cross-section measurements) $m = 176.7^{+4.0}_{-3.4}$ GeV
$m_t - m_{\bar{t}} = -0.2 \pm 0.5$ GeV (S = 1.1)
Full width $\Gamma = 2.0 \pm 0.5$ GeV
$\Gamma(W\,b)/\Gamma(W\,q(q = b, s, d)) = 0.91 \pm 0.04$

t-quark EW Couplings

$F_0 = 0.690 \pm 0.030$
$F_- = 0.314 \pm 0.025$
$F_+ = 0.008 \pm 0.016$
$F_{V+A} < 0.29$, CL = 95%

t DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$W\,q\,(q = b, s, d)$				–
$W\,b$				–
$\ell\,\nu_\ell$ anything	[c,d]	(9.4±2.4) %		–
$\gamma\,q\,(q{=}u,c)$	[e]	$< 5.9 \times 10^{-3}$	95%	–
$\Delta T = 1$ weak neutral current ($T1$) modes				
$Z\,q\,(q{=}u,c)$	$T1$ [f]	$< 2.1 \times 10^{-3}$	95%	–

b' (4th Generation) Quark, Searches for

Mass $m >$ 190 GeV, CL = 95% ($p\overline{p}$, quasi-stable b')
Mass $m >$ 400 GeV, CL = 95% (pp, neutral-current decays)
Mass $m >$ 675 GeV, CL = 95% (pp, charged-current decays)
Mass $m >$ 46.0 GeV, CL = 95% (e^+e^-, all decays)

t' (4th Generation) Quark, Searches for

Mass $m >$ 782 GeV, CL = 95% (pp, neutral-current decays)
Mass $m >$ 700 GeV, CL = 95% (pp, charged-current decays)

Free Quark Searches

All searches since 1977 have had negative results.

NOTES

[a] A discussion of the definition of the top quark mass in these measurements can be found in the review "The Top Quark."

[b] Based on published top mass measurements using data from Tevatron Run-I and Run-II and LHC at $\sqrt{s} = 7$ TeV. Including the most recent unpublished results from Tevatron Run-II, the Tevatron Electroweak Working Group reports a top mass of 173.2 ± 0.9 GeV. See the note "The Top Quark' in the Quark Particle Listings of this *Review*.

[c] ℓ means e or μ decay mode, not the sum over them.

[d] Assumes lepton universality and W-decay acceptance.

[e] This limit is for $\Gamma(t \to \gamma q)/\Gamma(t \to W b)$.

[f] This limit is for $\Gamma(t \to Z q)/\Gamma(t \to W b)$.

LIGHT UNFLAVORED MESONS ($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\overline{d}$, $(u\overline{u}-d\overline{d})/\sqrt{2}$, $d\overline{u}$;
for $I = 0$ (η, η', h, h', ω, ϕ, f, f'): $c_1(u\overline{u} + d\overline{d}) + c_2(s\overline{s})$

$\pi^\pm$

$I^G(J^P) = 1^-(0^-)$

Mass $m = 139.57018 \pm 0.00035$ MeV (S = 1.2)
Mean life $\tau = (2.6033 \pm 0.0005) \times 10^{-8}$ s (S = 1.2)
$c\tau = 7.8045$ m

$\pi^\pm \to \ell^\pm \nu\gamma$ form factors [a]

$F_V = 0.0254 \pm 0.0017$
$F_A = 0.0119 \pm 0.0001$
F_V slope parameter $a = 0.10 \pm 0.06$
$R = 0.059^{+0.009}_{-0.008}$

π^- modes are charge conjugates of the modes below.

For decay limits to particles which are not established, see the section on Searches for Axions and Other Very Light Bosons.

π^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\mu^+\nu_\mu$	[b]	(99.98770±0.00004) %		30
$\mu^+\nu_\mu\gamma$	[c]	(2.00 ±0.25) $\times 10^{-4}$		30
$e^+\nu_e$	[b]	(1.230 ±0.004) $\times 10^{-4}$		70
$e^+\nu_e\gamma$	[c]	(7.39 ±0.05) $\times 10^{-7}$		70
$e^+\nu_e\pi^0$		(1.036 ±0.006) $\times 10^{-8}$		4
$e^+\nu_e e^+ e^-$		(3.2 ±0.5) $\times 10^{-9}$		70
$e^+\nu_e\nu\overline{\nu}$		< 5 $\times 10^{-6}$	90%	70
Lepton Family number (LF) or Lepton number (L) violating modes				
$\mu^+\overline{\nu}_e$	L	[d] < 1.5 $\times 10^{-3}$	90%	30
$\mu^+\nu_e$	LF	[d] < 8.0 $\times 10^{-3}$	90%	30
$\mu^- e^+ e^+\nu$	LF	< 1.6 $\times 10^{-6}$	90%	30

π^0

$I^G(J^{PC}) = 1^-(0^-+)$

Mass $m = 134.9766 \pm 0.0006$ MeV (S = 1.1)
$m_{\pi^\pm} - m_{\pi^0} = 4.5936 \pm 0.0005$ MeV
Mean life $\tau = (8.52 \pm 0.18) \times 10^{-17}$ s (S = 1.2)
$c\tau = 25.5$ nm

For decay limits to particles which are not established, see the appropriate Search sections (A^0 (axion) and Other Light Boson (X^0) Searches, etc.).

π^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
2γ	(98.823±0.034) %	S=1.5	67
$e^+ e^-\gamma$	(1.174±0.035) %	S=1.5	67
γ positronium	(1.82 ±0.29) $\times 10^{-9}$		67
$e^+ e^+ e^- e^-$	(3.34 ±0.16) $\times 10^{-5}$		67

$e^+ e^-$		(6.46 ±0.33)	$\times 10^{-8}$		67
4γ		< 2	$\times 10^{-8}$	CL=90%	67
$\nu\overline{\nu}$		[e] < 2.7	$\times 10^{-7}$	CL=90%	67
$\nu_e \overline{\nu}_e$		< 1.7	$\times 10^{-6}$	CL=90%	67
$\nu_\mu \overline{\nu}_\mu$		< 1.6	$\times 10^{-6}$	CL=90%	67
$\nu_\tau \overline{\nu}_\tau$		< 2.1	$\times 10^{-6}$	CL=90%	67
$\gamma\nu\overline{\nu}$		< 6	$\times 10^{-4}$	CL=90%	67
Charge conjugation (C) or Lepton Family number (LF) violating modes					
3γ	C	< 3.1	$\times 10^{-8}$	CL=90%	67
$\mu^+ e^-$	LF	< 3.8	$\times 10^{-10}$	CL=90%	26
$\mu^- e^+$	LF	< 3.4	$\times 10^{-9}$	CL=90%	26
$\mu^+ e^- + \mu^- e^+$	LF	< 3.6	$\times 10^{-10}$	CL=90%	26

η

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 547.862 \pm 0.018$ MeV
Full width $\Gamma = 1.31 \pm 0.05$ keV

C-nonconserving decay parameters

$\pi^+\pi^-\pi^0$ left-right asymmetry $= (0.09^{+0.11}_{-0.12}) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ sextant asymmetry $= (0.12^{+0.10}_{-0.11}) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ quadrant asymmetry $= (-0.09 \pm 0.09) \times 10^{-2}$
$\pi^+\pi^-\gamma$ left-right asymmetry $= (0.9 \pm 0.4) \times 10^{-2}$
$\pi^+\pi^-\gamma$ β (D-wave) $= -0.02 \pm 0.07$ (S = 1.3)

CP-nonconserving decay parameters

$\pi^+\pi^- e^+ e^-$ decay-plane asymmetry $A_\phi = (-0.6 \pm 3.1) \times 10^{-2}$

Dalitz plot parameter

$\pi^0\pi^0\pi^0$ $\alpha = -0.0315 \pm 0.0015$

η DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Neutral modes			
neutral modes	(72.12±0.34) %	S=1.2	–
2γ	(39.41±0.20) %	S=1.1	274
$3\pi^0$	(32.68±0.23) %	S=1.1	179
$\pi^0 2\gamma$	(2.7 ±0.5) $\times 10^{-4}$	S=1.1	257
$2\pi^0 2\gamma$	< 1.2 $\times 10^{-3}$	CL=90%	238
4γ	< 2.8 $\times 10^{-4}$	CL=90%	274
invisible	< 1.0 $\times 10^{-4}$	CL=90%	–
Charged modes			
charged modes	(28.10±0.34) %	S=1.2	–
$\pi^+\pi^-\pi^0$	(22.92±0.28) %	S=1.2	174
$\pi^+\pi^-\gamma$	(4.22±0.08) %	S=1.1	236
$e^+ e^-\gamma$	(6.9 ±0.4) $\times 10^{-3}$	S=1.3	274
$\mu^+\mu^-\gamma$	(3.1 ±0.4) $\times 10^{-4}$		253
$e^+ e^-$	< 5.6 $\times 10^{-6}$	CL=90%	274
$\mu^+\mu^-$	(5.8 ±0.8) $\times 10^{-6}$		253
$2e^+ 2e^-$	(2.40±0.22) $\times 10^{-5}$		274
$\pi^+\pi^- e^+ e^-(\gamma)$	(2.68±0.11) $\times 10^{-4}$		235
$e^+ e^-\mu^+\mu^-$	< 1.6 $\times 10^{-4}$	CL=90%	253
$2\mu^+ 2\mu^-$	< 3.6 $\times 10^{-4}$	CL=90%	161

$\mu^+\mu^-\pi^+\pi^-$		$<$	3.6	$\times 10^{-4}$	CL=90%	113
$\pi^+ e^- \overline{\nu}_e +$ c.c.		$<$	1.7	$\times 10^{-4}$	CL=90%	256
$\pi^+\pi^- 2\gamma$		$<$	2.1	$\times 10^{-3}$		236
$\pi^+\pi^-\pi^0\gamma$		$<$	5	$\times 10^{-4}$	CL=90%	174
$\pi^0\mu^+\mu^-\gamma$		$<$	3	$\times 10^{-6}$	CL=90%	210
Charge conjugation (C), Parity (P), Charge conjugation × Parity (CP), or Lepton Family number (LF) violating modes						
$\pi^0\gamma$	C	$<$	9	$\times 10^{-5}$	CL=90%	257
$\pi^+\pi^-$	P,CP	$<$	1.3	$\times 10^{-5}$	CL=90%	236
$2\pi^0$	P,CP	$<$	3.5	$\times 10^{-4}$	CL=90%	238
$2\pi^0\gamma$	C	$<$	5	$\times 10^{-4}$	CL=90%	238
$3\pi^0\gamma$	C	$<$	6	$\times 10^{-5}$	CL=90%	179
3γ	C	$<$	1.6	$\times 10^{-5}$	CL=90%	274
$4\pi^0$	P,CP	$<$	6.9	$\times 10^{-7}$	CL=90%	40
$\pi^0 e^+ e^-$	C [f]	$<$	4	$\times 10^{-5}$	CL=90%	257
$\pi^0\mu^+\mu^-$	C [f]	$<$	5	$\times 10^{-6}$	CL=90%	210
$\mu^+ e^- + \mu^- e^+$	LF	$<$	6	$\times 10^{-6}$	CL=90%	264

$f_0(500)$ or σ [g] was $f_0(600)$

$I^G(J^{PC}) = 0^+(0^{++})$

Mass m = (400–550) MeV
Full width Γ = (400–700) MeV

$f_0(500)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	–
$\gamma\gamma$	seen	–

$\rho(770)$ [h]

$I^G(J^{PC}) = 1^+(1^{--})$

Mass m = 775.26 ± 0.25 MeV
Full width Γ = 149.1 ± 0.8 MeV
Γ_{ee} = 7.04 ± 0.06 keV

$\rho(770)$ DECAY MODES	Fraction (Γ_i/Γ)		Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$\sim$ 100	%		363
$\rho(770)^\pm$ decays				
$\pi^\pm\gamma$	(4.5 ±0.5)	$\times 10^{-4}$	S=2.2	375
$\pi^\pm\eta$	$<$ 6	$\times 10^{-3}$	CL=84%	152
$\pi^\pm\pi^+\pi^-\pi^0$	$<$ 2.0	$\times 10^{-3}$	CL=84%	254
$\rho(770)^0$ decays				
$\pi^+\pi^-\gamma$	(9.9 ±1.6)	$\times 10^{-3}$		362
$\pi^0\gamma$	(6.0 ±0.8)	$\times 10^{-4}$		376
$\eta\gamma$	(3.00±0.20)	$\times 10^{-4}$		194
$\pi^0\pi^0\gamma$	(4.5 ±0.8)	$\times 10^{-5}$		363
$\mu^+\mu^-$ [i]	(4.55±0.28)	$\times 10^{-5}$		373

$e^+ e^-$	[i]	(4.72 ± 0.05) × 10^{-5}			388
$\pi^+ \pi^- \pi^0$		($1.01^{+0.54}_{-0.36} \pm 0.34$) × 10^{-4}			323
$\pi^+ \pi^- \pi^+ \pi^-$		(1.8 ± 0.9) × 10^{-5}			251
$\pi^+ \pi^- \pi^0 \pi^0$		(1.6 ± 0.8) × 10^{-5}			257
$\pi^0 e^+ e^-$		< 1.2 × 10^{-5}		CL=90%	376

$\omega(782)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass m = 782.65 ± 0.12 MeV (S = 1.9)
Full width Γ = 8.49 ± 0.08 MeV
Γ_{ee} = 0.60 ± 0.02 keV

$\omega(782)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi^+ \pi^- \pi^0$	(89.2 ± 0.7) %		327
$\pi^0 \gamma$	(8.28 ± 0.28) %	S=2.1	380
$\pi^+ \pi^-$	($1.53^{+0.11}_{-0.13}$) %	S=1.2	366
neutrals (excluding $\pi^0 \gamma$)	(8^{+8}_{-5}) × 10^{-3}	S=1.1	–
$\eta \gamma$	(4.6 ± 0.4) × 10^{-4}	S=1.1	200
$\pi^0 e^+ e^-$	(7.7 ± 0.6) × 10^{-4}		380
$\pi^0 \mu^+ \mu^-$	(1.3 ± 0.4) × 10^{-4}	S=2.1	349
$e^+ e^-$	(7.28 ± 0.14) × 10^{-5}	S=1.3	391
$\pi^+ \pi^- \pi^0 \pi^0$	< 2 × 10^{-4}	CL=90%	262
$\pi^+ \pi^- \gamma$	< 3.6 × 10^{-3}	CL=95%	366
$\pi^+ \pi^- \pi^+ \pi^-$	< 1 × 10^{-3}	CL=90%	256
$\pi^0 \pi^0 \gamma$	(6.6 ± 1.1) × 10^{-5}		367
$\eta \pi^0 \gamma$	< 3.3 × 10^{-5}	CL=90%	162
$\mu^+ \mu^-$	(9.0 ± 3.1) × 10^{-5}		377
3γ	< 1.9 × 10^{-4}	CL=95%	391
Charge conjugation (C) violating modes			
$\eta \pi^0$	C < 2.1 × 10^{-4}	CL=90%	162
$2\pi^0$	C < 2.1 × 10^{-4}	CL=90%	367
$3\pi^0$	C < 2.3 × 10^{-4}	CL=90%	330

$\eta'(958)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass m = 957.78 ± 0.06 MeV
Full width Γ = 0.198 ± 0.009 MeV

$\eta'(958)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\pi^+ \pi^- \eta$	(42.9 ± 0.7) %		232
$\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	(29.1 ± 0.5) %		165
$\pi^0 \pi^0 \eta$	(22.2 ± 0.8) %		239
$\omega \gamma$	(2.75 ± 0.23) %		159
$\gamma \gamma$	(2.20 ± 0.08) %		479
$3\pi^0$	(2.14 ± 0.20) × 10^{-3}		430
$\mu^+ \mu^- \gamma$	(1.08 ± 0.27) × 10^{-4}		467
$\pi^+ \pi^- \mu^+ \mu^-$	< 2.9 × 10^{-5}	90%	401
$\pi^+ \pi^- \pi^0$	(3.8 ± 0.4) × 10^{-3}		428
$\pi^0 \rho^0$	< 4 %	90%	111
$2(\pi^+ \pi^-)$	< 2.4 × 10^{-4}	90%	372

$\pi^+\pi^-2\pi^0$	$<$ 2.5	$\times 10^{-3}$	90%	376
$2(\pi^+\pi^-)$ neutrals	$<$ 1	%	95%	–
$2(\pi^+\pi^-)\pi^0$	$<$ 1.9	$\times 10^{-3}$	90%	298
$2(\pi^+\pi^-)2\pi^0$	$<$ 1	%	95%	197
$3(\pi^+\pi^-)$	$<$ 3.1	$\times 10^{-5}$	90%	189
$\pi^+\pi^- e^+ e^-$	(2.4 $^{+1.3}_{-1.0}$)	$\times 10^{-3}$		458
$\pi^+ e^- \nu_e$ + c.c.	$<$ 2.1	$\times 10^{-4}$	90%	469
$\gamma e^+ e^-$	$<$ 9	$\times 10^{-4}$	90%	479
$\pi^0\gamma\gamma$	$<$ 8	$\times 10^{-4}$	90%	469
$4\pi^0$	$<$ 5	$\times 10^{-4}$	90%	380
$e^+ e^-$	$<$ 2.1	$\times 10^{-7}$	90%	479
invisible	$<$ 5	$\times 10^{-4}$	90%	–

Charge conjugation (C), Parity (P), Lepton family number (LF) violating modes

$\pi^+\pi^-$	P,CP		$<$ 6	$\times 10^{-5}$	90%	458
$\pi^0\pi^0$	P,CP		$<$ 4	$\times 10^{-4}$	90%	459
$\pi^0 e^+ e^-$	C	[f]	$<$ 1.4	$\times 10^{-3}$	90%	469
$\eta e^+ e^-$	C	[f]	$<$ 2.4	$\times 10^{-3}$	90%	322
3γ	C		$<$ 1.0	$\times 10^{-4}$	90%	479
$\mu^+\mu^-\pi^0$	C	[f]	$<$ 6.0	$\times 10^{-5}$	90%	445
$\mu^+\mu^-\eta$	C	[f]	$<$ 1.5	$\times 10^{-5}$	90%	273
$e\mu$	LF		$<$ 4.7	$\times 10^{-4}$	90%	473

$f_0(980)$ [j]

$I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 990 \pm 20$ MeV
Full width $\Gamma = 40$ to 100 MeV

$f_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	476
$K\overline{K}$	seen	36
$\gamma\gamma$	seen	495

$a_0(980)$ [j]

$I^G(J^{PC}) = 1^-(0^{++})$

Mass $m = 980 \pm 20$ MeV
Full width $\Gamma = 50$ to 100 MeV

$a_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	dominant	319
$K\overline{K}$	seen	†
$\gamma\gamma$	seen	490

$\phi(1020)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1019.461 \pm 0.019$ MeV (S = 1.1)
Full width $\Gamma = 4.266 \pm 0.031$ MeV (S = 1.2)

$\phi(1020)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
K^+K^-	(48.9 $\pm$0.5) %	S=1.1	127
$K^0_L K^0_S$	(34.2 $\pm$0.4) %	S=1.1	110

$\rho\pi + \pi^+\pi^-\pi^0$	(15.32 ±0.32) %		S=1.1	–
$\eta\gamma$	(1.309±0.024) %		S=1.2	363
$\pi^0\gamma$	(1.27 ±0.06) $\times 10^{-3}$			501
$\ell^+\ell^-$	—			510
e^+e^-	(2.954±0.030) $\times 10^{-4}$		S=1.1	510
$\mu^+\mu^-$	(2.87 ±0.19) $\times 10^{-4}$			499
ηe^+e^-	(1.15 ±0.10) $\times 10^{-4}$			363
$\pi^+\pi^-$	(7.4 ±1.3) $\times 10^{-5}$			490
$\omega\pi^0$	(4.7 ±0.5) $\times 10^{-5}$			172
$\omega\gamma$	< 5	%	CL=84%	209
$\rho\gamma$	< 1.2	$\times 10^{-5}$	CL=90%	215
$\pi^+\pi^-\gamma$	(4.1 ±1.3) $\times 10^{-5}$			490
$f_0(980)\gamma$	(3.22 ±0.19) $\times 10^{-4}$		S=1.1	29
$\pi^0\pi^0\gamma$	(1.13 ±0.06) $\times 10^{-4}$			492
$\pi^+\pi^-\pi^+\pi^-$	(4.0 $^{+2.8}_{-2.2}$) $\times 10^{-6}$			410
$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6	$\times 10^{-6}$	CL=90%	342
$\pi^0 e^+ e^-$	(1.12 ±0.28) $\times 10^{-5}$			501
$\pi^0\eta\gamma$	(7.27 ±0.30) $\times 10^{-5}$		S=1.5	346
$a_0(980)\gamma$	(7.6 ±0.6) $\times 10^{-5}$			39
$K^0\overline{K}{}^0\gamma$	< 1.9	$\times 10^{-8}$	CL=90%	110
$\eta'(958)\gamma$	(6.25 ±0.21) $\times 10^{-5}$			60
$\eta\pi^0\pi^0\gamma$	< 2	$\times 10^{-5}$	CL=90%	293
$\mu^+\mu^-\gamma$	(1.4 ±0.5) $\times 10^{-5}$			499
$\rho\gamma\gamma$	< 1.2	$\times 10^{-4}$	CL=90%	215
$\eta\pi^+\pi^-$	< 1.8	$\times 10^{-5}$	CL=90%	288
$\eta\mu^+\mu^-$	< 9.4	$\times 10^{-6}$	CL=90%	321
$\eta U \to \eta e^+e^-$	< 1	$\times 10^{-6}$	CL=90%	–

Lepton Family number (LF) violating modes

$e^\pm\mu^\mp$	*LF*	< 2	$\times 10^{-6}$	CL=90%	504

$h_1(1170)$

$I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 1170 \pm 20$ MeV
Full width $\Gamma = 360 \pm 40$ MeV

$h_1(1170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	308

$b_1(1235)$

$I^G(J^{PC}) = 1^+(1^{+-})$

Mass $m = 1229.5 \pm 3.2$ MeV (S = 1.6)
Full width $\Gamma = 142 \pm 9$ MeV (S = 1.2)

$b_1(1235)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\omega\pi$	dominant		348
[D/S amplitude ratio = 0.277 ± 0.027]			
$\pi^\pm\gamma$	(1.6±0.4) $\times 10^{-3}$		607
$\eta\rho$	seen		†
$\pi^+\pi^+\pi^-\pi^0$	< 50 %	84%	535

$K^*(892)^\pm K^\mp$	seen				†
$(K\overline{K})^\pm \pi^0$	< 8	%		90%	248
$K_S^0 K_L^0 \pi^\pm$	< 6	%		90%	235
$K_S^0 K_S^0 \pi^\pm$	< 2	%		90%	235
$\phi\pi$	< 1.5	%		84%	147

$a_1(1260)$ [k]

$I^G(J^{PC}) = 1^-(1^{++})$

Mass $m = 1230 \pm 40$ MeV [l]
Full width $\Gamma = 250$ to 600 MeV

$a_1(1260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$(\rho\pi)_{S-\text{wave}}$	seen	353
$(\rho\pi)_{D-\text{wave}}$	seen	353
$(\rho(1450)\pi)_{S-\text{wave}}$	seen	†
$(\rho(1450)\pi)_{D-\text{wave}}$	seen	†
$\sigma\pi$	seen	–
$f_0(980)\pi$	not seen	179
$f_0(1370)\pi$	seen	†
$f_2(1270)\pi$	seen	†
$K\overline{K}^*(892)+$ c.c.	seen	†
$\pi\gamma$	seen	608

$f_2(1270)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1275.1 \pm 1.2$ MeV (S = 1.1)
Full width $\Gamma = 185.1^{+2.9}_{-2.4}$ MeV (S = 1.5)

$f_2(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$(84.8\ ^{+2.4}_{-1.2})$ %	S=1.2	623
$\pi^+\pi^- 2\pi^0$	$(7.1\ ^{+1.4}_{-2.7})$ %	S=1.3	562
$K\overline{K}$	(4.6 ± 0.4) %	S=2.8	403
$2\pi^+ 2\pi^-$	(2.8 ± 0.4) %	S=1.2	559
$\eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	S=2.1	326
$4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$		564
$\gamma\gamma$	$(1.64 \pm 0.19) \times 10^{-5}$	S=1.9	638
$\eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%	477
$K^0 K^- \pi^+ +$ c.c.	$< 3.4 \times 10^{-3}$	CL=95%	293
$e^+ e^-$	$< 6 \times 10^{-10}$	CL=90%	638

$f_1(1285)$

$I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 1281.9 \pm 0.5$ MeV (S = 1.8)
Full width $\Gamma = 24.2 \pm 1.1$ MeV (S = 1.3)

$f_1(1285)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
4π	$(33.1^+_- {}^{2.1}_{1.8})$ %	S=1.3	568
$\pi^0\pi^0\pi^+\pi^-$	$(22.0^+_- {}^{1.4}_{1.2})$ %	S=1.3	566

$2\pi^+2\pi^-$	$(11.0^{+\ 0.7}_{-\ 0.6})$ %	S=1.3	563
$\rho^0\pi^+\pi^-$	$(11.0^{+\ 0.7}_{-\ 0.6})$ %	S=1.3	336
$\rho^0\rho^0$	seen		†
$4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	568
$\eta\pi^+\pi^-$	(35 ± 15) %		479
$\eta\pi\pi$	$(52.4^{+\ 1.9}_{-\ 2.2})$ %	S=1.2	482
$a_0(980)\pi$ [ignoring $a_0(980) \to K\overline{K}$]	(36 ± 7) %		238
$\eta\pi\pi$ [excluding $a_0(980)\pi$]	(16 ± 7) %		482
$K\overline{K}\pi$	(9.0 ± 0.4) %	S=1.1	308
$K\overline{K}^*(892)$	not seen		†
$\pi^+\pi^-\pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$		603
$\rho^\pm\pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%	390
$\gamma\rho^0$	(5.5 ± 1.3) %	S=2.8	407
$\phi\gamma$	$(7.4 \pm 2.6) \times 10^{-4}$		236

$\eta(1295)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 1294 \pm 4$ MeV (S = 1.6)
Full width $\Gamma = 55 \pm 5$ MeV

$\eta(1295)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^+\pi^-$	seen	487
$a_0(980)\pi$	seen	248
$\eta\pi^0\pi^0$	seen	490
$\eta(\pi\pi)_S$-wave	seen	–

$\pi(1300)$

$I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 1300 \pm 100$ MeV [l]
Full width $\Gamma = 200$ to 600 MeV

$\pi(1300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	404
$\pi(\pi\pi)_S$-wave	seen	–

$a_2(1320)$

$I^G(J^{PC}) = 1^-(2^{++})$

Mass $m = 1318.3^{+\ 0.5}_{-\ 0.6}$ MeV (S = 1.2)
Full width $\Gamma = 107 \pm 5$ MeV [l]

$a_2(1320)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
3π	(70.1 ± 2.7) %	S=1.2	624
$\eta\pi$	(14.5 ± 1.2) %		535
$\omega\pi\pi$	(10.6 ± 3.2) %	S=1.3	366
$K\overline{K}$	(4.9 ± 0.8) %		437
$\eta'(958)\pi$	$(5.3 \pm 0.9) \times 10^{-3}$		288
$\pi^\pm\gamma$	$(2.68 \pm 0.31) \times 10^{-3}$		652
$\gamma\gamma$	$(9.4 \pm 0.7) \times 10^{-6}$		659
e^+e^-	$< 5 \times 10^{-9}$	CL=90%	659

$f_0(1370)$ [j]

$I^G(J^{PC}) = 0^+(0^{++})$

Mass m = 1200 to 1500 MeV
Full width Γ = 200 to 500 MeV

$f_0(1370)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	672
4π	seen	617
$4\pi^0$	seen	617
$2\pi^+2\pi^-$	seen	612
$\pi^+\pi^-2\pi^0$	seen	615
$\rho\rho$	dominant	†
$2(\pi\pi)S$-wave	seen	–
$\pi(1300)\pi$	seen	†
$a_1(1260)\pi$	seen	35
$\eta\eta$	seen	411
$K\overline{K}$	seen	475
$K\overline{K}n\pi$	not seen	†
6π	not seen	508
$\omega\omega$	not seen	†
$\gamma\gamma$	seen	685
e^+e^-	not seen	685

$\pi_1(1400)$ [n]

$I^G(J^{PC}) = 1^-(1^{-+})$

Mass $m = 1354 \pm 25$ MeV (S = 1.8)
Full width $\Gamma = 330 \pm 35$ MeV

$\pi_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^0$	seen	557
$\eta\pi^-$	seen	556

$\eta(1405)$ [o]

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 1408.8 \pm 1.8$ MeV [l] (S = 2.1)
Full width $\Gamma = 51.0 \pm 2.9$ MeV [l] (S = 1.8)

$\eta(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\overline{K}\pi$	seen		424
$\eta\pi\pi$	seen		562
$a_0(980)\pi$	seen		345
$\eta(\pi\pi)S$-wave	seen		–
$f_0(980)\eta$	seen		†
4π	seen		639
$\rho\rho$	<58 %	99.85%	†
$\rho^0\gamma$	seen		491
$K^*(892)K$	seen		123

$f_1(1420)$ [p]

$I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 1426.4 \pm 0.9$ MeV (S = 1.1)
Full width $\Gamma = 54.9 \pm 2.6$ MeV

$f_1(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	dominant	438
$K\overline{K}^*(892)+$ c.c.	dominant	163
$\eta\pi\pi$	possibly seen	573
$\phi\gamma$	seen	349

$\omega(1420)$ [q]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass m (1400–1450) MeV
Full width Γ (180–250) MeV

$\omega(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	dominant	486
$\omega\pi\pi$	seen	444
$b_1(1235)\pi$	seen	125
e^+e^-	seen	710

$a_0(1450)$ [j]

$I^G(J^{PC}) = 1^-(0^{++})$

Mass $m = 1474 \pm 19$ MeV
Full width $\Gamma = 265 \pm 13$ MeV

$a_0(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\eta$	seen	627
$\pi\eta'(958)$	seen	410
$K\overline{K}$	seen	547
$\omega\pi\pi$	seen	484
$a_0(980)\pi\pi$	seen	342
$\gamma\gamma$	seen	737

$\rho(1450)$ [r]

$I^G(J^{PC}) = 1^+(1^{--})$

Mass $m = 1465 \pm 25$ MeV [l]
Full width $\Gamma = 400 \pm 60$ MeV [l]

$\rho(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	720
4π	seen	669
e^+e^-	seen	732
$\eta\rho$	possibly seen	311
$a_2(1320)\pi$	not seen	54
$K\overline{K}$	not seen	541
$K\overline{K}^*(892)+$ c.c.	possibly seen	229

$\eta\gamma$	possibly seen	630
$f_0(500)\gamma$	not seen	–
$f_0(980)\gamma$	not seen	398
$f_0(1370)\gamma$	not seen	92
$f_2(1270)\gamma$	not seen	178

$\eta(1475)$ [o]

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 1476 \pm 4$ MeV (S = 1.3)
Full width $\Gamma = 85 \pm 9$ MeV (S = 1.5)

$\eta(1475)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	dominant	477
$K\overline{K}^*(892)+$ c.c.	seen	245
$a_0(980)\pi$	seen	396
$\gamma\gamma$	seen	738

$f_0(1500)$ [n]

$I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 1505 \pm 6$ MeV (S = 1.3)
Full width $\Gamma = 109 \pm 7$ MeV

$f_0(1500)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\pi\pi$	(34.9±2.3) %	1.2	741
$\pi^+\pi^-$	seen		740
$2\pi^0$	seen		741
4π	(49.5±3.3) %	1.2	691
$4\pi^0$	seen		691
$2\pi^+2\pi^-$	seen		687
$2(\pi\pi)$ S-wave	seen		–
$\rho\rho$	seen		†
$\pi(1300)\pi$	seen		144
$a_1(1260)\pi$	seen		218
$\eta\eta$	(5.1±0.9) %	1.4	516
$\eta\eta'(958)$	(1.9±0.8) %	1.7	†
$K\overline{K}$	(8.6±1.0) %	1.1	568
$\gamma\gamma$	not seen		753

$f_2'(1525)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1525 \pm 5$ MeV [l]
Full width $\Gamma = 73^{+6}_{-5}$ MeV [l]

$f_2'(1525)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	(88.7 ±2.2) %	581
$\eta\eta$	(10.4 ±2.2) %	530
$\pi\pi$	(8.2 ±1.5) $\times 10^{-3}$	750
$\gamma\gamma$	(1.10±0.14) $\times 10^{-6}$	763

$\pi_1(1600)$ [n]

$I^G(J^{PC}) = 1^-(1^{-+})$

Mass $m = 1662^{+8}_{-9}$ MeV
Full width $\Gamma = 241 \pm 40$ MeV (S = 1.4)

$\pi_1(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	not seen	803
$\rho^0\pi^-$	not seen	641
$f_2(1270)\pi^-$	not seen	318
$b_1(1235)\pi$	seen	357
$\eta'(958)\pi^-$	seen	543
$f_1(1285)\pi$	seen	314

$\eta_2(1645)$

$I^G(J^{PC}) = 0^+(2^{-+})$

Mass $m = 1617 \pm 5$ MeV
Full width $\Gamma = 181 \pm 11$ MeV

$\eta_2(1645)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$a_2(1320)\pi$	seen	242
$K\overline{K}\pi$	seen	580
$K^*\overline{K}$	seen	404
$\eta\pi^+\pi^-$	seen	685
$a_0(980)\pi$	seen	499
$f_2(1270)\eta$	not seen	†

$\omega(1650)$ [s]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1670 \pm 30$ MeV
Full width $\Gamma = 315 \pm 35$ MeV

$\omega(1650)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	647
$\omega\pi\pi$	seen	617
$\omega\eta$	seen	500
e^+e^-	seen	835

$\omega_3(1670)$

$I^G(J^{PC}) = 0^-(3^{--})$

Mass $m = 1667 \pm 4$ MeV
Full width $\Gamma = 168 \pm 10$ MeV [l]

$\omega_3(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	645
$\omega\pi\pi$	seen	615
$b_1(1235)\pi$	possibly seen	361

$\pi_2(1670)$

$I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1672.2 \pm 3.0$ MeV [I] (S = 1.4)
Full width $\Gamma = 260 \pm 9$ MeV [I] (S = 1.2)

$\pi_2(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
3π	(95.8±1.4) %		809
$f_2(1270)\pi$	(56.3±3.2) %		329
$\rho\pi$	(31 ±4) %		648
$\sigma\pi$	(10.9±3.4) %		–
$(\pi\pi)_{S\text{-wave}}$	(8.7±3.4) %		–
$K\overline{K}^*(892)+$ c.c.	(4.2±1.4) %		455
$\omega\rho$	(2.7±1.1) %		304
$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%	836
$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%	147
$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%	365
$f_1(1285)\pi$	possibly seen		323
$a_2(1320)\pi$	not seen		292

$\phi(1680)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1680 \pm 20$ MeV [I]
Full width $\Gamma = 150 \pm 50$ MeV [I]

$\phi(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}^*(892)+$ c.c.	dominant	462
$K^0_S K\pi$	seen	621
$K\overline{K}$	seen	680
e^+e^-	seen	840
$\omega\pi\pi$	not seen	623
$K^+K^-\pi^+\pi^-$	seen	544

$\rho_3(1690)$

$I^G(J^{PC}) = 1^+(3^{--})$

Mass $m = 1688.8 \pm 2.1$ MeV [I]
Full width $\Gamma = 161 \pm 10$ MeV [I] (S = 1.5)

$\rho_3(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
4π	(71.1 ± 1.9) %		790
$\pi^\pm\pi^+\pi^-\pi^0$	(67 ±22) %		787
$\omega\pi$	(16 ± 6) %		655
$\pi\pi$	(23.6 ± 1.3) %		834
$K\overline{K}\pi$	(3.8 ± 1.2) %		629
$K\overline{K}$	(1.58± 0.26) %	1.2	685
$\eta\pi^+\pi^-$	seen		727
$\rho(770)\eta$	seen		520
$\pi\pi\rho$	seen		633
Excluding 2ρ and $a_2(1320)\pi$.			
$a_2(1320)\pi$	seen		307
$\rho\rho$	seen		335

$\rho(1700)$ [r]

$I^G(J^{PC}) = 1^+(1^{--})$

Mass $m = 1720 \pm 20$ MeV [l] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)
Full width $\Gamma = 250 \pm 100$ MeV [l] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)

$\rho(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$2(\pi^+\pi^-)$	large	803
$\rho\pi\pi$	dominant	653
$\rho^0\pi^+\pi^-$	large	651
$\rho^\pm\pi^\mp\pi^0$	large	652
$a_1(1260)\pi$	seen	404
$h_1(1170)\pi$	seen	447
$\pi(1300)\pi$	seen	349
$\rho\rho$	seen	372
$\pi^+\pi^-$	seen	849
$\pi\pi$	seen	849
$K\overline{K}^*(892)+$ c.c.	seen	496
$\eta\rho$	seen	545
$a_2(1320)\pi$	not seen	334
$K\overline{K}$	seen	704
e^+e^-	seen	860
$\pi^0\omega$	seen	674

$f_0(1710)$ [t]

$I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 1722^{+6}_{-5}$ MeV (S = 1.6)
Full width $\Gamma = 135 \pm 7$ MeV (S = 1.1)

$f_0(1710)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	705
$\eta\eta$	seen	664
$\pi\pi$	seen	850
$\omega\omega$	seen	358

$\pi(1800)$

$I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 1812 \pm 12$ MeV (S = 2.3)
Full width $\Gamma = 208 \pm 12$ MeV

$\pi(1800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-\pi^-$	seen	879
$f_0(500)\pi^-$	seen	–
$f_0(980)\pi^-$	seen	625
$f_0(1370)\pi^-$	seen	368
$f_0(1500)\pi^-$	not seen	250
$\rho\pi^-$	not seen	732
$\eta\eta\pi^-$	seen	661
$a_0(980)\eta$	seen	473
$a_2(1320)\eta$	not seen	†

$f_2(1270)\pi$	not seen	442
$f_0(1370)\pi^-$	not seen	368
$f_0(1500)\pi^-$	seen	250
$\eta\eta'(958)\pi^-$	seen	375
$K_0^*(1430)K^-$	seen	†
$K^*(892)K^-$	not seen	570

$\phi_3(1850)$

$I^G(J^{PC}) = 0^-(3^{--})$

Mass $m = 1854 \pm 7$ MeV
Full width $\Gamma = 87^{+28}_{-23}$ MeV (S = 1.2)

$\phi_3(1850)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	785
$K\overline{K}^*(892)+$ c.c.	seen	602

$\pi_2(1880)$

$I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1895 \pm 16$ MeV
Full width $\Gamma = 235 \pm 34$ MeV

$f_2(1950)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1944 \pm 12$ MeV (S = 1.5)
Full width $\Gamma = 472 \pm 18$ MeV

$f_2(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\overline{K}^*(892)$	seen	387
$\pi^+\pi^-$	seen	962
$\pi^0\pi^0$	seen	963
4π	seen	925
$\eta\eta$	seen	803
$K\overline{K}$	seen	837
$\gamma\gamma$	seen	972
$p\overline{p}$	seen	254

$f_2(2010)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2011^{+60}_{-80}$ MeV
Full width $\Gamma = 202 \pm 60$ MeV

$f_2(2010)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	†
$K\overline{K}$	seen	876

$a_4(2040)$

$I^G(J^{PC}) = 1^-(4^{++})$

Mass $m = 1996^{+10}_{-9}$ MeV (S = 1.1)
Full width $\Gamma = 255^{+28}_{-24}$ MeV (S = 1.3)

$a_4(2040)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	868
$\pi^+\pi^-\pi^0$	seen	974
$\rho\pi$	seen	841
$f_2(1270)\pi$	seen	580
$\omega\pi^-\pi^0$	seen	819
$\omega\rho$	seen	624
$\eta\pi^0$	seen	918
$\eta'(958)\pi$	seen	761

$f_4(2050)$

$I^G(J^{PC}) = 0^+(4^{++})$

Mass $m = 2018 \pm 11$ MeV (S = 2.1)
Full width $\Gamma = 237 \pm 18$ MeV (S = 1.9)

$f_4(2050)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\omega$	seen	637
$\pi\pi$	(17.0±1.5) %	1000
$K\overline{K}$	$(\ 6.8^{+3.4}_{-1.8}) \times 10^{-3}$	880
$\eta\eta$	$(\ 2.1\pm0.8) \times 10^{-3}$	848
$4\pi^0$	$<$ 1.2 %	964
$a_2(1320)\pi$	seen	567

$\phi(2170)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 2175 \pm 15$ MeV (S = 1.6)
Full width $\Gamma = 61 \pm 18$ MeV

$\phi(2170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	seen	1087
$\phi f_0(980)$	seen	416
$K^+K^-f_0(980) \rightarrow K^+K^-\pi^+\pi^-$	seen	–
$K^+K^-f_0(980) \rightarrow K^+K^-\pi^0\pi^0$	seen	–
$K^{*0}K^\pm\pi^\mp$	not seen	770
$K^*(892)^0\overline{K}^*(892)^0$	not seen	622

$f_2(2300)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2297 \pm 28$ MeV
Full width $\Gamma = 149 \pm 40$ MeV

$f_2(2300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	529
$K\overline{K}$	seen	1037
$\gamma\gamma$	seen	1149

$f_2(2340)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2339 \pm 60$ MeV
Full width $\Gamma = 319^{+80}_{-70}$ MeV

$f_2(2340)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	573
$\eta\eta$	seen	1033

STRANGE MESONS ($S = \pm 1, C = B = 0$)

$K^+ = u\overline{s}$, $K^0 = d\overline{s}$, $\overline{K}^0 = \overline{d}s$, $K^- = \overline{u}s$, similarly for K^*'s

$K^\pm$

$I(J^P) = \frac{1}{2}(0^-)$

Mass $m = 493.677 \pm 0.016$ MeV [u] (S = 2.8)
Mean life $\tau = (1.2380 \pm 0.0021) \times 10^{-8}$ s (S = 1.9)
$c\tau = 3.712$ m

Slope parameter g [v]

(See Particle Listings for quadratic coefficients and alternative parametrization related to $\pi\pi$ scattering)

$K^\pm \to \pi^\pm\pi^+\pi^-$ $g = -0.21134 \pm 0.00017$
$(g_+ - g_-)\ /\ (g_+ + g_-) = (-1.5 \pm 2.2) \times 10^{-4}$
$K^\pm \to \pi^\pm\pi^0\pi^0$ $g = 0.626 \pm 0.007$
$(g_+ - g_-)\ /\ (g_+ + g_-) = (1.8 \pm 1.8) \times 10^{-4}$

$K^\pm$ decay form factors [a,x]

Assuming μ-e universality
$\lambda_+(K^+_{\mu 3}) = \lambda_+(K^+_{e3}) = (2.97 \pm 0.05) \times 10^{-2}$
$\lambda_0(K^+_{\mu 3}) = (1.95 \pm 0.12) \times 10^{-2}$

Not assuming μ-e universality
$\lambda_+(K^+_{e3}) = (2.98 \pm 0.05) \times 10^{-2}$
$\lambda_+(K^+_{\mu 3}) = (2.96 \pm 0.17) \times 10^{-2}$
$\lambda_0(K^+_{\mu 3}) = (1.96 \pm 0.13) \times 10^{-2}$

K_{e3} form factor quadratic fit
$\lambda'_+(K^\pm_{e3})$ linear coeff. $= (2.49 \pm 0.17) \times 10^{-2}$
$\lambda''_+(K^\pm_{e3})$ quadratic coeff. $= (0.19 \pm 0.09) \times 10^{-2}$

K^+_{e3} $|f_S/f_+| = (-0.3^{+0.8}_{-0.7}) \times 10^{-2}$
K^+_{e3} $|f_T/f_+| = (-1.2 \pm 2.3) \times 10^{-2}$
$K^+_{\mu 3}$ $|f_S/f_+| = (0.2 \pm 0.6) \times 10^{-2}$
$K^+_{\mu 3}$ $|f_T/f_+| = (-0.1 \pm 0.7) \times 10^{-2}$

$K^+ \to e^+ \nu_e \gamma \quad |F_A + F_V| = 0.133 \pm 0.008 \quad (S = 1.3)$
$K^+ \to \mu^+ \nu_\mu \gamma \quad |F_A + F_V| = 0.165 \pm 0.013$
$K^+ \to e^+ \nu_e \gamma \quad |F_A - F_V| < 0.49$
$K^+ \to \mu^+ \nu_\mu \gamma \quad |F_A - F_V| = -0.24$ to 0.04, CL = 90%

Charge Radius

$\langle r \rangle = 0.560 \pm 0.031$ fm

***CP* violation parameters**

$\Delta(K^\pm_{\pi e e}) = (-2.2 \pm 1.6) \times 10^{-2}$
$\Delta(K^\pm_{\pi \mu \mu}) = 0.010 \pm 0.023$
$\Delta(K^\pm_{\pi \pi \gamma}) = (0.0 \pm 1.2) \times 10^{-3}$
$A_{FB}(K^\pm_{\pi \mu \mu}) = \frac{\Gamma(cos(\theta_{K\mu})>0) - \Gamma(cos(\theta_{K\mu})<0)}{\Gamma(cos(\theta_{K\mu})>0) + \Gamma(cos(\theta_{K\mu})<0)} < 2.3 \times 10^{-2}$, CL = 90%

***T* violation parameters**

$K^+ \to \pi^0 \mu^+ \nu_\mu \quad P_T = (-1.7 \pm 2.5) \times 10^{-3}$
$K^+ \to \mu^+ \nu_\mu \gamma \quad P_T = (-0.6 \pm 1.9) \times 10^{-2}$
$K^+ \to \pi^0 \mu^+ \nu_\mu \quad \mathrm{Im}(\xi) = -0.006 \pm 0.008$

K^- modes are charge conjugates of the modes below.

K^+ DECAY MODES	Fraction (Γ_j/Γ)	Scale factor/ Confidence level	p (MeV/c)
Leptonic and semileptonic modes			
$e^+ \nu_e$	$(1.581 \pm 0.007) \times 10^{-5}$		247
$\mu^+ \nu_\mu$	(63.55 ± 0.11) %	S=1.2	236
$\pi^0 e^+ \nu_e$	(5.07 ± 0.04) %	S=2.1	228
Called K^+_{e3}.			
$\pi^0 \mu^+ \nu_\mu$	(3.353 ± 0.034) %	S=1.8	215
Called $K^+_{\mu 3}$.			
$\pi^0 \pi^0 e^+ \nu_e$	$(2.2 \pm 0.4) \times 10^{-5}$		206
$\pi^+ \pi^- e^+ \nu_e$	$(4.254 \pm 0.032) \times 10^{-5}$		203
$\pi^+ \pi^- \mu^+ \nu_\mu$	$(1.4 \pm 0.9) \times 10^{-5}$		151
$\pi^0 \pi^0 \pi^0 e^+ \nu_e$	$< 3.5 \times 10^{-6}$	CL=90%	135
Hadronic modes			
$\pi^+ \pi^0$	(20.66 ± 0.08) %	S=1.2	205
$\pi^+ \pi^0 \pi^0$	(1.761 ± 0.022) %	S=1.1	133
$\pi^+ \pi^+ \pi^-$	(5.59 ± 0.04) %	S=1.3	125
Leptonic and semileptonic modes with photons			
$\mu^+ \nu_\mu \gamma$	[y,z] $(6.2 \pm 0.8) \times 10^{-3}$		236
$\mu^+ \nu_\mu \gamma (SD^+)$	[a,aa] $(1.33 \pm 0.22) \times 10^{-5}$		–
$\mu^+ \nu_\mu \gamma (SD^+ INT)$	[a,aa] $< 2.7 \times 10^{-5}$	CL=90%	–
$\mu^+ \nu_\mu \gamma (SD^- + SD^- INT)$	[a,aa] $< 2.6 \times 10^{-4}$	CL=90%	–
$e^+ \nu_e \gamma$	$(9.4 \pm 0.4) \times 10^{-6}$		247
$\pi^0 e^+ \nu_e \gamma$	[y,z] $(2.56 \pm 0.16) \times 10^{-4}$		228
$\pi^0 e^+ \nu_e \gamma (SD)$	[a,aa] $< 5.3 \times 10^{-5}$	CL=90%	228
$\pi^0 \mu^+ \nu_\mu \gamma$	[y,z] $(1.25 \pm 0.25) \times 10^{-5}$		215
$\pi^0 \pi^0 e^+ \nu_e \gamma$	$< 5 \times 10^{-6}$	CL=90%	206

Hadronic modes with photons or $\ell\overline{\ell}$ pairs

$\pi^+\pi^0\gamma$(INT)		(	$-$ 4.2	$\pm$0.9	) $\times 10^{-6}$		–
$\pi^+\pi^0\gamma$(DE)	[y,bb]	(	6.0	$\pm$0.4	) $\times 10^{-6}$		205
$\pi^+\pi^0\pi^0\gamma$	[y,z]	(	7.6	$^{+6.0}_{-3.0}$	) $\times 10^{-6}$		133
$\pi^+\pi^+\pi^-\gamma$	[y,z]	(	1.04	$\pm$0.31	) $\times 10^{-4}$		125
$\pi^+\gamma\gamma$	[y]	(	9.2	$\pm$0.7	) $\times 10^{-7}$		227
$\pi^+ 3\gamma$	[y]	<	1.0		$\times 10^{-4}$	CL=90%	227
$\pi^+ e^+ e^-\gamma$		(	1.19	$\pm$0.13	) $\times 10^{-8}$		227

Leptonic modes with $\ell\overline{\ell}$ pairs

$e^+\nu_e\nu\overline{\nu}$		<	6		$\times 10^{-5}$	CL=90%	247
$\mu^+\nu_\mu\nu\overline{\nu}$		<	6.0		$\times 10^{-6}$	CL=90%	236
$e^+\nu_e e^+ e^-$		(	2.48	$\pm$0.20	) $\times 10^{-8}$		247
$\mu^+\nu_\mu e^+ e^-$		(	7.06	$\pm$0.31	) $\times 10^{-8}$		236
$e^+\nu_e\mu^+\mu^-$		(	1.7	$\pm$0.5	) $\times 10^{-8}$		223
$\mu^+\nu_\mu\mu^+\mu^-$		<	4.1		$\times 10^{-7}$	CL=90%	185

Lepton Family number (LF), Lepton number (L), $\Delta S = \Delta Q$ (SQ) violating modes, or $\Delta S = 1$ weak neutral current ($S1$) modes

$\pi^+\pi^+ e^-\overline{\nu}_e$	SQ	<	1.3		$\times 10^{-8}$	CL=90%	203
$\pi^+\pi^+\mu^-\overline{\nu}_\mu$	SQ	<	3.0		$\times 10^{-6}$	CL=95%	151
$\pi^+ e^+ e^-$	$S1$	(	3.00	$\pm$0.09	) $\times 10^{-7}$		227
$\pi^+\mu^+\mu^-$	$S1$	(	9.4	$\pm$0.6	) $\times 10^{-8}$	S=2.6	172
$\pi^+\nu\overline{\nu}$	$S1$	(	1.7	$\pm$1.1	) $\times 10^{-10}$		227
$\pi^+\pi^0\nu\overline{\nu}$	$S1$	<	4.3		$\times 10^{-5}$	CL=90%	205
$\mu^-\nu e^+ e^+$	LF	<	2.1		$\times 10^{-8}$	CL=90%	236
$\mu^+\nu_e$	LF	[d] <	4		$\times 10^{-3}$	CL=90%	236
$\pi^+\mu^+ e^-$	LF	<	1.3		$\times 10^{-11}$	CL=90%	214
$\pi^+\mu^- e^+$	LF	<	5.2		$\times 10^{-10}$	CL=90%	214
$\pi^-\mu^+ e^+$	L	<	5.0		$\times 10^{-10}$	CL=90%	214
$\pi^- e^+ e^+$	L	<	6.4		$\times 10^{-10}$	CL=90%	227
$\pi^-\mu^+\mu^+$	L	[d] <	1.1		$\times 10^{-9}$	CL=90%	172
$\mu^+\overline{\nu}_e$	L	[d] <	3.3		$\times 10^{-3}$	CL=90%	236
$\pi^0 e^+\overline{\nu}_e$	L	<	3		$\times 10^{-3}$	CL=90%	228
$\pi^+\gamma$		[cc] <	2.3		$\times 10^{-9}$	CL=90%	227

K^0

$I(J^P) = \frac{1}{2}(0^-)$

50% K_S, 50% K_L

Mass $m = 497.614 \pm 0.024$ MeV (S = 1.6)

$m_{K^0} - m_{K^\pm} = 3.937 \pm 0.028$ MeV (S = 1.8)

Mean Square Charge Radius

$\langle r^2 \rangle = -0.077 \pm 0.010$ fm^2

***T*-violation parameters in K^0-$\overline{K}^0$ mixing** [x]

Asymmetry A_T in K^0-$\overline{K}^0$ mixing $= (6.6 \pm 1.6) \times 10^{-3}$

***CPT*-violation parameters** [x]

Re $\delta = (2.5 \pm 2.3) \times 10^{-4}$

Im $\delta = (-1.5 \pm 1.6) \times 10^{-5}$

Re(y), K_{e3} parameter $= (0.4 \pm 2.5) \times 10^{-3}$

Re(x$_-$), K_{e3} parameter $= (-2.9 \pm 2.0) \times 10^{-3}$

$\left|m_{K^0} - m_{\overline{K}^0}\right| / m_{\text{average}} < 6 \times 10^{-19}$, CL = 90% [dd]

$(\Gamma_{K^0} - \Gamma_{\overline{K}^0})/m_{\text{average}} = (8 \pm 8) \times 10^{-18}$

Tests of $\Delta S = \Delta Q$

Re(x_+), K_{e3} parameter = $(-0.9 \pm 3.0) \times 10^{-3}$

K^0_S

$I(J^P) = \frac{1}{2}(0^-)$

Mean life $\tau = (0.8954 \pm 0.0004) \times 10^{-10}$ s (S = 1.1) Assuming *CPT*

Mean life $\tau = (0.89564 \pm 0.00033) \times 10^{-10}$ s Not assuming *CPT*

$c\tau = 2.6844$ cm Assuming *CPT*

CP-violation parameters [ee]

Im(η_{+-0}) $= -0.002 \pm 0.009$

Im(η_{000}) $= (-0.1 \pm 1.6) \times 10^{-2}$

$|\eta_{000}| = |A(K^0_S \to 3\pi^0)/A(K^0_L \to 3\pi^0)| < 0.0088$, CL = 90%

CP asymmetry *A* in $\pi^+\pi^- e^+ e^-$ $= (-0.4 \pm 0.8)\%$

K^0_S DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	*p* (MeV/*c*)
Hadronic modes				
$\pi^0\pi^0$		(30.69±0.05) %		209
$\pi^+\pi^-$		(69.20±0.05) %		206
$\pi^+\pi^-\pi^0$		$(3.5 \ ^{+1.1}_{-0.9}) \times 10^{-7}$		133
Modes with photons or $\ell\bar{\ell}$ pairs				
$\pi^+\pi^-\gamma$	[z,ff]	$(1.79 \pm 0.05) \times 10^{-3}$		206
$\pi^+\pi^- e^+ e^-$		$(4.79 \pm 0.15) \times 10^{-5}$		206
$\pi^0\gamma\gamma$	[ff]	$(4.9 \pm 1.8) \times 10^{-8}$		231
$\gamma\gamma$		$(2.63 \pm 0.17) \times 10^{-6}$	S=3.0	249
Semileptonic modes				
$\pi^\pm e^\mp \nu_e$	[gg]	$(7.04 \pm 0.08) \times 10^{-4}$		229
***CP* violating (*CP*) and $\Delta S = 1$ weak neutral current (*S1*) modes**				
$3\pi^0$	*CP*	$< 2.6 \times 10^{-8}$	CL=90%	139
$\mu^+\mu^-$	*S1*	$< 9 \times 10^{-9}$	CL=90%	225
$e^+ e^-$	*S1*	$< 9 \times 10^{-9}$	CL=90%	249
$\pi^0 e^+ e^-$	*S1* [ff]	$(3.0 \ ^{+1.5}_{-1.2}) \times 10^{-9}$		230
$\pi^0\mu^+\mu^-$	*S1*	$(2.9 \ ^{+1.5}_{-1.2}) \times 10^{-9}$		177

K^0_L

$I(J^P) = \frac{1}{2}(0^-)$

$m_{K_L} - m_{K_S}$

$= (0.5293 \pm 0.0009) \times 10^{10}\ \hbar\ \mathrm{s}^{-1}$ (S = 1.3) Assuming *CPT*

$= (3.484 \pm 0.006) \times 10^{-12}$ MeV Assuming *CPT*

$= (0.5289 \pm 0.0010) \times 10^{10}\ \hbar\ \mathrm{s}^{-1}$ Not assuming *CPT*

Mean life $\tau = (5.116 \pm 0.021) \times 10^{-8}$ s (S = 1.1)

$c\tau = 15.34$ m

Slope parameter g [v]

(See Particle Listings for other linear and quadratic coefficients)

$K^0_L \to \pi^+\pi^-\pi^0$: $g = 0.678 \pm 0.008$ (S = 1.5)
$K^0_L \to \pi^0\pi^0\pi^0$: $h = (+0.59 \pm 0.20 \pm 1.16) \times 10^{-3}$

K_L decay form factors [x]

Linear parametrization assuming μ-e universality

$\lambda_+(K^0_{\mu 3}) = \lambda_+(K^0_{e3}) = (2.82 \pm 0.04) \times 10^{-2}$ (S = 1.1)
$\lambda_0(K^0_{\mu 3}) = (1.38 \pm 0.18) \times 10^{-2}$ (S = 2.2)

Quadratic parametrization assuming μ-e universality

$\lambda'_+(K^0_{\mu 3}) = \lambda'_+(K^0_{e3}) = (2.40 \pm 0.12) \times 10^{-2}$ (S = 1.2)
$\lambda''_+(K^0_{\mu 3}) = \lambda''_+(K^0_{e3}) = (0.20 \pm 0.05) \times 10^{-2}$ (S = 1.2)
$\lambda_0(K^0_{\mu 3}) = (1.16 \pm 0.09) \times 10^{-2}$ (S = 1.2)

Pole parametrization assuming μ-e universality

$M^\mu_V\ (K^0_{\mu 3}) = M^e_V\ (K^0_{e3}) = 878 \pm 6$ MeV (S = 1.1)
$M^\mu_S\ (K^0_{\mu 3}) = 1252 \pm 90$ MeV (S = 2.6)

Dispersive parametrization assuming μ-e universality

$\Lambda_+ = (0.251 \pm 0.006) \times 10^{-1}$ (S = 1.5)
$\ln(C) = (1.75 \pm 0.18) \times 10^{-1}$ (S = 2.0)

K^0_{e3} $|f_S/f_+| = (1.5^{+1.4}_{-1.6}) \times 10^{-2}$
K^0_{e3} $|f_T/f_+| = (5^{+4}_{-5}) \times 10^{-2}$
$K^0_{\mu 3}$ $|f_T/f_+| = (12 \pm 12) \times 10^{-2}$

$K_L \to \ell^+\ell^-\gamma$, $K_L \to \ell^+\ell^-\ell'^+\ell'^-$: $\alpha_{K^*} = -0.205 \pm 0.022$ (S = 1.8)
$K^0_L \to \ell^+\ell^-\gamma$, $K^0_L \to \ell^+\ell^-\ell'^+\ell'^-$: $\alpha_{DIP} = -1.69 \pm 0.08$ (S = 1.7)
$K_L \to \pi^+\pi^- e^+ e^-$: $a_1/a_2 = -0.737 \pm 0.014$ GeV^2
$K_L \to \pi^0 2\gamma$: $a_V = -0.43 \pm 0.06$ (S = 1.5)

CP-violation parameters [ee]

$A_L = (0.332 \pm 0.006)\%$
$|\eta_{00}| = (2.220 \pm 0.011) \times 10^{-3}$ (S = 1.8)
$|\eta_{+-}| = (2.232 \pm 0.011) \times 10^{-3}$ (S = 1.8)
$|\epsilon| = (2.228 \pm 0.011) \times 10^{-3}$ (S = 1.8)
$|\eta_{00}/\eta_{+-}| = 0.9950 \pm 0.0007$ [hh] (S = 1.6)
$\mathrm{Re}(\epsilon'/\epsilon) = (1.66 \pm 0.23) \times 10^{-3}$ [hh] (S = 1.6)

Assuming CPT

$\phi_{+-} = (43.51 \pm 0.05)^\circ$ (S = 1.2)
$\phi_{00} = (43.52 \pm 0.05)^\circ$ (S = 1.3)
$\phi_\epsilon = \phi_{SW} = (43.52 \pm 0.05)^\circ$ (S = 1.2)
$\mathrm{Im}(\epsilon'/\epsilon) = -(\phi_{00} - \phi_{+-})/3 = (-0.002 \pm 0.005)^\circ$ (S = 1.7)

Not assuming CPT

$\phi_{+-} = (43.4 \pm 0.5)^\circ$ (S = 1.2)

$\phi_{00} = (43.7 \pm 0.6)^\circ$ (S = 1.2)

$\phi_\epsilon = (43.5 \pm 0.5)^\circ$ (S = 1.3)

CP asymmetry A in $K_L^0 \to \pi^+\pi^- e^+ e^- = (13.7 \pm 1.5)\%$

β_{CP} from $K_L^0 \to e^+ e^- e^+ e^- = -0.19 \pm 0.07$

γ_{CP} from $K_L^0 \to e^+ e^- e^+ e^- = 0.01 \pm 0.11$ (S = 1.6)

j for $K_L^0 \to \pi^+\pi^-\pi^0 = 0.0012 \pm 0.0008$

f for $K_L^0 \to \pi^+\pi^-\pi^0 = 0.004 \pm 0.006$

$|\eta_{+-\gamma}| = (2.35 \pm 0.07) \times 10^{-3}$

$\phi_{+-\gamma} = (44 \pm 4)^\circ$

$|\epsilon'_{+-\gamma}|/\epsilon < 0.3$, CL = 90%

$|g_{E1}|$ for $K_L^0 \to \pi^+\pi^-\gamma < 0.21$, CL = 90%

T-violation parameters

Im(ξ) in $K^0_{\mu 3} = -0.007 \pm 0.026$

CPT invariance tests

$\phi_{00} - \phi_{+-} = (0.34 \pm 0.32)^\circ$

Re$(\frac{2}{3}\eta_{+-} + \frac{1}{3}\eta_{00}) - \frac{A_L}{2} = (-3 \pm 35) \times 10^{-6}$

$\Delta S = -\Delta Q$ in $K^0_{\ell 3}$ decay

Re $x = -0.002 \pm 0.006$

Im $x = 0.0012 \pm 0.0021$

K_L^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Semileptonic modes				
$\pi^\pm e^\mp \nu_e$ Called K^0_{e3}.	[gg]	(40.55 ±0.11) %	S=1.7	229
$\pi^\pm \mu^\mp \nu_\mu$ Called $K^0_{\mu 3}$.	[gg]	(27.04 ±0.07) %	S=1.1	216
$(\pi\mu\text{atom})\nu$		(1.05 ±0.11) $\times 10^{-7}$		188
$\pi^0\pi^\pm e^\mp \nu$	[gg]	(5.20 ±0.11) $\times 10^{-5}$		207
$\pi^\pm e^\mp \nu e^+ e^-$	[gg]	(1.26 ±0.04) $\times 10^{-5}$		229
Hadronic modes, including Charge conjugation×Parity Violating (CPV) modes				
$3\pi^0$		(19.52 ±0.12) %	S=1.6	139
$\pi^+\pi^-\pi^0$		(12.54 ±0.05) %		133
$\pi^+\pi^-$	CPV [ii]	(1.967±0.010) $\times 10^{-3}$	S=1.5	206
$\pi^0\pi^0$	CPV	(8.64 ±0.06) $\times 10^{-4}$	S=1.8	209
Semileptonic modes with photons				
$\pi^\pm e^\mp \nu_e \gamma$	[z,gg,jj]	(3.79 ±0.06) $\times 10^{-3}$		229
$\pi^\pm \mu^\mp \nu_\mu \gamma$		(5.65 ±0.23) $\times 10^{-4}$		216
Hadronic modes with photons or $\ell\overline{\ell}$ pairs				
$\pi^0\pi^0\gamma$		< 2.43 $\times 10^{-7}$	CL=90%	209
$\pi^+\pi^-\gamma$	[z,jj]	(4.15 ±0.15) $\times 10^{-5}$	S=2.8	206
$\pi^+\pi^-\gamma$(DE)		(2.84 ±0.11) $\times 10^{-5}$	S=2.0	206
$\pi^0 2\gamma$	[jj]	(1.273±0.033) $\times 10^{-6}$		231
$\pi^0\gamma e^+ e^-$		(1.62 ±0.17) $\times 10^{-8}$		230

Other modes with photons or $\ell\overline{\ell}$ pairs

2γ		$(\ 5.47 \pm 0.04\ ) \times 10^{-4}$		S=1.1	249
3γ		$< 7.4 \times 10^{-8}$		CL=90%	249
$e^+e^-\gamma$		$(\ 9.4 \pm 0.4\ ) \times 10^{-6}$		S=2.0	249
$\mu^+\mu^-\gamma$		$(\ 3.59 \pm 0.11\ ) \times 10^{-7}$		S=1.3	225
$e^+e^-\gamma\gamma$	[jj]	$(\ 5.95 \pm 0.33\ ) \times 10^{-7}$			249
$\mu^+\mu^-\gamma\gamma$	[jj]	$(\ 1.0\ {}^{+0.8}_{-0.6}\ ) \times 10^{-8}$			225

Charge conjugation × Parity (*CP*) or Lepton Family number (*LF*) violating modes, or $\Delta S = 1$ weak neutral current (*S1*) modes

$\mu^+\mu^-$	S1	$(\ 6.84 \pm 0.11\ ) \times 10^{-9}$			225
e^+e^-	S1	$(\ 9\ {}^{+6}_{-4}\ ) \times 10^{-12}$			249
$\pi^+\pi^-e^+e^-$	S1 [jj]	$(\ 3.11 \pm 0.19\ ) \times 10^{-7}$			206
$\pi^0\pi^0e^+e^-$	S1	$< 6.6 \times 10^{-9}$		CL=90%	209
$\pi^0\pi^0\mu^+\mu^-$	S1	$< 9.2 \times 10^{-11}$		CL=90%	57
$\mu^+\mu^-e^+e^-$	S1	$(\ 2.69 \pm 0.27\ ) \times 10^{-9}$			225
$e^+e^-e^+e^-$	S1	$(\ 3.56 \pm 0.21\ ) \times 10^{-8}$			249
$\pi^0\mu^+\mu^-$	CP,S1 [kk]	$< 3.8 \times 10^{-10}$		CL=90%	177
$\pi^0e^+e^-$	CP,S1 [kk]	$< 2.8 \times 10^{-10}$		CL=90%	230
$\pi^0\nu\overline{\nu}$	CP,S1 [ll]	$< 2.6 \times 10^{-8}$		CL=90%	231
$\pi^0\pi^0\nu\overline{\nu}$	S1	$< 8.1 \times 10^{-7}$		CL=90%	209
$e^\pm\mu^\mp$	LF [gg]	$< 4.7 \times 10^{-12}$		CL=90%	238
$e^\pm e^\pm\mu^\mp\mu^\mp$	LF [gg]	$< 4.12 \times 10^{-11}$		CL=90%	225
$\pi^0\mu^\pm e^\mp$	LF [gg]	$< 7.6 \times 10^{-11}$		CL=90%	217
$\pi^0\pi^0\mu^\pm e^\mp$	LF	$< 1.7 \times 10^{-10}$		CL=90%	159

$K^*(892)$

$I(J^P) = \frac{1}{2}(1^-)$

$K^*(892)^\pm$ hadroproduced mass $m = 891.66 \pm 0.26$ MeV
$K^*(892)^\pm$ in τ decays mass $m = 895.5 \pm 0.8$ MeV
$K^*(892)^0$ mass $m = 895.81 \pm 0.19$ MeV (S = 1.4)
$K^*(892)^\pm$ hadroproduced full width $\Gamma = 50.8 \pm 0.9$ MeV
$K^*(892)^\pm$ in τ decays full width $\Gamma = 46.2 \pm 1.3$ MeV
$K^*(892)^0$ full width $\Gamma = 47.4 \pm 0.6$ MeV (S = 2.2)

$K^*(892)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\pi$	~ 100 %		289
$K^0\gamma$	$(\ 2.46 \pm 0.21\ ) \times 10^{-3}$		307
$K^\pm\gamma$	$(\ 9.9 \pm 0.9\ ) \times 10^{-4}$		309
$K\pi\pi$	$< 7 \times 10^{-4}$	95%	223

$K_1(1270)$

$I(J^P) = \frac{1}{2}(1^+)$

Mass $m = 1272 \pm 7$ MeV [l]
Full width $\Gamma = 90 \pm 20$ MeV [l]

$K_1(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\rho$	(42 ±6) %	46
$K_0^*(1430)\pi$	(28 ±4) %	†
$K^*(892)\pi$	(16 ±5) %	302

$K\omega$	(11.0±2.0) %	†
$Kf_0(1370)$	(3.0±2.0) %	†
γK^0	seen	539

$K_1(1400)$

$I(J^P) = \frac{1}{2}(1^+)$

Mass $m = 1403 \pm 7$ MeV
Full width $\Gamma = 174 \pm 13$ MeV (S = 1.6)

$K_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\pi$	(94 ±6) %	402
$K\rho$	(3.0±3.0) %	293
$Kf_0(1370)$	(2.0±2.0) %	†
$K\omega$	(1.0±1.0) %	284
$K_0^*(1430)\pi$	not seen	†
γK^0	seen	613

$K^*(1410)$

$I(J^P) = \frac{1}{2}(1^-)$

Mass $m = 1414 \pm 15$ MeV (S = 1.3)
Full width $\Gamma = 232 \pm 21$ MeV (S = 1.1)

$K^*(1410)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K^*(892)\pi$	> 40 %	95%	410
$K\pi$	(6.6±1.3) %		612
$K\rho$	< 7 %	95%	305
γK^0	seen		619

$K_0^*(1430)$ [nn]

$I(J^P) = \frac{1}{2}(0^+)$

Mass $m = 1425 \pm 50$ MeV
Full width $\Gamma = 270 \pm 80$ MeV

$K_0^*(1430)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(93±10) %	619

$K_2^*(1430)$

$I(J^P) = \frac{1}{2}(2^+)$

$K_2^*(1430)^\pm$ mass $m = 1425.6 \pm 1.5$ MeV (S = 1.1)
$K_2^*(1430)^0$ mass $m = 1432.4 \pm 1.3$ MeV
$K_2^*(1430)^\pm$ full width $\Gamma = 98.5 \pm 2.7$ MeV (S = 1.1)
$K_2^*(1430)^0$ full width $\Gamma = 109 \pm 5$ MeV (S = 1.9)

$K_2^*(1430)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$K\pi$	(49.9±1.2) %		619
$K^*(892)\pi$	(24.7±1.5) %		419
$K^*(892)\pi\pi$	(13.4±2.2) %		372
$K\rho$	(8.7±0.8) %	S=1.2	318

$K\omega$	$(\ 2.9\pm0.8)$ %		311
$K^+\gamma$	$(\ 2.4\pm0.5)\times10^{-3}$	S=1.1	627
$K\eta$	$(\ 1.5^{+3.4}_{-1.0})\times10^{-3}$	S=1.3	486
$K\omega\pi$	$<\ 7.2\ \times10^{-4}$	CL=95%	100
$K^0\gamma$	$<\ 9\ \times10^{-4}$	CL=90%	626

$K^*(1680)$

$I(J^P) = \frac{1}{2}(1^-)$

Mass $m = 1717 \pm 27$ MeV (S = 1.4)
Full width $\Gamma = 322 \pm 110$ MeV (S = 4.2)

$K^*(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(38.7 ± 2.5) %	781
$K\rho$	$(31.4^{+5.0}_{-2.1})$ %	571
$K^*(892)\pi$	$(29.9^{+2.2}_{-5.0})$ %	618

$K_2(1770)$ [oo]

$I(J^P) = \frac{1}{2}(2^-)$

Mass $m = 1773 \pm 8$ MeV
Full width $\Gamma = 186 \pm 14$ MeV

$K_2(1770)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi\pi$		794
$K_2^*(1430)\pi$	dominant	288
$K^*(892)\pi$	seen	654
$Kf_2(1270)$	seen	55
$K\phi$	seen	441
$K\omega$	seen	607

$K_3^*(1780)$

$I(J^P) = \frac{1}{2}(3^-)$

Mass $m = 1776 \pm 7$ MeV (S = 1.1)
Full width $\Gamma = 159 \pm 21$ MeV (S = 1.3)

$K_3^*(1780)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\rho$	$(31\ \pm\ 9\ )$ %		613
$K^*(892)\pi$	$(20\ \pm\ 5\ )$ %		656
$K\pi$	$(18.8\pm\ 1.0)$ %		813
$K\eta$	$(30\ \pm13\ )$ %		719
$K_2^*(1430)\pi$	<16 %	95%	291

$K_2(1820)$ [pp]

$I(J^P) = \frac{1}{2}(2^-)$

Mass $m = 1816 \pm 13$ MeV
Full width $\Gamma = 276 \pm 35$ MeV

$K_2(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K_2^*(1430)\pi$	seen	327
$K^*(892)\pi$	seen	681
$Kf_2(1270)$	seen	186
$K\omega$	seen	638

$K_4^*(2045)$

$I(J^P) = \frac{1}{2}(4^+)$

Mass $m = 2045 \pm 9$ MeV (S = 1.1)
Full width $\Gamma = 198 \pm 30$ MeV

$K_4^*(2045)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(9.9±1.2) %	958
$K^*(892)\pi\pi$	(9 ±5) %	802
$K^*(892)\pi\pi\pi$	(7 ±5) %	768
$\rho K\pi$	(5.7±3.2) %	741
$\omega K\pi$	(5.0±3.0) %	738
$\phi K\pi$	(2.8±1.4) %	594
$\phi K^*(892)$	(1.4±0.7) %	363

CHARMED MESONS ($C = \pm 1$)

$D^+ = c\overline{d}$, $D^0 = c\overline{u}$, $\overline{D}^0 = \overline{c}u$, $D^- = \overline{c}d$, similarly for D^*'s

$D^\pm$

$I(J^P) = \frac{1}{2}(0^-)$

Mass $m = 1869.61 \pm 0.10$ MeV (S = 1.1)
Mean life $\tau = (1040 \pm 7) \times 10^{-15}$ s
$c\tau = 311.8$ μm

c-quark decays

$\Gamma(c \to \ell^+ \text{anything})/\Gamma(c \to \text{anything}) = 0.096 \pm 0.004$ [qq]
$\Gamma(c \to D^*(2010)^+ \text{anything})/\Gamma(c \to \text{anything}) = 0.255 \pm 0.017$

***CP*-violation decay-rate asymmetries**

$A_{CP}(\mu^\pm\nu) = (8 \pm 8)\%$
$A_{CP}(K_S^0\pi^\pm) = (-0.41 \pm 0.09)\%$
$A_{CP}(K^\mp 2\pi^\pm) = (-0.1 \pm 1.0)\%$
$A_{CP}(K^\mp\pi^\pm\pi^\pm\pi^0) = (1.0 \pm 1.3)\%$
$A_{CP}(K_S^0\pi^\pm\pi^0) = (0.3 \pm 0.9)\%$
$A_{CP}(K_S^0\pi^\pm\pi^+\pi^-) = (0.1 \pm 1.3)\%$
$A_{CP}(\pi^\pm\pi^0) = (2.9 \pm 2.9)\%$
$A_{CP}(\pi^\pm\eta) = (1.0 \pm 1.5)\%$ (S = 1.4)
$A_{CP}(\pi^\pm\eta'(958)) = (-0.5 \pm 1.2)\%$ (S = 1.1)

$A_{CP}(K^0_S K^\pm) = (-0.11 \pm 0.25)\%$
$A_{CP}(K^+ K^- \pi^\pm) = (0.36 \pm 0.29)\%$
$A_{CP}(K^\pm K^{*0}) = (-0.3 \pm 0.4)\%$
$A_{CP}(\phi\pi^\pm) = (0.09 \pm 0.19)\%$ (S = 1.2)
$A_{CP}(K^\pm K^*_0(1430)^0) = (8^{+7}_{-6})\%$
$A_{CP}(K^\pm K^*_2(1430)^0) = (43^{+20}_{-26})\%$
$A_{CP}(K^\pm K^*_0(800)) = (-12^{+18}_{-13})\%$
$A_{CP}(a_0(1450)^0\pi^\pm) = (-19^{+14}_{-16})\%$
$A_{CP}(\phi(1680)\pi^\pm) = (-9 \pm 26)\%$
$A_{CP}(\pi^+\pi^-\pi^\pm) = (-2 \pm 4)\%$
$A_{CP}(K^0_S K^\pm\pi^+\pi^-) = (-4 \pm 7)\%$
$A_{CP}(K^\pm\pi^0) = (-4 \pm 11)\%$

T-violation decay-rate asymmetry

$A_T(K^0_S K^\pm\pi^+\pi^-) = (-12 \pm 11) \times 10^{-3}$ [rr]

D^+ form factors

$f_+(0)|V_{cs}|$ in $\overline{K}^0\ell^+\nu_\ell = 0.707 \pm 0.013$
$r_1 \equiv a_1/a_0$ in $\overline{K}^0\ell^+\nu_\ell = -1.7 \pm 0.5$
$r_2 \equiv a_2/a_0$ in $\overline{K}^0\ell^+\nu_\ell = -14 \pm 11$
$f_+(0)|V_{cd}|$ in $\pi^0\ell^+\nu_\ell = 0.146 \pm 0.007$
$r_1 \equiv a_1/a_0$ in $\pi^0\ell^+\nu_\ell = -1.4 \pm 0.9$
$r_2 \equiv a_2/a_0$ in $\pi^0\ell^+\nu_\ell = -4 \pm 5$
$f_+(0)|V_{cd}|$ in $D^+ \to \eta e^+\nu_e = 0.086 \pm 0.006$
$r_1 \equiv a_1/a_0$ in $D^+ \to \eta e^+\nu_e = -1.8 \pm 2.2$
$r_v \equiv V(0)/A_1(0)$ in $D^+, D^0 \to \rho e^+\nu_e = 1.48 \pm 0.16$
$r_2 \equiv A_2(0)/A_1(0)$ in $D^+, D^0 \to \rho e^+\nu_e = 0.83 \pm 0.12$
$r_v \equiv V(0)/A_1(0)$ in $\overline{K}^*(892)^0\ell^+\nu_\ell = 1.51 \pm 0.07$ (S = 2.2)
$r_2 \equiv A_2(0)/A_1(0)$ in $\overline{K}^*(892)^0\ell^+\nu_\ell = 0.807 \pm 0.025$
$r_3 \equiv A_3(0)/A_1(0)$ in $\overline{K}^*(892)^0\ell^+\nu_\ell = 0.0 \pm 0.4$
Γ_L/Γ_T in $\overline{K}^*(892)^0\ell^+\nu_\ell = 1.13 \pm 0.08$
Γ_+/Γ_- in $\overline{K}^*(892)^0\ell^+\nu_\ell = 0.22 \pm 0.06$ (S = 1.6)

Most decay modes (other than the semileptonic modes) that involve a neutral K meson are now given as K^0_S modes, not as $\overline{K}^0$ modes. Nearly always it is a K^0_S that is measured, and interference between Cabibbo-allowed and doubly Cabibbo-suppressed modes can invalidate the assumption that $2\,\Gamma(K^0_S) = \Gamma(\overline{K}^0)$.

D^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
e^+ semileptonic	(16.07±0.30) %		–
μ^+ anything	(17.6 ±3.2) %		–
$\overline{K}^-$ anything	(25.7 ±1.4) %		–
$\overline{K}^0$ anything + K^0 anything	(61 ±5) %		–
K^+ anything	(5.9 ±0.8) %		–
$\overline{K}^*(892)^-$ anything	(6 ±5) %		–
$\overline{K}^*(892)^0$ anything	(23 ±5) %		–
$K^*(892)^0$ anything	< 6.6 %	CL=90%	–
η anything	(6.3 ±0.7) %		–
η' anything	(1.04±0.18) %		–
ϕ anything	(1.03±0.12) %		–

Leptonic and semileptonic modes

$e^+\nu_e$	$<$ 8.8	$\times10^{-6}$	CL=90%	935
$\mu^+\nu_\mu$	(3.82±0.33)	$\times10^{-4}$		932
$\tau^+\nu_\tau$	$<$ 1.2	$\times10^{-3}$	CL=90%	90
$\overline{K}^0 e^+\nu_e$	(8.83±0.22)	%		869
$\overline{K}^0\mu^+\nu_\mu$	(9.2 ±0.6)	%		865
$K^-\pi^+ e^+\nu_e$	(4.00±0.10)	%		864
$\overline{K}^*(892)^0 e^+\nu_e$, $\overline{K}^*(892)^0\to K^-\pi^+$	(3.68±0.10)	%		722
$(K^-\pi^+)_{S-wave}\, e^+\nu_e$	(2.32±0.10)	$\times10^{-3}$		–
$\overline{K}^*(1410)^0 e^+\nu_e$, $\overline{K}^*(1410)^0\to K^-\pi^+$	$<$ 6	$\times10^{-3}$	CL=90%	–
$\overline{K}_2^*(1430)^0 e^+\nu_e$, $\overline{K}_2^*(1430)^0\to K^-\pi^+$	$<$ 5	$\times10^{-4}$	CL=90%	–
$K^-\pi^+ e^+\nu_e$ nonresonant	$<$ 7	$\times10^{-3}$	CL=90%	864
$K^-\pi^+\mu^+\nu_\mu$	(3.8 ±0.4)	%		851
$\overline{K}^*(892)^0\mu^+\nu_\mu$, $\overline{K}^*(892)^0\to K^-\pi^+$	(3.52±0.10)	%		717
$K^-\pi^+\mu^+\nu_\mu$ nonresonant	(2.0 ±0.5)	$\times10^{-3}$		851
$K^-\pi^+\pi^0\mu^+\nu_\mu$	$<$ 1.6	$\times10^{-3}$	CL=90%	825
$\pi^0 e^+\nu_e$	(4.05±0.18)	$\times10^{-3}$		930
$\eta e^+\nu_e$	(1.14±0.10)	$\times10^{-3}$		855
$\rho^0 e^+\nu_e$	($2.18^{+0.17}_{-0.25}$)	$\times10^{-3}$		774
$\rho^0\mu^+\nu_\mu$	(2.4 ±0.4)	$\times10^{-3}$		770
$\omega e^+\nu_e$	(1.82±0.19)	$\times10^{-3}$		771
$\eta'(958) e^+\nu_e$	(2.2 ±0.5)	$\times10^{-4}$		689
$\phi e^+\nu_e$	$<$ 9	$\times10^{-5}$	CL=90%	657

Fractions of some of the following modes with resonances have already appeared above as submodes of particular charged-particle modes.

$\overline{K}^*(892)^0 e^+\nu_e$	(5.52±0.15)	%		722
$\overline{K}^*(892)^0\mu^+\nu_\mu$	(5.28±0.15)	%		717
$\overline{K}_0^*(1430)^0\mu^+\nu_\mu$	$<$ 2.4	$\times10^{-4}$	CL=90%	380
$\overline{K}^*(1680)^0\mu^+\nu_\mu$	$<$ 1.5	$\times10^{-3}$	CL=90%	105

Hadronic modes with a $\overline{K}$ or $\overline{K}K\overline{K}$

$K^0_S\pi^+$		(1.47±0.07)	%	S=2.0	863
$K^0_L\pi^+$		(1.46±0.05)	%		863
$K^-2\pi^+$	[ss]	(9.13±0.19)	%		846
$(K^-\pi^+)_{S-\text{wave}}\pi^+$		(7.32±0.19)	%		846
$\overline{K}_0^*(1430)^0\pi^+$, $\overline{K}_0^*(1430)^0\to K^-\pi^+$	[tt]	(1.21±0.06)	%		382
$\overline{K}^*(892)^0\pi^+$, $\overline{K}^*(892)^0\to K^-\pi^+$		(1.01±0.11)	%		714
$\overline{K}^*(1410)^0\pi^+$, $\overline{K}^{*0}\to K^-\pi^+$		not seen			381
$\overline{K}_2^*(1430)^0\pi^+$, $\overline{K}_2^*(1430)^0\to K^-\pi^+$	[tt]	(2.2 ±0.7)	$\times10^{-4}$		371
$\overline{K}^*(1680)^0\pi^+$, $\overline{K}^*(1680)^0\to K^-\pi^+$	[tt]	(2.1 ±1.1)	$\times10^{-4}$		58
$K^-(2\pi^+)_{I=2}$		(1.41±0.26)	%		–
$K^0_S\pi^+\pi^0$	[ss]	(6.99±0.27)	%		845
$K^0_S\rho^+$		(4.8 ±1.0)	%		677

$\overline{K}^*(892)^0\pi^+$,		(1.3 ±0.6) %		714
$\overline{K}^*(892)^0 \to K^0_S\pi^0$				
$K^0_S\pi^+\pi^0$ nonresonant		(9 ±7) $\times 10^{-3}$		845
$K^-2\pi^+\pi^0$	[uu]	(5.99±0.18) %		816
$K^0_S 2\pi^+\pi^-$	[uu]	(3.12±0.11) %		814
$K^-3\pi^+\pi^-$	[ss]	(5.6 ±0.5) $\times 10^{-3}$	S=1.1	772
$\overline{K}^*(892)^0 2\pi^+\pi^-$,		(1.2 ±0.4) $\times 10^{-3}$		645
$\overline{K}^*(892)^0 \to K^-\pi^+$				
$\overline{K}^*(892)^0\rho^0\pi^+$,		(2.2 ±0.4) $\times 10^{-3}$		239
$\overline{K}^*(892)^0 \to K^-\pi^+$				
$\overline{K}^*(892)^0 a_1(1260)^+$	[vv]	(9.0 ±1.8) $\times 10^{-3}$		†
$K^-\rho^0 2\pi^+$		(1.68±0.27) $\times 10^{-3}$		524
$K^-3\pi^+\pi^-$ nonresonant		(3.9 ±2.9) $\times 10^{-4}$		772
$K^+2K^0_S$		(4.5 ±2.0) $\times 10^{-3}$		545
$K^+K^-K^0_S\pi^+$		(2.4 ±0.6) $\times 10^{-4}$		436
Pionic modes				
$\pi^+\pi^0$		(1.19±0.06) $\times 10^{-3}$		925
$2\pi^+\pi^-$		(3.18±0.18) $\times 10^{-3}$		909
$\rho^0\pi^+$		(8.1 ±1.5) $\times 10^{-4}$		767
$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$		(1.78±0.16) $\times 10^{-3}$		909
$\sigma\pi^+$, $\sigma \to \pi^+\pi^-$		(1.34±0.12) $\times 10^{-3}$		–
$f_0(980)\pi^+$,		(1.52±0.33) $\times 10^{-4}$		669
$f_0(980) \to \pi^+\pi^-$				
$f_0(1370)\pi^+$,		(8 ±4) $\times 10^{-5}$		–
$f_0(1370) \to \pi^+\pi^-$				
$f_2(1270)\pi^+$,		(4.9 ±0.9) $\times 10^{-4}$		485
$f_2(1270) \to \pi^+\pi^-$				
$\rho(1450)^0\pi^+$,		< 8 $\times 10^{-5}$	CL=95%	338
$\rho(1450)^0 \to \pi^+\pi^-$				
$f_0(1500)\pi^+$,		(1.1 ±0.4) $\times 10^{-4}$		–
$f_0(1500) \to \pi^+\pi^-$				
$f_0(1710)\pi^+$,		< 5 $\times 10^{-5}$	CL=95%	–
$f_0(1710) \to \pi^+\pi^-$				
$f_0(1790)\pi^+$,		< 6 $\times 10^{-5}$	CL=95%	–
$f_0(1790) \to \pi^+\pi^-$				
$(\pi^+\pi^+)_{S-\text{wave}}\pi^-$		< 1.2 $\times 10^{-4}$	CL=95%	909
$2\pi^+\pi^-$ nonresonant		< 1.1 $\times 10^{-4}$	CL=95%	909
$\pi^+2\pi^0$		(4.6 ±0.4) $\times 10^{-3}$		910
$2\pi^+\pi^-\pi^0$		(1.13±0.08) %		883
$\eta\pi^+$, $\eta \to \pi^+\pi^-\pi^0$		(8.0 ±0.5) $\times 10^{-4}$		848
$\omega\pi^+$, $\omega \to \pi^+\pi^-\pi^0$		< 3 $\times 10^{-4}$	CL=90%	763
$3\pi^+2\pi^-$		(1.61±0.16) $\times 10^{-3}$		845

Fractions of some of the following modes with resonances have already appeared above as submodes of particular charged-particle modes.

$\eta\pi^+$	(3.53±0.21) $\times 10^{-3}$		848
$\eta\pi^+\pi^0$	(1.38±0.35) $\times 10^{-3}$		830
$\omega\pi^+$	< 3.4 $\times 10^{-4}$	CL=90%	764
$\eta'(958)\pi^+$	(4.67±0.29) $\times 10^{-3}$		681
$\eta'(958)\pi^+\pi^0$	(1.6 ±0.5) $\times 10^{-3}$		654

Hadronic modes with a $K\overline{K}$ pair

$K^+ K^0_S$		$(2.83 \pm 0.16) \times 10^{-3}$	S=2.2	793
$K^+ K^- \pi^+$	[ss]	$(9.54 \pm 0.26) \times 10^{-3}$	S=1.1	744
$\phi\pi^+$, $\phi \to K^+ K^-$		$(2.65^{+0.08}_{-0.09}) \times 10^{-3}$		647
$K^+ \overline{K}^*(892)^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(2.45^{+0.09}_{-0.14}) \times 10^{-3}$		613
$K^+ \overline{K}^*_0(1430)^0$, $\overline{K}^*_0(1430)^0 \to K^-\pi^+$		$(1.79 \pm 0.34) \times 10^{-3}$		–
$K^+ \overline{K}^*_2(1430)^0$, $\overline{K}^*_2 \to K^-\pi^+$		$(1.6\ ^{+1.2}_{-0.8}) \times 10^{-4}$		–
$K^+ \overline{K}^*_0(800)$, $\overline{K}^*_0 \to K^-\pi^+$		$(6.7\ ^{+3.4}_{-2.1}) \times 10^{-4}$		–
$a_0(1450)^0\pi^+$, $a^0_0 \to K^+K^-$		$(4.4\ ^{+7.0}_{-1.8}) \times 10^{-4}$		–
$\phi(1680)\pi^+$, $\phi \to K^+K^-$		$(4.9\ ^{+4.0}_{-1.9}) \times 10^{-5}$		–
$K^+ K^- \pi^+$ nonresonant		not seen		744
$K^+ K^0_S \pi^+\pi^-$		$(1.75 \pm 0.18) \times 10^{-3}$		678
$K^0_S K^- 2\pi^+$		$(2.40 \pm 0.18) \times 10^{-3}$		678
$K^+ K^- 2\pi^+\pi^-$		$(2.2 \pm 1.2) \times 10^{-4}$		600

A few poorly measured branching fractions:

$\phi\pi^+\pi^0$		$(2.3 \pm 1.0)\ \%$		619
$\phi\rho^+$		$< 1.5\ \%$	CL=90%	260
$K^+ K^- \pi^+\pi^0$ non-ϕ		$(1.5\ ^{+0.7}_{-0.6})\ \%$		682
$K^*(892)^+ K^0_S$		$(1.6 \pm 0.7)\ \%$		612

Doubly Cabibbo-suppressed modes

$K^+\pi^0$		$(1.83 \pm 0.26) \times 10^{-4}$	S=1.4	864
$K^+\eta$		$(1.08 \pm 0.17) \times 10^{-4}$		776
$K^+\eta'(958)$		$(1.76 \pm 0.22) \times 10^{-4}$		571
$K^+\pi^+\pi^-$		$(5.27 \pm 0.23) \times 10^{-4}$		846
$K^+\rho^0$		$(2.0 \pm 0.5) \times 10^{-4}$		679
$K^*(892)^0\pi^+$, $K^*(892)^0 \to K^+\pi^-$		$(2.5 \pm 0.4) \times 10^{-4}$		714
$K^+ f_0(980)$, $f_0(980) \to \pi^+\pi^-$		$(4.7 \pm 2.8) \times 10^{-5}$		–
$K^*_2(1430)^0\pi^+$, $K^*_2(1430)^0 \to K^+\pi^-$		$(4.2 \pm 2.9) \times 10^{-5}$		–
$K^+\pi^+\pi^-$ nonresonant		not seen		846
$2K^+K^-$		$(8.7 \pm 2.0) \times 10^{-5}$		550

$\Delta C = 1$ weak neutral current ($C1$) modes, or Lepton Family number (LF) or Lepton number (L) violating modes

$\pi^+ e^+ e^-$	$C1$		$< 1.1 \times 10^{-6}$	CL=90%	930
$\pi^+\phi$, $\phi \to e^+e^-$	[xx]	$(1.7\ ^{+1.4}_{-0.9}) \times 10^{-6}$			–
$\pi^+\mu^+\mu^-$	$C1$		$< 7.3 \times 10^{-8}$	CL=90%	918
$\pi^+\phi$, $\phi \to \mu^+\mu^-$	[xx]	$(1.8 \pm 0.8) \times 10^{-6}$			–
$\rho^+\mu^+\mu^-$	$C1$		$< 5.6 \times 10^{-4}$	CL=90%	757
$K^+ e^+ e^-$	[yy]		$< 1.0 \times 10^{-6}$	CL=90%	870
$K^+\mu^+\mu^-$	[yy]		$< 4.3 \times 10^{-6}$	CL=90%	856
$\pi^+ e^+\mu^-$	LF		$< 2.9 \times 10^{-6}$	CL=90%	927
$\pi^+ e^-\mu^+$	LF		$< 3.6 \times 10^{-6}$	CL=90%	927
$K^+ e^+\mu^-$	LF		$< 1.2 \times 10^{-6}$	CL=90%	866
$K^+ e^-\mu^+$	LF		$< 2.8 \times 10^{-6}$	CL=90%	866

$\pi^- 2e^+$	L	$<$	1.1	$\times 10^{-6}$	CL=90%	930
$\pi^- 2\mu^+$	L	$<$	2.2	$\times 10^{-8}$	CL=90%	918
$\pi^- e^+ \mu^+$	L	$<$	2.0	$\times 10^{-6}$	CL=90%	927
$\rho^- 2\mu^+$	L	$<$	5.6	$\times 10^{-4}$	CL=90%	757
$K^- 2e^+$	L	$<$	9	$\times 10^{-7}$	CL=90%	870
$K^- 2\mu^+$	L	$<$	1.0	$\times 10^{-5}$	CL=90%	856
$K^- e^+ \mu^+$	L	$<$	1.9	$\times 10^{-6}$	CL=90%	866
$K^*(892)^- 2\mu^+$	L	$<$	8.5	$\times 10^{-4}$	CL=90%	703

D^0

$I(J^P) = \frac{1}{2}(0^-)$

Mass $m = 1864.84 \pm 0.07$ MeV (S = 1.1)
$m_{D^\pm} - m_{D^0} = 4.77 \pm 0.08$ MeV
Mean life $\tau = (410.1 \pm 1.5) \times 10^{-15}$ s
$c\tau = 122.9\ \mu$m
$|m_{D_1^0} - m_{D_2^0}| = (0.95^{+0.41}_{-0.44}) \times 10^{10}\ \hbar\ \text{s}^{-1}$
$(\Gamma_{D_1^0} - \Gamma_{D_2^0})/\Gamma = 2y = (1.29^{+0.14}_{-0.18}) \times 10^{-2}$
$|q/p| = 0.92^{+0.12}_{-0.09}$
$A_\Gamma = (-0.125 \pm 0.526) \times 10^{-3}$
$K^+\pi^-$ relative strong phase: $\cos\delta = 0.81^{+0.23}_{-0.19}$
$K^-\pi^+\pi^0$ coherence factor $R_{K\pi\pi^0} = 0.78^{+0.11}_{-0.25}$
$K^-\pi^+\pi^0$ average relative strong phase $\delta^{K\pi\pi^0} = (239^{+32}_{-28})^\circ$
$K^-\pi^-2\pi^+$ coherence factor $R_{K3\pi} = 0.36^{+0.24}_{-0.30}$
$K^-\pi^-2\pi^+$ average relative strong phase $\delta^{K3\pi} = (118^{+60}_{-50})^\circ$
$K^0_S K^+\pi^-$ coherence factor $R_{K^0_S K\pi} = 0.73 \pm 0.08$
$K^0_S K^+\pi^-$ average relative strong phase $\delta^{K^0_S K\pi} = (8 \pm 15)^\circ$
K^*K coherence factor $R_{K^*K} = 1.00 \pm 0.16$
K^*K average relative strong phase $\delta^{K^*K} = (26 \pm 16)^\circ$

CP-violation decay-rate asymmetries (labeled by the D^0 decay)

$A_{CP}(K^+K^-) = (-0.21 \pm 0.17)\%$
$A_{CP}(2K^0_S) = (-23 \pm 19)\%$
$A_{CP}(\pi^+\pi^-) = (0.22 \pm 0.21)\%$
$A_{CP}(2\pi^0) = (0 \pm 5)\%$
$A_{CP}(\pi^+\pi^-\pi^0) = (0.3 \pm 0.4)\%$
$A_{CP}(\rho(770)^+\pi^- \to \pi^+\pi^-\pi^0) = (1.2 \pm 0.9)\%$ [zz]
$A_{CP}(\rho(770)^0\pi^0 \to \pi^+\pi^-\pi^0) = (-3.1 \pm 3.0)\%$ [zz]
$A_{CP}(\rho(770)^-\pi^+ \to \pi^+\pi^-\pi^0) = (-1.0 \pm 1.7)\%$ [zz]
$A_{CP}(\rho(1450)^+\pi^- \to \pi^+\pi^-\pi^0) = (0 \pm 70)\%$ [zz]
$A_{CP}(\rho(1450)^0\pi^0 \to \pi^+\pi^-\pi^0) = (-20 \pm 40)\%$ [zz]
$A_{CP}(\rho(1450)^-\pi^+ \to \pi^+\pi^-\pi^0) = (6 \pm 9)\%$ [zz]
$A_{CP}(\rho(1700)^+\pi^- \to \pi^+\pi^-\pi^0) = (-5 \pm 14)\%$ [zz]
$A_{CP}(\rho(1700)^0\pi^0 \to \pi^+\pi^-\pi^0) = (13 \pm 9)\%$ [zz]
$A_{CP}(\rho(1700)^-\pi^+ \to \pi^+\pi^-\pi^0) = (8 \pm 11)\%$ [zz]
$A_{CP}(f_0(980)\pi^0 \to \pi^+\pi^-\pi^0) = (0 \pm 35)\%$ [zz]
$A_{CP}(f_0(1370)\pi^0 \to \pi^+\pi^-\pi^0) = (25 \pm 18)\%$ [zz]
$A_{CP}(f_0(1500)\pi^0 \to \pi^+\pi^-\pi^0) = (0 \pm 18)\%$ [zz]
$A_{CP}(f_0(1710)\pi^0 \to \pi^+\pi^-\pi^0) = (0 \pm 24)\%$ [zz]
$A_{CP}(f_2(1270)\pi^0 \to \pi^+\pi^-\pi^0) = (-4 \pm 6)\%$ [zz]
$A_{CP}(\sigma(400)\pi^0 \to \pi^+\pi^-\pi^0) = (6 \pm 8)\%$ [zz]

$A_{CP}(\text{nonresonant } \pi^+\pi^-\pi^0) = (-13 \pm 23)\%$ [zz]
$A_{CP}(2\pi^+2\pi^-)$
$A_{CP}(K^+K^-\pi^0) = (-1.0 \pm 1.7)\%$
$A_{CP}(K^*(892)^+K^- \to K^+K^-\pi^0) = (-0.9 \pm 1.3)\%$ [zz]
$A_{CP}(K^*(1410)^+K^- \to K^+K^-\pi^0) = (-21 \pm 24)\%$ [zz]
$A_{CP}((K^+\pi^0)_{S-wave}K^- \to K^+K^-\pi^0) = (7 \pm 15)\%$ [zz]
$A_{CP}(\phi(1020)\pi^0 \to K^+K^-\pi^0) = (1.1 \pm 2.2)\%$ [zz]
$A_{CP}(f_0(980)\pi^0 \to K^+K^-\pi^0) = (-3 \pm 19)\%$ [zz]
$A_{CP}(a_0(980)^0\pi^0 \to K^+K^-\pi^0) = (-5 \pm 16)\%$ [zz]
$A_{CP}(f_2'(1525)\pi^0 \to K^+K^-\pi^0) = (0 \pm 160)\%$ [zz]
$A_{CP}(K^*(892)^-K^+ \to K^+K^-\pi^0) = (-5 \pm 4)\%$ [zz]
$A_{CP}(K^*(1410)^-K^+ \to K^+K^-\pi^0) = (-17 \pm 29)\%$ [zz]
$A_{CP}((K^-\pi^0)_{S-wave}K^+ \to K^+K^-\pi^0) = (-10 \pm 40)\%$ [zz]
$A_{CP}(K^0_S\pi^0) = (-0.27 \pm 0.21)\%$
$A_{CP}(K^0_S\eta) = (0.5 \pm 0.5)\%$
$A_{CP}(K^0_S\eta') = (1.0 \pm 0.7)\%$
$A_{CP}(K^0_S\phi) = (-3 \pm 9)\%$
$A_{CP}(K^-\pi^+) = (0.1 \pm 0.7)\%$
$A_{CP}(K^+\pi^-) = (0.0 \pm 1.6)\%$
$A_{CP}(K^-\pi^+\pi^0) = (0.2 \pm 0.9)\%$
$A_{CP}(K^+\pi^-\pi^0) = (0 \pm 5)\%$
$A_{CP}(K^0_S\pi^+\pi^-) = (-0.1 \pm 0.8)\%$
$A_{CP}(K^*(892)^-\pi^+ \to K^0_S\pi^+\pi^-) = (0.4 \pm 0.5)\%$
$A_{CP}(K^*(892)^+\pi^- \to K^0_S\pi^+\pi^-) = (1 \pm 6)\%$
$A_{CP}(\overline{K}^0\rho^0 \to K^0_S\pi^+\pi^-) = (-0.1 \pm 0.5)\%$
$A_{CP}(\overline{K}^0\omega \to K^0_S\pi^+\pi^-) = (-13 \pm 7)\%$
$A_{CP}(\overline{K}^0 f_0(980) \to K^0_S\pi^+\pi^-) = (-0.4 \pm 2.7)\%$
$A_{CP}(\overline{K}^0 f_2(1270) \to K^0_S\pi^+\pi^-) = (-4 \pm 5)\%$
$A_{CP}(\overline{K}^0 f_0(1370) \to K^0_S\pi^+\pi^-) = (-1 \pm 9)\%$
$A_{CP}(\overline{K}^0\rho^0(1450) \to K^0_S\pi^+\pi^-) = (-4 \pm 10)\%$
$A_{CP}(\overline{K}^0 f_0(600) \to K^0_S\pi^+\pi^-) = (-3 \pm 5)\%$
$A_{CP}(K^*(1410)^-\pi^+ \to K^0_S\pi^+\pi^-) = (-2 \pm 9)\%$
$A_{CP}(K^*_0(1430)^-\pi^+ \to K^0_S\pi^+\pi^-) = (4 \pm 4)\%$
$A_{CP}(K^*_0(1430)^+\pi^- \to K^0_S\pi^+\pi^-) = (12 \pm 15)\%$
$A_{CP}(K^*_2(1430)^-\pi^+ \to K^0_S\pi^+\pi^-) = (3 \pm 6)\%$
$A_{CP}(K^*_2(1430)^+\pi^- \to K^0_S\pi^+\pi^-) = (-10 \pm 32)\%$
$A_{CP}(K^*(1680)^-\pi^+ \to K^0_S\pi^+\pi^-)$
$A_{CP}(K^-\pi^+\pi^+\pi^-) = (0.7 \pm 1.0)\%$
$A_{CP}(K^+\pi^-\pi^+\pi^-) = (-2 \pm 4)\%$
$A_{CP}(K^+K^-\pi^+\pi^-) = (-8 \pm 7)\%$
$A_{CP}(K^*_1(1270)^+K^- \to K^{*0}\pi^+K^-) = (-1 \pm 10)\%$
$A_{CP}(K^*_1(1270)^-K^+ \to \overline{K}^{*0}\pi^-K^+) = (-10 \pm 32)\%$
$A_{CP}(K^*_1(1270)^+K^- \to \rho^0K^+K^-) = (-7 \pm 17)\%$
$A_{CP}(K^*_1(1270)^-K^+ \to \rho^0K^-K^+) = (10 \pm 13)\%$
$A_{CP}(K^*(1410)^+K^- \to K^{*0}\pi^+K^-) = (-20 \pm 17)\%$
$A_{CP}(K^*(1410)^-K^+ \to \overline{K}^{*0}\pi^-K^+) = (-1 \pm 14)\%$
$A_{CP}(K^{*0}\overline{K}^{*0}\ S\text{-wave}) = (10 \pm 14)\%$
$A_{CP}(\phi\rho^0\ S\text{-wave}) = (-3 \pm 5)\%$
$A_{CP}(\phi\rho^0\ D\text{-wave}) = (-37 \pm 19)\%$
$A_{CP}(\phi(\pi^+\pi^-)_{S-wave}) = (-9 \pm 10)\%$
$A_{CP}((K^-\pi^+)_{P-wave}\ (K^+\pi^-)_{S-wave}) = (3 \pm 11)\%$

CP-violation asymmetry difference

$\Delta A_{CP} = A_{CP}(K^+K^-) - A_{CP}(\pi^+\pi^-) = (-0.46 \pm 0.25)\%$ (S = 1.8)

T-violation decay-rate asymmetry

$A_T(K^+K^-\pi^+\pi^-) = (1 \pm 7) \times 10^{-3}$ [rr]

CPT-violation decay-rate asymmetry

$A_{CPT}(K^\mp\pi^\pm) = 0.008 \pm 0.008$

Form factors

$r_V \equiv V(0)/A_1(0)$ in $D^0 \to K^*(892)^-\ell^+\nu_\ell = 1.7 \pm 0.8$
$r_2 \equiv A_2(0)/A_1(0)$ in $D^0 \to K^*(892)^-\ell^+\nu_\ell = 0.9 \pm 0.4$
$f_+(0)$ in $D^0 \to K^-\ell^+\nu_\ell = 0.727 \pm 0.011$
$f_+(0)|V_{cs}|$ in $D^0 \to K^-\ell^+\nu_\ell = 0.726 \pm 0.009$
$r_1 \equiv a_1/a_0$ in $D^0 \to K^-\ell^+\nu_\ell = -2.65 \pm 0.35$
$r_2 \equiv a_1/a_0$ in $D^0 \to K^-\ell^+\nu_\ell = 13 \pm 9$
$f_+(0)|V_{cd}|$ in $D^0 \to \pi^-\ell^+\nu_\ell = 0.152 \pm 0.005$
$r_1 \equiv a_1/a_0$ in $D^0 \to \pi^-\ell^+\nu_\ell = -2.8 \pm 0.5$
$r_2 \equiv a_1/a_0$ in $D^0 \to \pi^-\ell^+\nu_\ell = 6 \pm 3.0$

Most decay modes (other than the semileptonic modes) that involve a neutral K meson are now given as K^0_S modes, not as $\overline{K}^0$ modes. Nearly always it is a K^0_S that is measured, and interference between Cabibbo-allowed and doubly Cabibbo-suppressed modes can invalidate the assumption that $2\,\Gamma(K^0_S) = \Gamma(\overline{K}^0)$.

D^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Topological modes				
0-prongs	[*aaa*]	(15 ± 6) %		–
2-prongs		(70 ± 6) %		–
4-prongs	[*bbb*]	(14.5 ± 0.5) %		–
6-prongs	[*ccc*]	(6.4 ± 1.3) $\times 10^{-4}$		–
Inclusive modes				
e^+ anything	[*ddd*]	(6.49 ± 0.11) %		–
μ^+ anything		(6.7 ± 0.6) %		–
K^- anything		(54.7 ± 2.8) %	S=1.3	–
$\overline{K}^0$ anything + K^0 anything		(47 ± 4) %		–
K^+ anything		(3.4 ± 0.4) %		–
$K^*(892)^-$ anything		(15 ± 9) %		–
$\overline{K}^*(892)^0$ anything		(9 ± 4) %		–
$K^*(892)^+$ anything		< 3.6 %	CL=90%	–
$K^*(892)^0$ anything		(2.8 ± 1.3) %		–
η anything		(9.5 ± 0.9) %		–
η' anything		(2.48 ± 0.27) %		–
ϕ anything		(1.05 ± 0.11) %		–
Semileptonic modes				
$K^- e^+ \nu_e$		(3.55 ± 0.05) %	S=1.2	867
$K^- \mu^+ \nu_\mu$		(3.31 ± 0.13) %		864
$K^*(892)^- e^+ \nu_e$		(2.16 ± 0.16) %		719
$K^*(892)^- \mu^+ \nu_\mu$		(1.91 ± 0.24) %		714
$K^- \pi^0 e^+ \nu_e$		(1.6 $^{+\ 1.3}_{-\ 0.5}$) %		861

$\overline{K}^0 \pi^- e^+ \nu_e$		$(2.7 \pm^{0.9}_{0.7}) \%$		860
$K^- \pi^+ \pi^- e^+ \nu_e$		$(2.8 \pm^{1.4}_{1.1}) \times 10^{-4}$		843
$K_1(1270)^- e^+ \nu_e$		$(7.6 \pm^{4.0}_{3.1}) \times 10^{-4}$		498
$K^- \pi^+ \pi^- \mu^+ \nu_\mu$		$< 1.2 \times 10^{-3}$	CL=90%	821
$(\overline{K}^*(892)\pi)^- \mu^+ \nu_\mu$		$< 1.4 \times 10^{-3}$	CL=90%	692
$\pi^- e^+ \nu_e$		$(2.89 \pm 0.08) \times 10^{-3}$	S=1.1	927
$\pi^- \mu^+ \nu_\mu$		$(2.37 \pm 0.24) \times 10^{-3}$		924
$\rho^- e^+ \nu_e$		$(1.77 \pm 0.16) \times 10^{-3}$		771

Hadronic modes with one $\overline{K}$

$K^- \pi^+$		$(3.88 \pm 0.05) \%$	S=1.1	861
$K^+ \pi^-$		$(1.380 \pm 0.028) \times 10^{-4}$		861
$K^0_S \pi^0$		$(1.19 \pm 0.04) \%$		860
$K^0_L \pi^0$		$(10.0 \pm 0.7) \times 10^{-3}$		860
$K^0_S \pi^+ \pi^-$	[ss]	$(2.83 \pm 0.20) \%$	S=1.1	842
$K^0_S \rho^0$		$(6.3 \pm^{0.7}_{0.8}) \times 10^{-3}$		674
$K^0_S \omega,\ \omega \to \pi^+ \pi^-$		$(2.1 \pm 0.6) \times 10^{-4}$		670
$K^0_S (\pi^+ \pi^-)_{S-\text{wave}}$		$(3.4 \pm 0.8) \times 10^{-3}$		842
$K^0_S f_0(980),\ f_0(980) \to \pi^+ \pi^-$		$(1.22 \pm^{0.40}_{0.24}) \times 10^{-3}$		549
$K^0_S f_0(1370),\ f_0(1370) \to \pi^+ \pi^-$		$(2.8 \pm^{0.9}_{1.3}) \times 10^{-3}$		†
$K^0_S f_2(1270),\ f_2(1270) \to \pi^+ \pi^-$		$(9 \pm^{10}_{6}) \times 10^{-5}$		262
$K^*(892)^- \pi^+,\ K^*(892)^- \to K^0_S \pi^-$		$(1.66 \pm^{0.15}_{0.17}) \%$		711
$K^*_0(1430)^- \pi^+,\ K^*_0(1430)^- \to K^0_S \pi^-$		$(2.70 \pm^{0.40}_{0.34}) \times 10^{-3}$		378
$K^*_2(1430)^- \pi^+,\ K^*_2(1430)^- \to K^0_S \pi^-$		$(3.4 \pm^{1.9}_{1.0}) \times 10^{-4}$		367
$K^*(1680)^- \pi^+,\ K^*(1680)^- \to K^0_S \pi^-$		$(4 \pm 4) \times 10^{-4}$		46
$K^*(892)^+ \pi^-,\ K^*(892)^+ \to K^0_S \pi^+$	[eee]	$(1.14 \pm^{0.60}_{0.34}) \times 10^{-4}$		711
$K^*_0(1430)^+ \pi^-,\ K^*_0(1430)^+ \to K^0_S \pi^+$	[eee]	$< 1.4 \times 10^{-5}$	CL=95%	–
$K^*_2(1430)^+ \pi^-,\ K^*_2(1430)^+ \to K^0_S \pi^+$	[eee]	$< 3.4 \times 10^{-5}$	CL=95%	–
$K^0_S \pi^+ \pi^-$ nonresonant		$(2.5 \pm^{6.0}_{1.6}) \times 10^{-4}$		842
$K^- \pi^+ \pi^0$	[ss]	$(13.9 \pm 0.5) \%$	S=1.7	844
$K^- \rho^+$		$(10.8 \pm 0.7) \%$		675
$K^- \rho(1700)^+,\ \rho(1700)^+ \to \pi^+ \pi^0$		$(7.9 \pm 1.7) \times 10^{-3}$		†
$K^*(892)^- \pi^+,\ K^*(892)^- \to K^- \pi^0$		$(2.22 \pm^{0.40}_{0.19}) \%$		711
$\overline{K}^*(892)^0 \pi^0,\ \overline{K}^*(892)^0 \to K^- \pi^+$		$(1.88 \pm 0.23) \%$		711

$K_0^*(1430)^-\pi^+$, $K_0^*(1430)^- \to K^-\pi^0$		$(\ 4.6 \pm 2.1\ ) \times 10^{-3}$		378
$\overline{K}_0^*(1430)^0\pi^0$, $\overline{K}_0^*(1430)^0 \to K^-\pi^+$		$(\ 5.7\ ^{+\ 5.0}_{-\ 1.5}\ ) \times 10^{-3}$		379
$K^*(1680)^-\pi^+$, $K^*(1680)^- \to K^-\pi^0$		$(\ 1.8 \pm 0.7\ ) \times 10^{-3}$		46
$K^-\pi^+\pi^0$ nonresonant		$(\ 1.11\ ^{+\ 0.50}_{-\ 0.19}\ )$ %		844
$K_S^0 2\pi^0$		$(\ 9.1 \pm 1.1\ ) \times 10^{-3}$	S=2.2	843
$K_S^0(2\pi^0)$-S-wave		$(\ 2.6 \pm 0.7\ ) \times 10^{-3}$		–
$\overline{K}^*(892)^0\pi^0$, $\overline{K}^*(892)^0 \to K_S^0\pi^0$		$(\ 7.8 \pm 0.7\ ) \times 10^{-3}$		711
$\overline{K}^*(1430)^0\pi^0$, $\overline{K}^{*0} \to K_S^0\pi^0$		$(\ 4 \pm 23\ ) \times 10^{-5}$		–
$\overline{K}^*(1680)^0\pi^0$, $\overline{K}^{*0} \to K_S^0\pi^0$		$(\ 1.0 \pm 0.4\ ) \times 10^{-3}$		–
$K_S^0 f_2(1270)$, $f_2 \to 2\pi^0$		$(\ 2.3 \pm 1.1\ ) \times 10^{-4}$		–
$2K_S^0$, one $K_S^0 \to 2\pi^0$		$(\ 3.2 \pm 1.1\ ) \times 10^{-4}$		–
$K^-2\pi^+\pi^-$	[ss]	$(\ 8.08\ ^{+\ 0.21}_{-\ 0.19}\ )$ %	S=1.3	813
$K^-\pi^+\rho^0$ total		$(\ 6.75 \pm 0.33\ )$ %		609
$K^-\pi^+\rho^0$ 3-body		$(\ 5.1 \pm 2.3\ ) \times 10^{-3}$		609
$\overline{K}^*(892)^0\rho^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 1.05 \pm 0.23\ )$ %		416
$K^- a_1(1260)^+$, $a_1(1260)^+ \to 2\pi^+\pi^-$		$(\ 3.6 \pm 0.6\ )$ %		327
$\overline{K}^*(892)^0\pi^+\pi^-$ total, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 1.6 \pm 0.4\ )$ %		685
$\overline{K}^*(892)^0\pi^+\pi^-$ 3-body, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 9.9 \pm 2.3\ ) \times 10^{-3}$		685
$K_1(1270)^-\pi^+$, $K_1(1270)^- \to K^-\pi^+\pi^-$	[fff]	$(\ 2.9 \pm 0.3\ ) \times 10^{-3}$		484
$K^-2\pi^+\pi^-$ nonresonant		$(\ 1.88 \pm 0.26\ )$ %		813
$K_S^0\pi^+\pi^-\pi^0$	[ggg]	$(\ 5.2 \pm 0.6\ )$ %		813
$K_S^0\eta$, $\eta \to \pi^+\pi^-\pi^0$		$(\ 1.02 \pm 0.09\ ) \times 10^{-3}$		772
$K_S^0\omega$, $\omega \to \pi^+\pi^-\pi^0$		$(\ 9.9 \pm 0.5\ ) \times 10^{-3}$		670
$K^-2\pi^+\pi^-\pi^0$		$(\ 4.2 \pm 0.4\ )$ %		771
$\overline{K}^*(892)^0\pi^+\pi^-\pi^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 1.3 \pm 0.6\ )$ %		643
$K^-\pi^+\omega$, $\omega \to \pi^+\pi^-\pi^0$		$(\ 2.7 \pm 0.5\ )$ %		605
$\overline{K}^*(892)^0\omega$, $\overline{K}^*(892)^0 \to K^-\pi^+$, $\omega \to \pi^+\pi^-\pi^0$		$(\ 6.5 \pm 3.0\ ) \times 10^{-3}$		410
$K_S^0\eta\pi^0$		$(\ 5.5 \pm 1.1\ ) \times 10^{-3}$		721
$K_S^0 a_0(980)$, $a_0(980) \to \eta\pi^0$		$(\ 6.5 \pm 2.0\ ) \times 10^{-3}$		–
$\overline{K}^*(892)^0\eta$, $\overline{K}^*(892)^0 \to K_S^0\pi^0$		$(\ 1.6 \pm 0.5\ ) \times 10^{-3}$		–
$K_S^0 2\pi^+ 2\pi^-$		$(\ 2.69 \pm 0.31\ ) \times 10^{-3}$		768
$K_S^0\rho^0\pi^+\pi^-$, no $K^*(892)^-$		$(\ 1.1 \pm 0.7\ ) \times 10^{-3}$		–
$K^*(892)^- 2\pi^+\pi^-$, $K^*(892)^- \to K_S^0\pi^-$, no ρ^0		$(\ 5 \pm 8\ ) \times 10^{-4}$		642
$K^*(892)^-\rho^0\pi^+$, $K^*(892)^- \to K_S^0\pi^-$		$(\ 1.6 \pm 0.6\ ) \times 10^{-3}$		230
$K_S^0 2\pi^+ 2\pi^-$ nonresonant		$< 1.2 \times 10^{-3}$	CL=90%	768
$K^-3\pi^+2\pi^-$		$(\ 2.2 \pm 0.6\ ) \times 10^{-4}$		713

Fractions of many of the following modes with resonances have already appeared above as submodes of particular charged-particle modes. (Modes for which there are only upper limits and $\overline{K}^*(892)\rho$ submodes only appear below.)

$K^0_S\eta$		$(\ 4.79 \pm 0.30\ )\times10^{-3}$			772
$K^0_S\omega$		$(\ 1.11 \pm 0.06\ )$ %			670
$K^0_S\eta'(958)$		$(\ 9.4 \pm 0.5\ )\times10^{-3}$			565
$K^-a_1(1260)^+$		$(\ 7.8 \pm 1.1\ )$ %			327
$K^-a_2(1320)^+$		$< 2 \times10^{-3}$		CL=90%	198
$\overline{K}^*(892)^0\pi^+\pi^-$ total		$(\ 2.4 \pm 0.5\ )$ %			685
$\overline{K}^*(892)^0\pi^+\pi^-$ 3-body		$(\ 1.48 \pm 0.34\ )$ %			685
$\overline{K}^*(892)^0\rho^0$		$(\ 1.58 \pm 0.34\ )$ %			417
$\overline{K}^*(892)^0\rho^0$ transverse		$(\ 1.7 \pm 0.6\ )$ %			417
$\overline{K}^*(892)^0\rho^0$ S-wave		$(\ 3.0 \pm 0.6\ )$ %			417
$\overline{K}^*(892)^0\rho^0$ S-wave long.		$< 3 \times10^{-3}$		CL=90%	417
$\overline{K}^*(892)^0\rho^0$ P-wave		$< 3 \times10^{-3}$		CL=90%	417
$\overline{K}^*(892)^0\rho^0$ D-wave		$(\ 2.1 \pm 0.6\ )$ %			417
$K_1(1270)^-\pi^+$	[*fff*]	$(\ 1.6 \pm 0.8\ )$ %			484
$K_1(1400)^-\pi^+$		< 1.2 %		CL=90%	386
$\overline{K}^*(892)^0\pi^+\pi^-\pi^0$		$(\ 1.9 \pm 0.9\ )$ %			643
$K^-\pi^+\omega$		$(\ 3.0 \pm 0.6\ )$ %			605
$\overline{K}^*(892)^0\omega$		$(\ 1.1 \pm 0.5\ )$ %			410
$K^-\pi^+\eta'(958)$		$(\ 7.5 \pm 1.9\ )\times10^{-3}$			479
$\overline{K}^*(892)^0\eta'(958)$		$< 1.1 \times10^{-3}$		CL=90%	119

Hadronic modes with three K's

$K^0_SK^+K^-$		$(\ 4.47 \pm 0.34\ )\times10^{-3}$			544
$K^0_Sa_0(980)^0$, $a_0^0 \to K^+K^-$		$(\ 3.0 \pm 0.4\ )\times10^{-3}$			–
$K^-a_0(980)^+$, $a_0^+ \to K^+K^0_S$		$(\ 6.0 \pm 1.8\ )\times10^{-4}$			–
$K^+a_0(980)^-$, $a_0^- \to K^-K^0_S$		$< 1.1 \times10^{-4}$		CL=95%	–
$K^0_Sf_0(980)$, $f_0 \to K^+K^-$		$< 9 \times10^{-5}$		CL=95%	–
$K^0_S\phi$, $\phi \to K^+K^-$		$(\ 2.05 \pm 0.16\ )\times10^{-3}$			520
$K^0_Sf_0(1370)$, $f_0 \to K^+K^-$		$(\ 1.7 \pm 1.1\ )\times10^{-4}$			–
$3K^0_S$		$(\ 9.1 \pm 1.3\ )\times10^{-4}$			539
$K^+2K^-\pi^+$		$(\ 2.21 \pm 0.31\ )\times10^{-4}$			434
$K^+K^-\overline{K}^*(892)^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 4.4 \pm 1.7\ )\times10^{-5}$			†
$K^-\pi^+\phi$, $\phi \to K^+K^-$		$(\ 4.0 \pm 1.7\ )\times10^{-5}$			422
$\phi\overline{K}^*(892)^0$, $\phi \to K^+K^-$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(\ 1.06 \pm 0.20\ )\times10^{-4}$			†
$K^+2K^-\pi^+$ nonresonant		$(\ 3.3 \pm 1.5\ )\times10^{-5}$			434
$2K^0_SK^\pm\pi^\mp$		$(\ 6.0 \pm 1.3\ )\times10^{-4}$			427

Pionic modes

$\pi^+\pi^-$		$(\ 1.402 \pm 0.026)\times10^{-3}$		S=1.1	922
$2\pi^0$		$(\ 8.20 \pm 0.35\ )\times10^{-4}$			923
$\pi^+\pi^-\pi^0$		$(\ 1.43 \pm 0.06\ )$ %		S=1.9	907
$\rho^+\pi^-$		$(\ 9.8 \pm 0.4\ )\times10^{-3}$			764
$\rho^0\pi^0$		$(\ 3.72 \pm 0.22\ )\times10^{-3}$			764
$\rho^-\pi^+$		$(\ 4.96 \pm 0.24\ )\times10^{-3}$			764
$\rho(1450)^+\pi^-$, $\rho(1450)^+ \to \pi^+\pi^0$		$(\ 1.6 \pm 2.0\ )\times10^{-5}$			–
$\rho(1450)^0\pi^0$, $\rho(1450)^0 \to \pi^+\pi^-$		$(\ 4.3 \pm 1.9\ )\times10^{-5}$			–

$\rho(1450)^-\pi^+$, $\rho(1450)^- \to \pi^-\pi^0$		(2.6 ± 0.4) $\times 10^{-4}$			–
$\rho(1700)^+\pi^-$, $\rho(1700)^+ \to \pi^+\pi^0$		(5.9 ± 1.4) $\times 10^{-4}$			–
$\rho(1700)^0\pi^0$, $\rho(1700)^0 \to \pi^+\pi^-$		(7.2 ± 1.7) $\times 10^{-4}$			–
$\rho(1700)^-\pi^+$, $\rho(1700)^- \to \pi^-\pi^0$		(4.6 ± 1.1) $\times 10^{-4}$			–
$f_0(980)\pi^0$, $f_0(980) \to \pi^+\pi^-$		(3.6 ± 0.8) $\times 10^{-5}$			–
$f_0(500)\pi^0$, $f_0(500) \to \pi^+\pi^-$		(1.18 ± 0.21) $\times 10^{-4}$			–
$f_0(1370)\pi^0$, $f_0(1370) \to \pi^+\pi^-$		(5.3 ± 2.1) $\times 10^{-5}$			–
$f_0(1500)\pi^0$, $f_0(1500) \to \pi^+\pi^-$		(5.6 ± 1.5) $\times 10^{-5}$			–
$f_0(1710)\pi^0$, $f_0(1710) \to \pi^+\pi^-$		(4.4 ± 1.5) $\times 10^{-5}$			–
$f_2(1270)\pi^0$, $f_2(1270) \to \pi^+\pi^-$		(1.89 ± 0.20) $\times 10^{-4}$			–
$\pi^+\pi^-\pi^0$ nonresonant		(1.20 ± 0.35) $\times 10^{-4}$			907
$3\pi^0$		< 3.5	$\times 10^{-4}$	CL=90%	908
$2\pi^+2\pi^-$		(7.42 ± 0.21) $\times 10^{-3}$		S=1.1	880
$a_1(1260)^+\pi^-$, $a_1^+ \to 2\pi^+\pi^-$ total		(4.45 ± 0.31) $\times 10^{-3}$			–
$a_1(1260)^+\pi^-$, $a_1^+ \to \rho^0\pi^+$ S-wave		(3.21 ± 0.25) $\times 10^{-3}$			–
$a_1(1260)^+\pi^-$, $a_1^+ \to \rho^0\pi^+$ D-wave		(1.9 ± 0.5) $\times 10^{-4}$			–
$a_1(1260)^+\pi^-$, $a_1^+ \to \sigma\pi^+$		(6.2 ± 0.7) $\times 10^{-4}$			–
$2\rho^0$ total		(1.82 ± 0.13) $\times 10^{-3}$			518
$2\rho^0$, parallel helicities		(8.2 ± 3.2) $\times 10^{-5}$			–
$2\rho^0$, perpendicular helicities		(4.8 ± 0.6) $\times 10^{-4}$			–
$2\rho^0$, longitudinal helicities		(1.25 ± 0.10) $\times 10^{-3}$			–
Resonant $(\pi^+\pi^-)\pi^+\pi^-$ 3-body total		(1.48 ± 0.12) $\times 10^{-3}$			–
$\sigma\pi^+\pi^-$		(6.1 ± 0.9) $\times 10^{-4}$			–
$f_0(980)\pi^+\pi^-$, $f_0 \to \pi^+\pi^-$		(1.8 ± 0.5) $\times 10^{-4}$			–
$f_2(1270)\pi^+\pi^-$, $f_2 \to \pi^+\pi^-$		(3.6 ± 0.6) $\times 10^{-4}$			–
$\pi^+\pi^-2\pi^0$		(1.00 ± 0.09) %			882
$\eta\pi^0$	[hhh]	(6.8 ± 0.7) $\times 10^{-4}$			846
$\omega\pi^0$	[hhh]	< 2.6	$\times 10^{-4}$	CL=90%	761
$2\pi^+2\pi^-\pi^0$		(4.1 ± 0.5) $\times 10^{-3}$			844
$\eta\pi^+\pi^-$	[hhh]	(1.09 ± 0.16) $\times 10^{-3}$			827
$\omega\pi^+\pi^-$	[hhh]	(1.6 ± 0.5) $\times 10^{-3}$			738
$3\pi^+3\pi^-$		(4.2 ± 1.2) $\times 10^{-4}$			795
$\eta'(958)\pi^0$		(9.0 ± 1.4) $\times 10^{-4}$			678
$\eta'(958)\pi^+\pi^-$		(4.5 ± 1.7) $\times 10^{-4}$			650
2η		(1.67 ± 0.20) $\times 10^{-3}$			754
$\eta\eta'(958)$		(1.05 ± 0.26) $\times 10^{-3}$			537
Hadronic modes with a $K\overline{K}$ pair					
K^+K^-		(3.96 ± 0.08) $\times 10^{-3}$		S=1.4	791
$2K_S^0$		(1.7 ± 0.4) $\times 10^{-4}$		S=2.5	789
$K_S^0K^-\pi^+$		(3.5 ± 0.5) $\times 10^{-3}$		S=1.2	739
$\overline{K}^*(892)^0K_S^0$, $\overline{K}^{*0} \to K^-\pi^+$		< 5	$\times 10^{-4}$	CL=90%	608
$K_S^0K^+\pi^-$		(2.1 ± 0.4) $\times 10^{-3}$		S=1.3	739
$K^*(892)^0K_S^0$, $K^{*0} \to K^+\pi^-$		< 1.8	$\times 10^{-4}$	CL=90%	608

$K^+ K^- \pi^0$		$(3.29 \pm 0.14) \times 10^{-3}$		743
$K^*(892)^+ K^-$, $K^*(892)^+ \to K^+ \pi^0$		$(1.46 \pm 0.07) \times 10^{-3}$		–
$K^*(892)^- K^+$, $K^*(892)^- \to K^- \pi^0$		$(5.2 \pm 0.4) \times 10^{-4}$		–
$(K^+ \pi^0)_{S-wave} K^-$		$(2.34 \pm 0.17) \times 10^{-3}$		743
$(K^- \pi^0)_{S-wave} K^+$		$(1.3 \pm 0.4) \times 10^{-4}$		743
$f_0(980)\pi^0$, $f_0 \to K^+ K^-$		$(3.5 \pm 0.6) \times 10^{-4}$		–
$\phi\pi^0$, $\phi \to K^+ K^-$		$(6.4 \pm 0.4) \times 10^{-4}$		–
$2K_S^0 \pi^0$		$< 5.9 \times 10^{-4}$		740
$K^+ K^- \pi^+ \pi^-$		$(2.43 \pm 0.12) \times 10^{-3}$		677
$\phi(\pi^+ \pi^-)_{S-wave}$, $\phi \to K^+ K^-$		$(2.50 \pm 0.33) \times 10^{-4}$		614
$(\phi\rho^0)_{S-wave}$, $\phi \to K^+ K^-$		$(9.3 \pm 1.2) \times 10^{-4}$		250
$(\phi\rho^0)_{D-wave}$, $\phi \to K^+ K^-$		$(8.3 \pm 2.3) \times 10^{-5}$		–
$(K^{*0}\overline{K}^{*0})_{S-wave}$, $K^{*0} \to K^\pm \pi^\mp$		$(1.48 \pm 0.30) \times 10^{-4}$		–
$(K^- \pi^+)_{P-wave}$, $(K^+ \pi^-)_{S-wave}$,		$(2.6 \pm 0.5) \times 10^{-4}$		–
$K_1(1270)^+ K^-$, $K_1(1270)^+ \to K^{*0}\pi^+$		$(1.8 \pm 0.5) \times 10^{-4}$		–
$K_1(1270)^+ K^-$, $K_1(1270)^+ \to \rho^0 K^+$		$(1.14 \pm 0.26) \times 10^{-4}$		–
$K_1(1270)^- K^+$, $K_1(1270)^- \to \overline{K}^{*0}\pi^-$		$(2.2 \pm 1.2) \times 10^{-5}$		–
$K_1(1270)^- K^+$, $K_1(1270)^- \to \rho^0 K^-$		$(1.46 \pm 0.25) \times 10^{-4}$		–
$K^*(1410)^+ K^-$, $K^*(1410)^+ \to K^{*0}\pi^+$		$(1.02 \pm 0.26) \times 10^{-4}$		–
$K^*(1410)^- K^+$, $K^*(1410)^- \to \overline{K}^{*0}\pi^-$		$(1.14 \pm 0.25) \times 10^{-4}$		–
$2K_S^0 \pi^+ \pi^-$		$(1.23 \pm 0.24) \times 10^{-3}$		673
$K_S^0 K^- 2\pi^+ \pi^-$		$< 1.5 \times 10^{-4}$	CL=90%	595
$K^+ K^- \pi^+ \pi^- \pi^0$		$(3.1 \pm 2.0) \times 10^{-3}$		600

Other $K\overline{K}X$ modes. They include all decay modes of the ϕ, η, and ω.

$\phi\eta$		$(1.4 \pm 0.5) \times 10^{-4}$		489
$\phi\omega$		$< 2.1 \times 10^{-3}$	CL=90%	238

Radiative modes

$\rho^0\gamma$		$< 2.4 \times 10^{-4}$	CL=90%	771
$\omega\gamma$		$< 2.4 \times 10^{-4}$	CL=90%	768
$\phi\gamma$		$(2.70 \pm 0.35) \times 10^{-5}$		654
$\overline{K}^*(892)^0\gamma$		$(3.27 \pm 0.34) \times 10^{-4}$		719

Doubly Cabibbo suppressed (*DC*) modes or $\Delta C = 2$ forbidden via mixing (*C2M*) modes

$K^+ \ell^- \overline{\nu}_\ell$ via $\overline{D}^0$		$< 2.2 \times 10^{-5}$	CL=90%	–
K^+ or $K^*(892)^+ e^- \overline{\nu}_e$ via $\overline{D}^0$		$< 6 \times 10^{-5}$	CL=90%	–
$K^+ \pi^-$	*DC*	$(1.47 \pm 0.07) \times 10^{-4}$	S=2.8	861
$K^+ \pi^-$ via DCS		$(1.31 \pm 0.08) \times 10^{-4}$		–
$K^+ \pi^-$ via $\overline{D}^0$		$< 1.6 \times 10^{-5}$	CL=95%	861
$K_S^0 \pi^+ \pi^-$ in $D^0 \to \overline{D}^0$		$< 1.8 \times 10^{-4}$	CL=95%	–
$K^*(892)^+ \pi^-$, $K^*(892)^+ \to K_S^0 \pi^+$	*DC*	$(1.14 \, {}^{+0.60}_{-0.34}) \times 10^{-4}$		711

$K_0^*(1430)^+\pi^-$, $K_0^*(1430)^+ \to K_S^0\pi^+$	DC	$<$	1.4	$\times 10^{-5}$		–
$K_2^*(1430)^+\pi^-$, $K_2^*(1430)^+ \to K_S^0\pi^+$	DC	$<$	3.4	$\times 10^{-5}$		–
$K^+\pi^-\pi^0$	DC	(3.04	± 0.17)	$\times 10^{-4}$		844
$K^+\pi^-\pi^0$ via $\overline{D}^0$		(7.3	± 0.5)	$\times 10^{-4}$		–
$K^+\pi^+2\pi^-$	DC	(2.62	± 0.11)	$\times 10^{-4}$		813
$K^+\pi^+2\pi^-$ via $\overline{D}^0$		$<$	4	$\times 10^{-4}$	CL=90%	812
μ^- anything via $\overline{D}^0$		$<$	4	$\times 10^{-4}$	CL=90%	–

$\Delta C = 1$ weak neutral current ($C1$) modes, Lepton Family number (LF) violating modes, Lepton (L) or Baryon (B) number violating modes

$\gamma\gamma$	$C1$	$<$	2.2	$\times 10^{-6}$	CL=90%	932
e^+e^-	$C1$	$<$	7.9	$\times 10^{-8}$	CL=90%	932
$\mu^+\mu^-$	$C1$	$<$	6.2	$\times 10^{-9}$	CL=90%	926
$\pi^0 e^+e^-$	$C1$	$<$	4.5	$\times 10^{-5}$	CL=90%	928
$\pi^0\mu^+\mu^-$	$C1$	$<$	1.8	$\times 10^{-4}$	CL=90%	915
ηe^+e^-	$C1$	$<$	1.1	$\times 10^{-4}$	CL=90%	852
$\eta\mu^+\mu^-$	$C1$	$<$	5.3	$\times 10^{-4}$	CL=90%	838
$\pi^+\pi^-e^+e^-$	$C1$	$<$	3.73	$\times 10^{-4}$	CL=90%	922
$\rho^0 e^+e^-$	$C1$	$<$	1.0	$\times 10^{-4}$	CL=90%	771
$\pi^+\pi^-\mu^+\mu^-$	$C1$	$<$	5.5	$\times 10^{-7}$	CL=90%	894
$\rho^0\mu^+\mu^-$	$C1$	$<$	2.2	$\times 10^{-5}$	CL=90%	754
ωe^+e^-	$C1$	$<$	1.8	$\times 10^{-4}$	CL=90%	768
$\omega\mu^+\mu^-$	$C1$	$<$	8.3	$\times 10^{-4}$	CL=90%	751
$K^-K^+e^+e^-$	$C1$	$<$	3.15	$\times 10^{-4}$	CL=90%	791
ϕe^+e^-	$C1$	$<$	5.2	$\times 10^{-5}$	CL=90%	654
$K^-K^+\mu^+\mu^-$	$C1$	$<$	3.3	$\times 10^{-5}$	CL=90%	710
$\phi\mu^+\mu^-$	$C1$	$<$	3.1	$\times 10^{-5}$	CL=90%	631
$\overline{K}^0 e^+e^-$	[yy]	$<$	1.1	$\times 10^{-4}$	CL=90%	866
$\overline{K}^0\mu^+\mu^-$	[yy]	$<$	2.6	$\times 10^{-4}$	CL=90%	852
$K^-\pi^+e^+e^-$	$C1$	$<$	3.85	$\times 10^{-4}$	CL=90%	861
$\overline{K}^*(892)^0 e^+e^-$	[yy]	$<$	4.7	$\times 10^{-5}$	CL=90%	719
$K^-\pi^+\mu^+\mu^-$	$C1$	$<$	3.59	$\times 10^{-4}$	CL=90%	829
$\overline{K}^*(892)^0\mu^+\mu^-$	[yy]	$<$	2.4	$\times 10^{-5}$	CL=90%	700
$\pi^+\pi^-\pi^0\mu^+\mu^-$	$C1$	$<$	8.1	$\times 10^{-4}$	CL=90%	863
$\mu^\pm e^\mp$	LF	[gg] $<$	2.6	$\times 10^{-7}$	CL=90%	929
$\pi^0 e^\pm\mu^\mp$	LF	[gg] $<$	8.6	$\times 10^{-5}$	CL=90%	924
$\eta e^\pm\mu^\mp$	LF	[gg] $<$	1.0	$\times 10^{-4}$	CL=90%	848
$\pi^+\pi^-e^\pm\mu^\mp$	LF	[gg] $<$	1.5	$\times 10^{-5}$	CL=90%	911
$\rho^0 e^\pm\mu^\mp$	LF	[gg] $<$	4.9	$\times 10^{-5}$	CL=90%	767
$\omega e^\pm\mu^\mp$	LF	[gg] $<$	1.2	$\times 10^{-4}$	CL=90%	764
$K^-K^+e^\pm\mu^\mp$	LF	[gg] $<$	1.8	$\times 10^{-4}$	CL=90%	754
$\phi e^\pm\mu^\mp$	LF	[gg] $<$	3.4	$\times 10^{-5}$	CL=90%	648
$\overline{K}^0 e^\pm\mu^\mp$	LF	[gg] $<$	1.0	$\times 10^{-4}$	CL=90%	863
$K^-\pi^+e^\pm\mu^\mp$	LF	[gg] $<$	5.53	$\times 10^{-4}$	CL=90%	848
$\overline{K}^*(892)^0 e^\pm\mu^\mp$	LF	[gg] $<$	8.3	$\times 10^{-5}$	CL=90%	714
$2\pi^-2e^+ +$ c.c.	L	$<$	1.12	$\times 10^{-4}$	CL=90%	922
$2\pi^-2\mu^+ +$ c.c.	L	$<$	2.9	$\times 10^{-5}$	CL=90%	894
$K^-\pi^-2e^+ +$ c.c.	L	$<$	2.06	$\times 10^{-4}$	CL=90%	861
$K^-\pi^-2\mu^+ +$ c.c.	L	$<$	3.9	$\times 10^{-4}$	CL=90%	829
$2K^-2e^+ +$ c.c.	L	$<$	1.52	$\times 10^{-4}$	CL=90%	791
$2K^-2\mu^+ +$ c.c.	L	$<$	9.4	$\times 10^{-5}$	CL=90%	710
$\pi^-\pi^-e^+\mu^+ +$ c.c.	L	$<$	7.9	$\times 10^{-5}$	CL=90%	911

$K^-\pi^-e^+\mu^+$ + c.c.	L	<	2.18	$\times 10^{-4}$	CL=90%	848
$2K^-e^+\mu^+$ + c.c.	L	<	5.7	$\times 10^{-5}$	CL=90%	754
pe^-	L,B	[iii] <	1.0	$\times 10^{-5}$	CL=90%	696
$\overline{p}e^+$	L,B	[jjj] <	1.1	$\times 10^{-5}$	CL=90%	696

$D^*(2007)^0$

$I(J^P) = \frac{1}{2}(1^-)$
I, J, P need confirmation.

Mass $m = 2006.96 \pm 0.10$ MeV
$m_{D^{*0}} - m_{D^0} = 142.12 \pm 0.07$ MeV
Full width $\Gamma < 2.1$ MeV, CL = 90%

$\overline{D}^*(2007)^0$ modes are charge conjugates of modes below.

$D^*(2007)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0\pi^0$	(61.9±2.9) %	43
$D^0\gamma$	(38.1±2.9) %	137

$D^*(2010)^\pm$

$I(J^P) = \frac{1}{2}(1^-)$
I, J, P need confirmation.

Mass $m = 2010.26 \pm 0.07$ MeV (S = 1.1)
$m_{D^*(2010)^+} - m_{D^+} = 140.66 \pm 0.08$ MeV
$m_{D^*(2010)^+} - m_{D^0} = 145.4257 \pm 0.0017$ MeV
Full width $\Gamma = 83.4 \pm 1.8$ keV

$D^*(2010)^-$ modes are charge conjugates of the modes below.

$D^*(2010)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0\pi^+$	(67.7±0.5) %	39
$D^+\pi^0$	(30.7±0.5) %	38
$D^+\gamma$	(1.6±0.4) %	136

$D_0^*(2400)^0$

$I(J^P) = \frac{1}{2}(0^+)$

Mass $m = 2318 \pm 29$ MeV (S = 1.7)
Full width $\Gamma = 267 \pm 40$ MeV

$D_0^*(2400)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+\pi^-$	seen	385

$D_1(2420)^0$

$I(J^P) = \frac{1}{2}(1^+)$
I needs confirmation.

Mass $m = 2421.4 \pm 0.6$ MeV (S = 1.2)
$m_{D_1^0} - m_{D^{*+}} = 411.1 \pm 0.6$ (S = 1.2)
Full width $\Gamma = 27.4 \pm 2.5$ MeV (S = 2.3)

$\overline{D}_1(2420)^0$ modes are charge conjugates of modes below.

$D_1(2420)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+\pi^-$	seen	354
$D^0\pi^+\pi^-$	seen	425
$D^+\pi^-$	not seen	473
$D^{*0}\pi^+\pi^-$	not seen	280

$D_2^*(2460)^0$

$I(J^P) = \frac{1}{2}(2^+)$

$J^P = 2^+$ assignment strongly favored.

Mass $m = 2462.6 \pm 0.6$ MeV (S = 1.2)
$m_{D_2^{*0}} - m_{D^+} = 593.0 \pm 0.6$ MeV (S = 1.2)
$m_{D_2^{*0}} - m_{D^{*+}} = 452.3 \pm 0.6$ MeV (S = 1.2)
Full width $\Gamma = 49.0 \pm 1.3$ MeV (S = 1.5)

$\overline{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

$D_2^*(2460)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+\pi^-$	seen	507
$D^*(2010)^+\pi^-$	seen	391
$D^0\pi^+\pi^-$	not seen	463
$D^{*0}\pi^+\pi^-$	not seen	326

$D_2^*(2460)^\pm$

$I(J^P) = \frac{1}{2}(2^+)$

$J^P = 2^+$ assignment strongly favored.

Mass $m = 2464.3 \pm 1.6$ MeV (S = 1.7)
$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0} = 2.4 \pm 1.7$ MeV
Full width $\Gamma = 37 \pm 6$ MeV (S = 1.4)

$D_2^*(2460)^-$ modes are charge conjugates of modes below.

$D_2^*(2460)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0\pi^+$	seen	512
$D^{*0}\pi^+$	seen	395
$D^+\pi^+\pi^-$	not seen	461
$D^{*+}\pi^+\pi^-$	not seen	324

CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$D_s^+ = c\overline{s}$, $D_s^- = \overline{c}s$, similarly for D_s^*'s

$D_s^\pm$

$I(J^P) = 0(0^-)$

Mass $m = 1968.30 \pm 0.11$ MeV (S = 1.1)
$m_{D_s^\pm} - m_{D^\pm} = 98.69 \pm 0.05$ MeV
Mean life $\tau = (500 \pm 7) \times 10^{-15}$ s (S = 1.3)
$c\tau = 149.9$ μm

CP-violating decay-rate asymmetries

$A_{CP}(\mu^\pm\nu) = (5 \pm 6)\%$
$A_{CP}(K^\pm K_S^0) = (0.08 \pm 0.26)\%$
$A_{CP}(K^+K^-\pi^\pm) = (-0.5 \pm 0.9)\%$
$A_{CP}(K^\pm K_S^0\pi^0) = (-2 \pm 6)\%$
$A_{CP}(2K_S^0\pi^\pm) = (3 \pm 5)\%$
$A_{CP}(K^+K^-\pi^\pm\pi^0) = (0.0 \pm 3.0)\%$
$A_{CP}(K^\pm K_S^0\pi^+\pi^-) = (-6 \pm 5)\%$
$A_{CP}(K_S^0 K^\mp 2\pi^\pm) = (4.1 \pm 2.8)\%$
$A_{CP}(\pi^+\pi^-\pi^\pm) = (-0.7 \pm 3.1)\%$
$A_{CP}(\pi^\pm\eta) = (1.1 \pm 3.1)\%$
$A_{CP}(\pi^\pm\eta') = (-2.2 \pm 2.3)\%$
$A_{CP}(\eta\pi^\pm\pi^0) = (-1 \pm 4)\%$
$A_{CP}(\eta'\pi^\pm\pi^0) = (0 \pm 8)\%$
$A_{CP}(K^\pm\pi^0) = (-27 \pm 24)\%$
$A_{CP}(K_S^0\pi^\pm) = (1.2 \pm 1.0)\%$ (S = 1.3)
$A_{CP}(K^\pm\pi^+\pi^-) = (4 \pm 5)\%$
$A_{CP}(K^\pm\eta) = (9 \pm 15)\%$
$A_{CP}(K^\pm\eta'(958)) = (6 \pm 19)\%$

T-violating decay-rate asymmetry

$A_T(K_S^0 K^\pm\pi^+\pi^-) = (-14 \pm 8) \times 10^{-3}$ [rr]

$D_s^+ \to \phi\ell^+\nu_\ell$ form factors

$r_2 = 0.84 \pm 0.11$ (S = 2.4)
$r_v = 1.80 \pm 0.08$
$\Gamma_L/\Gamma_T = 0.72 \pm 0.18$

Unless otherwise noted, the branching fractions for modes with a resonance in the final state include all the decay modes of the resonance. D_S^- modes are charge conjugates of the modes below.

D_s^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
e^+ semileptonic	[kkk] (6.5 ±0.4) %		–
π^+ anything	(119.3 ±1.4) %		–
π^- anything	(43.2 ±0.9) %		–
π^0 anything	(123 ±7) %		–
K^- anything	(18.7 ±0.5) %		–

K^+ anything		(28.9 ±0.7) %			–
K^0_S anything		(19.0 ±1.1) %			–
η anything	[*lll*]	(29.9 ±2.8) %			–
ω anything		(6.1 ±1.4) %			–
η' anything	[*nnn*]	(11.7 ±1.8) %			–
$f_0(980)$ anything, $f_0 \to \pi^+\pi^-$		< 1.3	%	CL=90%	–
ϕ anything		(15.7 ±1.0) %			–
K^+K^- anything		(15.8 ±0.7) %			–
$K^0_S K^+$ anything		(5.8 ±0.5) %			–
$K^0_S K^-$ anything		(1.9 ±0.4) %			–
$2K^0_S$ anything		(1.70±0.32) %			–
$2K^+$ anything		< 2.6	$\times 10^{-3}$	CL=90%	–
$2K^-$ anything		< 6	$\times 10^{-4}$	CL=90%	–

Leptonic and semileptonic modes

$e^+\nu_e$		< 8.3	$\times 10^{-5}$	CL=90%	984
$\mu^+\nu_\mu$		(5.56±0.25)	$\times 10^{-3}$		981
$\tau^+\nu_\tau$		(5.54±0.24) %			182
$K^+K^-e^+\nu_e$		—			851
$\phi e^+\nu_e$	[*ooo*]	(2.49±0.14) %			720
$\eta e^+\nu_e + \eta'(958)e^+\nu_e$	[*ooo*]	(3.66±0.37) %			–
$\eta e^+\nu_e$	[*ooo*]	(2.67±0.29) %		S=1.1	908
$\eta'(958)e^+\nu_e$	[*ooo*]	(9.9 ±2.3)	$\times 10^{-3}$		751
$\omega e^+\nu_e$	[*ppp*]	< 2.0	$\times 10^{-3}$	CL=90%	829
$K^0 e^+\nu_e$		(3.7 ±1.0)	$\times 10^{-3}$		921
$K^*(892)^0 e^+\nu_e$	[*ooo*]	(1.8 ±0.7)	$\times 10^{-3}$		782
$f_0(980)e^+\nu_e$, $f_0 \to \pi^+\pi^-$		(2.00±0.32)	$\times 10^{-3}$		–

Hadronic modes with a $K\overline{K}$ pair

$K^+K^0_S$		(1.49±0.06) %			850
$K^+\overline{K}^0$		(2.95±0.14) %			850
$K^+K^-\pi^+$	[*ss*]	(5.39±0.21) %		S=1.4	805
$\phi\pi^+$	[*ooo,qqq*]	(4.5 ±0.4) %			712
$\phi\pi^+$, $\phi \to K^+K^-$	[*qqq*]	(2.24±0.10) %			712
$K^+\overline{K}^*(892)^0$, $\overline{K}^{*0} \to K^-\pi^+$		(2.58±0.11) %			416
$f_0(980)\pi^+$, $f_0 \to K^+K^-$		(1.14±0.31) %			732
$f_0(1370)\pi^+$, $f_0 \to K^+K^-$		(7 ±5)	$\times 10^{-4}$		–
$f_0(1710)\pi^+$, $f_0 \to K^+K^-$		(6.6 ±2.9)	$\times 10^{-4}$		198
$K^+\overline{K}^*_0(1430)^0$, $\overline{K}^*_0 \to K^-\pi^+$		(1.8 ±0.4)	$\times 10^{-3}$		218
$K^+K^0_S\pi^0$		(1.52±0.22) %			805
$2K^0_S\pi^+$		(7.7 ±0.6)	$\times 10^{-3}$		802
$K^0\overline{K}^0\pi^+$		—			802
$K^*(892)^+\overline{K}^0$	[*ooo*]	(5.4 ±1.2) %			683
$K^+K^-\pi^+\pi^0$		(6.3 ±0.7) %		S=1.1	748
$\phi\rho^+$	[*ooo*]	(8.4 $^{+1.9}_{-2.3}$) %			401
$K^0_S K^-2\pi^+$		(1.66±0.11) %			744
$K^*(892)^+\overline{K}^*(892)^0$	[*ooo*]	(7.2 ±2.6) %			417
$K^+K^0_S\pi^+\pi^-$		(1.03±0.10) %			744
$K^+K^-2\pi^+\pi^-$		(8.6 ±1.5)	$\times 10^{-3}$		673
$\phi 2\pi^+\pi^-$	[*ooo*]	(1.21±0.16) %			640
$K^+K^-\rho^0\pi^+$ non-ϕ		< 2.6	$\times 10^{-4}$	CL=90%	249
$\phi\rho^0\pi^+$, $\phi \to K^+K^-$		(6.5 ±1.3)	$\times 10^{-3}$		181

$\phi a_1(1260)^+$, $\phi \to K^+K^-$, $a_1^+ \to \rho^0\pi^+$		(7.4 ±1.2) × 10^{-3}			†
$K^+K^-2\pi^+\pi^-$ nonresonant		(9 ±7) × 10^{-4}			673
$2K_S^0 2\pi^+\pi^-$		(8 ±4) × 10^{-4}			669
Hadronic modes without K's					
$\pi^+\pi^0$		< 3.4 × 10^{-4}		CL=90%	975
$2\pi^+\pi^-$		(1.09±0.05) %		S=1.2	959
$\rho^0\pi^+$		(2.0 ±1.2) × 10^{-4}			825
$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$	[rrr]	(9.0 ±0.5) × 10^{-3}			959
$f_2(1270)\pi^+$, $f_2 \to \pi^+\pi^-$		(1.09±0.20) × 10^{-3}			559
$\rho(1450)^0\pi^+$, $\rho^0 \to \pi^+\pi^-$		(3.0 ±1.9) × 10^{-4}			421
$\pi^+2\pi^0$		(6.5 ±1.3) × 10^{-3}			960
$2\pi^+\pi^-\pi^0$		—			935
$\eta\pi^+$	[ooo]	(1.69±0.10) %		S=1.2	902
$\omega\pi^+$	[ooo]	(2.4 ±0.6) × 10^{-3}			822
$3\pi^+2\pi^-$		(7.9 ±0.8) × 10^{-3}			899
$2\pi^+\pi^-2\pi^0$		—			902
$\eta\rho^+$	[ooo]	(8.9 ±0.8) %			724
$\eta\pi^+\pi^0$		(9.2 ±1.2) %			885
$\omega\pi^+\pi^0$	[ooo]	(2.8 ±0.7) %			802
$3\pi^+2\pi^-\pi^0$		(4.9 ±3.2) %			856
$\omega 2\pi^+\pi^-$	[ooo]	(1.6 ±0.5) %			766
$\eta'(958)\pi^+$	[nnn,ooo]	(3.94±0.25) %			743
$3\pi^+2\pi^-2\pi^0$		—			803
$\omega\eta\pi^+$	[ooo]	< 2.13	%	CL=90%	654
$\eta'(958)\rho^+$	[nnn,ooo]	(12.5 ±2.2) %			465
$\eta'(958)\pi^+\pi^0$		(5.6 ±0.8) %			720
Modes with one or three K's					
$K^+\pi^0$		(6.3 ±2.1) × 10^{-4}			917
$K_S^0\pi^+$		(1.21±0.06) × 10^{-3}			916
$K^+\eta$	[ooo]	(1.76±0.35) × 10^{-3}			835
$K^+\omega$	[ooo]	< 2.4 × 10^{-3}		CL=90%	741
$K^+\eta'(958)$	[ooo]	(1.8 ±0.6) × 10^{-3}			646
$K^+\pi^+\pi^-$		(6.5 ±0.4) × 10^{-3}			900
$K^+\rho^0$		(2.5 ±0.4) × 10^{-3}			745
$K^+\rho(1450)^0$, $\rho^0 \to \pi^+\pi^-$		(6.9 ±2.4) × 10^{-4}			–
$K^*(892)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(1.41±0.24) × 10^{-3}			775
$K^*(1410)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(1.23±0.28) × 10^{-3}			–
$K^*(1430)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(5.0 ±3.5) × 10^{-4}			–
$K^+\pi^+\pi^-$ nonresonant		(1.04±0.34) × 10^{-3}			900
$K^0\pi^+\pi^0$		(1.00±0.18) %			899
$K_S^0 2\pi^+\pi^-$		(3.0 ±1.1) × 10^{-3}			870
$K^+\omega\pi^0$	[ooo]	< 8.2 × 10^{-3}		CL=90%	684
$K^+\omega\pi^+\pi^-$	[ooo]	< 5.4 × 10^{-3}		CL=90%	603
$K^+\omega\eta$	[ooo]	< 7.9 × 10^{-3}		CL=90%	366
$2K^+K^-$		(2.16±0.21) × 10^{-4}			627
ϕK^+, $\phi \to K^+K^-$		(8.8 ±2.0) × 10^{-5}			–
Doubly Cabibbo-suppressed modes					
$2K^+\pi^-$		(1.26±0.13) × 10^{-4}			805
$K^+K^*(892)^0$, $K^{*0} \to K^+\pi^-$		(5.9 ±3.4) × 10^{-5}			–
Baryon-antibaryon mode					
$p\overline{n}$		(1.3 ±0.4) × 10^{-3}			295

$\Delta C = 1$ weak neutral current ($C1$) modes, Lepton family number (LF), or Lepton number (L) violating modes

$\pi^+ e^+ e^-$		[yy]	<	1.3	$\times 10^{-5}$	CL=90%	979
$\pi^+ \phi,\ \phi \to e^+ e^-$		[xx]	(	$6\ ^{+8}_{-4}$	$) \times 10^{-6}$		–
$\pi^+ \mu^+ \mu^-$		[yy]	<	4.1	$\times 10^{-7}$	CL=90%	968
$K^+ e^+ e^-$	$C1$		<	3.7	$\times 10^{-6}$	CL=90%	922
$K^+ \mu^+ \mu^-$	$C1$		<	2.1	$\times 10^{-5}$	CL=90%	909
$K^*(892)^+ \mu^+ \mu^-$	$C1$		<	1.4	$\times 10^{-3}$	CL=90%	765
$\pi^+ e^+ \mu^-$	LF		<	1.2	$\times 10^{-5}$	CL=90%	976
$\pi^+ e^- \mu^+$	LF		<	2.0	$\times 10^{-5}$	CL=90%	976
$K^+ e^+ \mu^-$	LF		<	1.4	$\times 10^{-5}$	CL=90%	919
$K^+ e^- \mu^+$	LF		<	9.7	$\times 10^{-6}$	CL=90%	919
$\pi^- 2e^+$	L		<	4.1	$\times 10^{-6}$	CL=90%	979
$\pi^- 2\mu^+$	L		<	1.2	$\times 10^{-7}$	CL=90%	968
$\pi^- e^+ \mu^+$	L		<	8.4	$\times 10^{-6}$	CL=90%	976
$K^- 2e^+$	L		<	5.2	$\times 10^{-6}$	CL=90%	922
$K^- 2\mu^+$	L		<	1.3	$\times 10^{-5}$	CL=90%	909
$K^- e^+ \mu^+$	L		<	6.1	$\times 10^{-6}$	CL=90%	919
$K^*(892)^- 2\mu^+$	L		<	1.4	$\times 10^{-3}$	CL=90%	765

$D_s^{*\pm}$

$I(J^P) = 0(?^?)$

J^P is natural, width and decay modes consistent with 1^-.

Mass $m = 2112.1 \pm 0.4$ MeV

$m_{D_s^{*\pm}} - m_{D_s^{\pm}} = 143.8 \pm 0.4$ MeV

Full width $\Gamma < 1.9$ MeV, CL = 90%

D_s^{*-} modes are charge conjugates of the modes below.

D_s^{*+} DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D_s^+ \gamma$	(94.2±0.7) %	139
$D_s^+ \pi^0$	(5.8±0.7) %	48

$D_{s0}^*(2317)^{\pm}$

$I(J^P) = 0(0^+)$

J, P need confirmation.

J^P is natural, low mass consistent with 0^+.

Mass $m = 2317.7 \pm 0.6$ MeV (S = 1.1)

$m_{D_{s0}^*(2317)^{\pm}} - m_{D_s^{\pm}} = 349.4 \pm 0.6$ MeV (S = 1.1)

Full width $\Gamma < 3.8$ MeV, CL = 95%

$D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

$D_{s0}^*(2317)^{\pm}$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D_s^+ \pi^0$	seen	298
$D_s^+ \pi^0 \pi^0$	not seen	205

$D_{s1}(2460)^{\pm}$

$I(J^P) = 0(1^+)$

Mass $m = 2459.5 \pm 0.6$ MeV (S = 1.1)
$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{*\pm}} = 347.3 \pm 0.7$ MeV (S = 1.2)
$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}} = 491.2 \pm 0.6$ MeV (S = 1.1)
Full width $\Gamma < 3.5$ MeV, CL = 95%

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

$D_{s1}(2460)^+$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D_s^{*+}\pi^0$	(48 ±11) %		297
$D_s^+\gamma$	(18 ± 4) %		442
$D_s^+\pi^+\pi^-$	(4.3± 1.3) %	S=1.1	363
$D_s^{*+}\gamma$	< 8 %	CL=90%	323
$D_{s0}^*(2317)^+\gamma$	($3.7^{+\ 5.0}_{-\ 2.4}$) %		138

$D_{s1}(2536)^{\pm}$

$I(J^P) = 0(1^+)$
J, P need confirmation.

Mass $m = 2535.10 \pm 0.08$ MeV (S = 1.1)
Full width $\Gamma = 0.92 \pm 0.05$ MeV

$D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

$D_{s1}(2536)^+$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$D^*(2010)^+K^0$	0.85 ±0.12		149
$(D^*(2010)^+K^0)_{S-wave}$	0.61 ±0.09		149
$D^+\pi^-K^+$	0.028±0.005		176
$D^*(2007)^0K^+$	**DEFINED AS 1**		167
D^+K^0	<0.34	90%	381
D^0K^+	<0.12	90%	391
$D_s^{*+}\gamma$	possibly seen		388
$D_s^+\pi^+\pi^-$	seen		437

$D_{s2}^*(2573)$

$I(J^P) = 0(?^?)$

J^P is natural, width and decay modes consistent with 2^+.

Mass $m = 2571.9 \pm 0.8$ MeV
Full width $\Gamma = 17 \pm 4$ MeV (S = 1.3)

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

$D_{s2}^*(2573)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
D^0K^+	seen	434
$D^*(2007)^0K^+$	not seen	243

$D_{s1}^*(2700)^{\pm}$

$I(J^P) = 0(1^-)$

Mass $m = 2709 \pm 4$ MeV
Full width $\Gamma = 117 \pm 13$ MeV

BOTTOM MESONS
($B = \pm 1$)

$B^+ = u\overline{b}$, $B^0 = d\overline{b}$, $\overline{B}^0 = \overline{d}\,b$, $B^- = \overline{u}\,b$, similarly for B^*'s

B-particle organization

Many measurements of B decays involve admixtures of B hadrons. Previously we arbitrarily included such admixtures in the $B^\pm$ section, but because of their importance we have created two new sections: "$B^\pm/B^0$ Admixture" for $\Upsilon(4S)$ results and "$B^\pm/B^0/B_s^0/b$-baryon Admixture" for results at higher energies. Most inclusive decay branching fractions and χ_b at high energy are found in the Admixture sections. B^0-$\overline{B}^0$ mixing data are found in the B^0 section, while B_s^0-$\overline{B}_s^0$ mixing data and B-$\overline{B}$ mixing data for a B^0/B_s^0 admixture are found in the B_s^0 section. *CP*-violation data are found in the $B^\pm$, B^0, and $B^\pm$ B^0 Admixture sections. b-baryons are found near the end of the Baryon section.

The organization of the B sections is now as follows, where bullets indicate particle sections and brackets indicate reviews.

- $B^\pm$
  mass, mean life, *CP* violation, branching fractions
- B^0
  mass, mean life, B^0-$\overline{B}^0$ mixing, *CP* violation, branching fractions
- $B^\pm$ B^0 Admixtures
  CP violation, branching fractions
- $B^\pm/B^0/B_s^0/b$-baryon Admixtures
  mean life, production fractions, branching fractions
- B^*
  mass
- $B_1(5721)^0$
  mass
- $B_2^*(5747)^0$
  mass
- B_s^0
  mass, mean life, B_s^0-$\overline{B}_s^0$ mixing, *CP* violation, branching fractions
- B_s^*
  mass
- $B_{s1}(5830)^0$
  mass

- $B_{s2}^*(5840)^0$
  mass
- $B_c^\pm$
  mass, mean life, branching fractions

At the end of Baryon Listings:

- Λ_b
  mass, mean life, branching fractions
- $\Lambda_b(5912)^0$
  mass, mean life
- $\Lambda_b(5920)^0$
  mass, mean life
- Σ_b
  mass
- Σ_b^*
  mass
- Ξ_b^0, Ξ_b^-
  mass, mean life, branching fractions
- $\Xi_b(5945)^0$
  mass, mean life
- Ω_b^-
  mass, branching fractions
- b-baryon Admixture
  mean life, branching fractions

$B^\pm$ $I(J^P) = \frac{1}{2}(0^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

Mass $m_{B^\pm} = 5279.26 \pm 0.17$ MeV
Mean life $\tau_{B^\pm} = (1.638 \pm 0.004) \times 10^{-12}$ s
$c\tau = 491.1\ \mu$m

CP violation

$A_{CP}(B^+ \to J/\psi(1S)K^+) = 0.003 \pm 0.006$ (S = 1.8)
$A_{CP}(B^+ \to J/\psi(1S)\pi^+) = (0.1 \pm 2.8) \times 10^{-2}$ (S = 1.2)
$A_{CP}(B^+ \to J/\psi\rho^+) = -0.11 \pm 0.14$
$A_{CP}(B^+ \to J/\psi K^*(892)^+) = -0.048 \pm 0.033$
$A_{CP}(B^+ \to \eta_c K^+) = -0.02 \pm 0.10$ (S = 2.0)
$A_{CP}(B^+ \to \psi(2S)\pi^+) = 0.03 \pm 0.06$
$A_{CP}(B^+ \to \psi(2S)K^+) = -0.024 \pm 0.023$
$A_{CP}(B^+ \to \psi(2S)K^*(892)^+) = 0.08 \pm 0.21$
$A_{CP}(B^+ \to \chi_{c1}(1P)\pi^+) = 0.07 \pm 0.18$
$A_{CP}(B^+ \to \chi_{c0}K^+) = -0.20 \pm 0.18$ (S = 1.5)
$A_{CP}(B^+ \to \chi_{c1}K^+) = -0.009 \pm 0.033$
$A_{CP}(B^+ \to \chi_{c1}K^*(892)^+) = 0.5 \pm 0.5$
$A_{CP}(B^+ \to \overline{D}^0\pi^+) = -0.007 \pm 0.007$

$A_{CP}(B^+ \to D_{CP(+1)}\pi^+) = 0.035 \pm 0.024$
$A_{CP}(B^+ \to D_{CP(-1)}\pi^+) = 0.017 \pm 0.026$
$A_{CP}([K^\mp\pi^\pm\pi^+\pi^-]_D\pi^+) = 0.13 \pm 0.10$
$A_{CP}(B^+ \to \overline{D}{}^0 K^+) = 0.01 \pm 0.05$ (S = 2.1)
$A_{CP}([K^\mp\pi^\pm\pi^+\pi^-]_D K^+) = -0.42 \pm 0.22$
$r_B(B^+ \to D^0 K^+) = 0.096 \pm 0.008$
$\delta_B(B^+ \to D^0 K^+) = (115 \pm 13)^\circ$
$r_B(B^+ \to \overline{D}{}^0 K^{*+}) = 0.17 \pm 0.11$ (S = 2.3)
$\delta_B(B^+ \to D^0 K^{*+}) = (155 \pm 70)^\circ$ (S = 2.0)
$A_{CP}(B^+ \to [K^-\pi^+]_D K^+) = -0.58 \pm 0.21$
$A_{CP}(B^+ \to [K^-\pi^+\pi^0]_D K^+) = 0.41 \pm 0.30$
$A_{CP}(B^+ \to [K^-\pi^+]_{\overline{D}} K^*(892)^+) = -0.3 \pm 0.5$
$A_{CP}(B^+ \to [K^-\pi^+]_D\pi^+) = 0.00 \pm 0.09$
$A_{CP}(B^+ \to [K^-\pi^+\pi^0]_D\pi^+) = 0.16 \pm 0.27$
$A_{CP}(B^+ \to [K^-\pi^+]_{(D\pi)}\pi^+) = -0.09 \pm 0.27$
$A_{CP}(B^+ \to [K^-\pi^+]_{(D\gamma)}\pi^+) = -0.7 \pm 0.6$
$A_{CP}(B^+ \to [K^-\pi^+]_{(D\pi)} K^+) = 0.8 \pm 0.4$
$A_{CP}(B^+ \to [K^-\pi^+]_{(D\gamma)} K^+) = 0.4 \pm 1.0$
$A_{CP}(B^+ \to [\pi^+\pi^-\pi^0]_D K^+) = -0.02 \pm 0.15$
$A_{CP}(B^+ \to D_{CP(+1)}K^+)$ $= 0.170 \pm 0.033$ (S = 1.2)
$A_{ADS}(B^+ \to D K^+) = -0.52 \pm 0.15$
$A_{ADS}(B^+ \to D\pi^+) = 0.14 \pm 0.06$
$A_{CP}(B^+ \to D_{CP(-1)} K^+) = -0.10 \pm 0.07$
$A_{CP}(B^+ \to \overline{D}{}^{*0}\pi^+) = -0.014 \pm 0.015$
$A_{CP}(B^+ \to (D^*_{CP(+1)})^0\pi^+) = -0.02 \pm 0.05$
$A_{CP}(B^+ \to (D^*_{CP(-1)})^0\pi^+) = -0.09 \pm 0.05$
$A_{CP}(B^+ \to D^{*0} K^+) = -0.07 \pm 0.04$
$r_B^*(B^+ \to D^{*0} K^+) = 0.114^{+0.023}_{-0.040}$ (S = 1.2)
$\delta_B^*(B^+ \to D^{*0} K^+) = (310^{+22}_{-28})^\circ$ (S = 1.3)
$A_{CP}(B^+ \to D^{*0}_{CP(+1)} K^+) = -0.12 \pm 0.08$
$A_{CP}(B^+ \to D^*_{CP(-1)} K^+) = 0.07 \pm 0.10$
$A_{CP}(B^+ \to D_{CP(+1)} K^*(892)^+) = 0.09 \pm 0.14$
$A_{CP}(B^+ \to D_{CP(-1)} K^*(892)^+) = -0.23 \pm 0.22$
$A_{CP}(B^+ \to D_s^+\phi) = 0.0 \pm 0.4$
$A_{CP}(B^+ \to D^{*+}\overline{D}{}^{*0}) = -0.15 \pm 0.11$
$A_{CP}(B^+ \to D^{*+}\overline{D}{}^0) = -0.06 \pm 0.13$
$A_{CP}(B^+ \to D^+\overline{D}{}^{*0}) = 0.13 \pm 0.18$
$A_{CP}(B^+ \to D^+\overline{D}{}^0) = -0.03 \pm 0.07$
$A_{CP}(B^+ \to K^0_S\pi^+) = -0.017 \pm 0.016$
$A_{CP}(B^+ \to K^+\pi^0) = 0.037 \pm 0.021$
$A_{CP}(B^+ \to \eta' K^+) = 0.013 \pm 0.017$
$A_{CP}(B^+ \to \eta' K^*(892)^+) = -0.26 \pm 0.27$
$A_{CP}(B^+ \to \eta' K_0^*(1430)^+) = 0.06 \pm 0.20$
$A_{CP}(B^+ \to \eta' K_2^*(1430)^+) = 0.15 \pm 0.13$
$A_{CP}(B^+ \to \eta K^+)$ $= -0.37 \pm 0.08$
$A_{CP}(B^+ \to \eta K^*(892)^+) = 0.02 \pm 0.06$
$A_{CP}(B^+ \to \eta K_0^*(1430)^+) = 0.05 \pm 0.13$
$A_{CP}(B^+ \to \eta K_2^*(1430)^+) = -0.45 \pm 0.30$

$A_{CP}(B^+ \to \omega K^+) = 0.02 \pm 0.05$
$A_{CP}(B^+ \to \omega K^{*+}) = 0.29 \pm 0.35$
$A_{CP}(B^+ \to \omega (K\pi)_0^{*+}) = -0.10 \pm 0.09$
$A_{CP}(B^+ \to \omega K_2^*(1430)^+) = 0.14 \pm 0.15$
$A_{CP}(B^+ \to K^{*0}\pi^+) = -0.04 \pm 0.09 \quad (S = 2.1)$
$A_{CP}(B^+ \to K^*(892)^+\pi^0) = -0.06 \pm 0.24$
$A_{CP}(B^+ \to K^+\pi^-\pi^+) = 0.033 \pm 0.010$
$A_{CP}(B^+ \to K^+K^-K^+ \text{ nonresonant}) = 0.06 \pm 0.05$
$A_{CP}(B^+ \to f(980)^0 K^+) = -0.08 \pm 0.09$
$A_{CP}(B^+ \to f_2(1270)K^+) = -0.68^{+0.19}_{-0.17}$
$A_{CP}(B^+ \to f_0(1500)K^+) = 0.28 \pm 0.30$
$A_{CP}(B^+ \to f_2'(1525)^0 K^+) = -0.08^{+0.05}_{-0.04}$
$A_{CP}(B^+ \to \rho^0 K^+) = 0.37 \pm 0.10$
$A_{CP}(B^+ \to K_0^*(1430)^0\pi^+) = 0.055 \pm 0.033$
$A_{CP}(B^+ \to K_2^*(1430)^0\pi^+) = 0.05^{+0.29}_{-0.24}$
$A_{CP}(B^+ \to K^+\pi^0\pi^0) = -0.06 \pm 0.07$
$A_{CP}(B^+ \to K^0\rho^+) = -0.12 \pm 0.17$
$A_{CP}(B^+ \to K^{*+}\pi^+\pi^-) = 0.07 \pm 0.08$
$A_{CP}(B^+ \to \rho^0 K^*(892)^+) = 0.31 \pm 0.13$
$A_{CP}(B^+ \to K^*(892)^+ f_0(980)) = -0.15 \pm 0.12$
$A_{CP}(B^+ \to a_1^+ K^0) = 0.12 \pm 0.11$
$A_{CP}(B^+ \to b_1^+ K^0) = -0.03 \pm 0.15$
$A_{CP}(B^+ \to K^*(892)^0\rho^+) = -0.01 \pm 0.16$
$A_{CP}(B^+ \to b_1^0 K^+) = -0.46 \pm 0.20$
$A_{CP}(B^+ \to K^0 K^+) = 0.04 \pm 0.14$
$A_{CP}(B^+ \to K_S^0 K^+) = -0.21 \pm 0.14$
$A_{CP}(B^+ \to K^+ K_S^0 K_S^0) = 0.04^{+0.04}_{-0.05}$
$A_{CP}(B^+ \to K^+K^-\pi^+) = -0.12 \pm 0.05 \quad (S = 1.2)$
$A_{CP}(B^+ \to K^+K^-K^+) = -0.036 \pm 0.012 \quad (S = 1.1)$
$A_{CP}(B^+ \to \phi K^+) = 0.04 \pm 0.04 \quad (S = 2.1)$
$A_{CP}(B^+ \to X_0(1550)K^+) = -0.04 \pm 0.07$
$A_{CP}(B^+ \to K^{*+}K^+K^-) = 0.11 \pm 0.09$
$A_{CP}(B^+ \to \phi K^*(892)^+) = -0.01 \pm 0.08$
$A_{CP}(B^+ \to \phi (K\pi)_0^{*+}) = 0.04 \pm 0.16$
$A_{CP}(B^+ \to \phi K_1(1270)^+) = 0.15 \pm 0.20$
$A_{CP}(B^+ \to \phi K_2^*(1430)^+) = -0.23 \pm 0.20$
$A_{CP}(B^+ \to K^+\phi\phi) = -0.10 \pm 0.08$
$A_{CP}(B^+ \to K^+[\phi\phi]_{\eta_c}) = 0.09 \pm 0.10$
$A_{CP}(B^+ \to K^*(892)^+\gamma) = 0.018 \pm 0.029$
$A_{CP}(B^+ \to \eta K^+\gamma) = -0.12 \pm 0.07$
$A_{CP}(B^+ \to \phi K^+\gamma) = -0.13 \pm 0.11 \quad (S = 1.1)$
$A_{CP}(B^+ \to \rho^+\gamma) = -0.11 \pm 0.33$
$A_{CP}(B^+ \to \pi^+\pi^0) = 0.03 \pm 0.04$
$A_{CP}(B^+ \to \pi^+\pi^-\pi^+) = 0.105 \pm 0.029 \quad (S = 1.3)$
$A_{CP}(B^+ \to \rho^0\pi^+) = 0.18^{+0.09}_{-0.17}$
$A_{CP}(B^+ \to f_2(1270)\pi^+) = 0.41 \pm 0.30$
$A_{CP}(B^+ \to \rho^0(1450)\pi^+) = -0.1^{+0.4}_{-0.5}$
$A_{CP}(B^+ \to f_0(1370)\pi^+) = 0.72 \pm 0.22$
$A_{CP}(B^+ \to \pi^+\pi^-\pi^+ \text{ nonresonant}) = -0.14^{+0.23}_{-0.16}$

$A_{CP}(B^+ \to \rho^+\pi^0) = 0.02 \pm 0.11$
$A_{CP}(B^+ \to \rho^+\rho^0) = -0.05 \pm 0.05$
$A_{CP}(B^+ \to \omega\pi^+) = -0.04 \pm 0.06$
$A_{CP}(B^+ \to \omega\rho^+) = -0.20 \pm 0.09$
$A_{CP}(B^+ \to \eta\pi^+) = -0.14 \pm 0.07$ (S = 1.4)
$A_{CP}(B^+ \to \eta\rho^+) = 0.11 \pm 0.11$
$A_{CP}(B^+ \to \eta'\pi^+) = 0.06 \pm 0.16$
$A_{CP}(B^+ \to \eta'\rho^+) = 0.26 \pm 0.17$
$A_{CP}(B^+ \to b_1^0\pi^+) = 0.05 \pm 0.16$
$A_{CP}(B^+ \to p\overline{p}\pi^+) = 0.00 \pm 0.04$
$A_{CP}(B^+ \to p\overline{p}K^+) = -0.08 \pm 0.04$ (S = 1.1)
$A_{CP}(B^+ \to p\overline{p}K^*(892)^+) = 0.21 \pm 0.16$ (S = 1.4)
$A_{CP}(B^+ \to p\overline{\Lambda}\gamma) = 0.17 \pm 0.17$
$A_{CP}(B^+ \to p\overline{\Lambda}\pi^0) = 0.01 \pm 0.17$
$A_{CP}(B^+ \to K^+\ell^+\ell^-) = -0.02 \pm 0.08$
$A_{CP}(B^+ \to K^+e^+e^-) = 0.14 \pm 0.14$
$A_{CP}(B^+ \to K^+\mu^+\mu^-) = -0.003 \pm 0.033$
$A_{CP}(B^+ \to K^{*+}\ell^+\ell^-) = -0.09 \pm 0.14$
$A_{CP}(B^+ \to K^*e^+e^-) = -0.14 \pm 0.23$
$A_{CP}(B^+ \to K^*\mu^+\mu^-) = -0.12 \pm 0.24$
$\gamma(B^+ \to D^{(*)0}K^{(*)+}) = (73^{+7}_{-9})^\circ$

B^- modes are charge conjugates of the modes below. Modes which do not identify the charge state of the B are listed in the $B^\pm/B^0$ ADMIXTURE section.

The branching fractions listed below assume 50% $B^0\overline{B}^0$ and 50% B^+B^- production at the $\Upsilon(4S)$. We have attempted to bring older measurements up to date by rescaling their assumed $\Upsilon(4S)$ production ratio to 50:50 and their assumed D, D_S, D^*, and ψ branching ratios to current values whenever this would affect our averages and best limits significantly.

Indentation is used to indicate a subchannel of a previous reaction. All resonant subchannels have been corrected for resonance branching fractions to the final state so the sum of the subchannel branching fractions can exceed that of the final state.

For inclusive branching fractions, *e.g.*, $B \to D^\pm$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

B^+ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Semileptonic and leptonic modes				
$\ell^+\nu_\ell$ anything	[sss]	(10.99 ±0.28) %		–
$e^+\nu_e X_c$		(10.8 ±0.4) %		–
$D\ell^+\nu_\ell$ anything		(9.8 ±0.7) %		–
$\overline{D}^0\ell^+\nu_\ell$	[sss]	(2.27 ±0.11) %		2310
$\overline{D}^0\tau^+\nu_\tau$		(7.7 ±2.5) $\times 10^{-3}$		1911
$\overline{D}^*(2007)^0\ell^+\nu_\ell$	[sss]	(5.69 ±0.19) %		2258
$\overline{D}^*(2007)^0\tau^+\nu_\tau$		(1.88 ±0.20) %		1839
$D^-\pi^+\ell^+\nu_\ell$		(4.2 ±0.5) $\times 10^{-3}$		2306
$\overline{D}_0^*(2420)^0\ell^+\nu_\ell$, $\overline{D}_0^{*0} \to D^-\pi^+$		(2.5 ±0.5) $\times 10^{-3}$		–
$\overline{D}_2^*(2460)^0\ell^+\nu_\ell$, $\overline{D}_2^{*0} \to D^-\pi^+$		(1.53 ±0.16) $\times 10^{-3}$		2065
$D^{(*)}\,n\pi\ell^+\nu_\ell$(n $\geq$ 1)		(1.87 ±0.26) %		–
$D^{*-}\pi^+\ell^+\nu_\ell$		(6.1 ±0.6) $\times 10^{-3}$		2254

$\overline{D}_1(2420)^0\,\ell^+\nu_\ell,\ \overline{D}_1^0 \to D^{*-}\pi^+$		(3.03	±0.20) $\times10^{-3}$			2084
$\overline{D}_1'(2430)^0\,\ell^+\nu_\ell,\ \overline{D}_1'^0 \to D^{*-}\pi^+$		(2.7	±0.6) $\times10^{-3}$			–
$\overline{D}_2^*(2460)^0\,\ell^+\nu_\ell,\ \overline{D}_2^{*0} \to D^{*-}\pi^+$		(1.01	±0.24) $\times10^{-3}$		S=2.0	2065
$D_s^{(*)-}\,K^+\,\ell^+\nu_\ell$		(6.1	±1.0) $\times10^{-4}$			–
$D_s^-\,K^+\,\ell^+\nu_\ell$		(3.0	$^{+1.4}_{-1.2}$) $\times10^{-4}$			2242
$D_s^{*-}\,K^+\,\ell^+\nu_\ell$		(2.9	±1.9) $\times10^{-4}$			2185
$\pi^0\,\ell^+\nu_\ell$		(7.80	±0.27) $\times10^{-5}$			2638
$\eta\,\ell^+\nu_\ell$		(3.8	±0.6) $\times10^{-5}$			2611
$\eta'\,\ell^+\nu_\ell$		(2.3	±0.8) $\times10^{-5}$			2553
$\omega\,\ell^+\nu_\ell$	[sss]	(1.19	±0.09) $\times10^{-4}$			2582
$\rho^0\,\ell^+\nu_\ell$	[sss]	(1.58	±0.11) $\times10^{-4}$			2583
$p\overline{p}\,\ell^+\nu_\ell$		(5.8	$^{+2.6}_{-2.3}$) $\times10^{-6}$			2467
$p\overline{p}\,\mu^+\nu_\mu$		< 8.5		$\times10^{-6}$	CL=90%	2446
$p\overline{p}\,e^+\nu_e$		(8.2	$^{+4.0}_{-3.3}$) $\times10^{-6}$			2467
$e^+\nu_e$		< 9.8		$\times10^{-7}$	CL=90%	2640
$\mu^+\nu_\mu$		< 1.0		$\times10^{-6}$	CL=90%	2639
$\tau^+\nu_\tau$		(1.14	±0.27) $\times10^{-4}$		S=1.3	2341
$\ell^+\nu_\ell\gamma$		< 1.56		$\times10^{-5}$	CL=90%	2640
$e^+\nu_e\gamma$		< 1.7		$\times10^{-5}$	CL=90%	2640
$\mu^+\nu_\mu\gamma$		< 2.4		$\times10^{-5}$	CL=90%	2639
Inclusive modes						
$D^0\,X$		(8.6	±0.7) %			–
$\overline{D}^0\,X$		(79	±4) %			–
$D^+\,X$		(2.5	±0.5) %			–
$D^-\,X$		(9.9	±1.2) %			–
$D_s^+\,X$		(7.9	$^{+1.4}_{-1.3}$) %			–
$D_s^-\,X$		(1.10	$^{+0.40}_{-0.32}$) %			–
$\Lambda_c^+\,X$		(2.1	$^{+0.9}_{-0.6}$) %			–
$\overline{\Lambda}_c^-\,X$		(2.8	$^{+1.1}_{-0.9}$) %			–
$\overline{c}\,X$		(97	±4) %			–
$c\,X$		(23.4	$^{+2.2}_{-1.8}$) %			–
$c/\overline{c}\,X$		(120	±6) %			–
***D*, *D**, or D_s modes**						
$\overline{D}^0\pi^+$		(4.81	±0.15) $\times10^{-3}$			2308
$D_{CP(+1)}\pi^+$	[ttt]	(2.20	±0.24) $\times10^{-3}$			–
$D_{CP(-1)}\pi^+$	[ttt]	(2.1	±0.4) $\times10^{-3}$			–
$\overline{D}^0\rho^+$		(1.34	±0.18) %			2237
$\overline{D}^0 K^+$		(3.70	±0.17) $\times10^{-4}$			2281
$D_{CP(+1)}K^+$	[ttt]	(1.92	±0.14) $\times10^{-4}$			–
$D_{CP(-1)}K^+$	[ttt]	(2.00	±0.19) $\times10^{-4}$			–
$[K^-\pi^+]_D\,K^+$	[uuu]	< 2.8		$\times10^{-7}$	CL=90%	–
$[K^+\pi^-]_D\,K^+$	[uuu]	< 1.8		$\times10^{-5}$	CL=90%	–
$[K^-\pi^+]_D\,\pi^+$	[uuu]	(6.3	±1.1) $\times10^{-7}$			–
$[K^+\pi^-]_D\,\pi^+$		(1.68	±0.31) $\times10^{-4}$			–
$[\pi^+\pi^-\pi^0]_D\,K^-$		(4.6	±0.9) $\times10^{-6}$			–

$\overline{D}^0 K^*(892)^+$		(	5.3	± 0.4)	$\times 10^{-4}$		2213
$D_{CP(-1)} K^*(892)^+$	[ttt]	(	2.7	± 0.8)	$\times 10^{-4}$		–
$D_{CP(+1)} K^*(892)^+$	[ttt]	(	5.8	± 1.1)	$\times 10^{-4}$		–
$\overline{D}^0 K^+ \pi^+ \pi^-$		(	5.4	± 2.2)	$\times 10^{-4}$		2237
$\overline{D}^0 K^+ \overline{K}^0$		(	5.5	± 1.6)	$\times 10^{-4}$		2189
$\overline{D}^0 K^+ \overline{K}^*(892)^0$		(	7.5	± 1.7)	$\times 10^{-4}$		2071
$\overline{D}^0 \pi^+ \pi^+ \pi^-$		(	5.7	± 2.2)	$\times 10^{-3}$	S=3.6	2289
$\overline{D}^0 \pi^+ \pi^+ \pi^-$ nonresonant		(	5	± 4)	$\times 10^{-3}$		2289
$\overline{D}^0 \pi^+ \rho^0$		(	4.2	± 3.0)	$\times 10^{-3}$		2207
$\overline{D}^0 a_1(1260)^+$		(	4	± 4)	$\times 10^{-3}$		2123
$\overline{D}^0 \omega \pi^+$		(	4.1	± 0.9)	$\times 10^{-3}$		2206
$D^*(2010)^- \pi^+ \pi^+$		(	1.35	± 0.22)	$\times 10^{-3}$		2247
$\overline{D}_1(2420)^0 \pi^+$, $\overline{D}_1^0 \to D^*(2010)^- \pi^+$		(	5.3	± 2.3)	$\times 10^{-4}$		2081
$D^- \pi^+ \pi^+$		(	1.07	± 0.05)	$\times 10^{-3}$		2299
$D^+ K^0$		<	2.9		$\times 10^{-6}$	CL=90%	2278
$D^+ K^{*0}$		<	1.8		$\times 10^{-6}$	CL=90%	2211
$D^+ \overline{K}^{*0}$		<	1.4		$\times 10^{-6}$	CL=90%	2211
$\overline{D}^*(2007)^0 \pi^+$		(	5.18	± 0.26)	$\times 10^{-3}$		2256
$\overline{D}^{*0}_{CP(+1)} \pi^+$	[vvv]	(	2.9	± 0.7)	$\times 10^{-3}$		–
$D^{*0}_{CP(-1)} \pi^+$	[vvv]	(	2.6	± 1.0)	$\times 10^{-3}$		–
$\overline{D}^*(2007)^0 \omega \pi^+$		(	4.5	± 1.2)	$\times 10^{-3}$		2149
$\overline{D}^*(2007)^0 \rho^+$		(	9.8	± 1.7)	$\times 10^{-3}$		2181
$\overline{D}^*(2007)^0 K^+$		(	4.20	± 0.34)	$\times 10^{-4}$		2227
$\overline{D}^{*0}_{CP(+1)} K^+$	[vvv]	(	2.8	± 0.4)	$\times 10^{-4}$		–
$\overline{D}^{*0}_{CP(-1)} K^+$	[vvv]	(	2.31	± 0.33)	$\times 10^{-4}$		–
$\overline{D}^*(2007)^0 K^*(892)^+$		(	8.1	± 1.4)	$\times 10^{-4}$		2156
$\overline{D}^*(2007)^0 K^+ \overline{K}^0$		<	1.06		$\times 10^{-3}$	CL=90%	2132
$\overline{D}^*(2007)^0 K^+ K^*(892)^0$		(	1.5	± 0.4)	$\times 10^{-3}$		2008
$\overline{D}^*(2007)^0 \pi^+ \pi^+ \pi^-$		(	1.03	± 0.12)	%		2236
$\overline{D}^*(2007)^0 a_1(1260)^+$		(	1.9	± 0.5)	%		2063
$\overline{D}^*(2007)^0 \pi^- \pi^+ \pi^+ \pi^0$		(	1.8	± 0.4)	%		2219
$\overline{D}^{*0} 3\pi^+ 2\pi^-$		(	5.7	± 1.2)	$\times 10^{-3}$		2196
$D^*(2010)^+ \pi^0$		<	3.6		$\times 10^{-6}$		2255
$D^*(2010)^+ K^0$		<	9.0		$\times 10^{-6}$	CL=90%	2225
$D^*(2010)^- \pi^+ \pi^+ \pi^0$		(	1.5	± 0.7)	%		2235
$D^*(2010)^- \pi^+ \pi^+ \pi^+ \pi^-$		(	2.6	± 0.4)	$\times 10^{-3}$		2217
$\overline{D}^{**0} \pi^+$	[xxx]	(	5.9	± 1.3)	$\times 10^{-3}$		–
$\overline{D}_1^*(2420)^0 \pi^+$		(	1.5	± 0.6)	$\times 10^{-3}$	S=1.3	2081
$\overline{D}_1(2420)^0 \pi^+ \times$ B($\overline{D}_1^0 \to \overline{D}^0 \pi^+ \pi^-$)		(	2.5	$^{+1.7}_{-1.4}$)	$\times 10^{-4}$	S=4.0	2081
$\overline{D}_1(2420)^0 \pi^+ \times$ B($\overline{D}_1^0 \to \overline{D}^0 \pi^+ \pi^-$ (nonresonant))		(	2.3	± 1.0)	$\times 10^{-4}$		2081
$\overline{D}_2^*(2462)^0 \pi^+ \times$ B($\overline{D}_2^*(2462)^0 \to D^- \pi^+$)		(	3.5	± 0.4)	$\times 10^{-4}$		–
$\overline{D}_2^*(2462)^0 \pi^+ \times$B($\overline{D}_2^{*0} \to \overline{D}^0 \pi^- \pi^+$)		(	2.3	± 1.1)	$\times 10^{-4}$		–
$\overline{D}_2^*(2462)^0 \pi^+ \times$B($\overline{D}_2^{*0} \to \overline{D}^0 \pi^- \pi^+$ (nonresonant))		<	1.7		$\times 10^{-4}$	CL=90%	–
$\overline{D}_2^*(2462)^0 \pi^+ \times$B($\overline{D}_2^{*0} \to D^*(2010)^- \pi^+$)		(	2.2	± 1.1)	$\times 10^{-4}$		–

$\overline{D}_0^*(2400)^0\pi^+$	(	6.4	±1.4)	$\times10^{-4}$		2128
$\times$ B($\overline{D}_0^*(2400)^0 \to D^-\pi^+$)						
$\overline{D}_1(2421)^0\pi^+$	(	6.8	±1.5)	$\times10^{-4}$		–
$\times$ B($\overline{D}_1(2421)^0 \to D^{*-}\pi^+$)						
$\overline{D}_2^*(2462)^0\pi^+$	(	1.8	±0.5)	$\times10^{-4}$		–
$\times$ B($\overline{D}_2^*(2462)^0 \to D^{*-}\pi^+$)						
$\overline{D}_1'(2427)^0\pi^+$	(	5.0	±1.2)	$\times10^{-4}$		–
$\times$ B($\overline{D}_1'(2427)^0 \to D^{*-}\pi^+$)						
$\overline{D}_1(2420)^0\pi^+ \times$B($\overline{D}_1^0 \to$ $\overline{D}^{*0}\pi^+\pi^-$)	$<$	6		$\times10^{-6}$	CL=90%	2081
$\overline{D}_1^*(2420)^0\rho^+$	$<$	1.4		$\times10^{-3}$	CL=90%	1996
$\overline{D}_2^*(2460)^0\pi^+$	$<$	1.3		$\times10^{-3}$	CL=90%	2062
$\overline{D}_2^*(2460)^0\pi^+ \times$B($\overline{D}_2^{*0} \to$ $\overline{D}^{*0}\pi^+\pi^-$)	$<$	2.2		$\times10^{-5}$	CL=90%	2062
$\overline{D}_2^*(2460)^0\rho^+$	$<$	4.7		$\times10^{-3}$	CL=90%	1976
$\overline{D}^0 D_s^+$	(	9.0	±0.9)	$\times10^{-3}$		1815
$D_{s0}(2317)^+\overline{D}^0\times$ B($D_{s0}(2317)^+ \to D_s^+\pi^0$)	(	7.3	$^{+2.2}_{-1.7}$)	$\times10^{-4}$		1605
$D_{s0}(2317)^+\overline{D}^0\times$ B($D_{s0}(2317)^+ \to D_s^{*+}\gamma$)	$<$	7.6		$\times10^{-4}$	CL=90%	1605
$D_{s0}(2317)^+\overline{D}^*(2007)^0\times$ B($D_{s0}(2317)^+ \to D_s^+\pi^0$)	(	9	±7)	$\times10^{-4}$		1511
$D_{sJ}(2457)^+\overline{D}^0$	(	3.1	$^{+1.0}_{-0.9}$)	$\times10^{-3}$		–
$D_{sJ}(2457)^+\overline{D}^0\times$ B($D_{sJ}(2457)^+ \to D_s^+\gamma$)	(	4.6	$^{+1.3}_{-1.1}$)	$\times10^{-4}$		–
$D_{sJ}(2457)^+\overline{D}^0\times$ B($D_{sJ}(2457)^+ \to D_s^+\pi^+\pi^-$)	$<$	2.2		$\times10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+\overline{D}^0\times$ B($D_{sJ}(2457)^+ \to D_s^+\pi^0$)	$<$	2.7		$\times10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+\overline{D}^0\times$ B($D_{sJ}(2457)^+ \to D_s^{*+}\gamma$)	$<$	9.8		$\times10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+\overline{D}^*(2007)^0$	(	1.20	±0.30)	%		–
$D_{sJ}(2457)^+\overline{D}^*(2007)^0\times$ B($D_{sJ}(2457)^+ \to D_s^+\gamma$)	(	1.4	$^{+0.7}_{-0.6}$)	$\times10^{-3}$		–
$\overline{D}^0 D_{s1}(2536)^+\times$ B($D_{s1}(2536)^+ \to$ $D^*(2007)^0K^+ +$ $D^*(2010)^+K^0$)	(	4.0	±1.0)	$\times10^{-4}$		1447
$\overline{D}^0 D_{s1}(2536)^+\times$ B($D_{s1}(2536)^+ \to$ $D^*(2007)^0K^+$)	(	2.2	±0.7)	$\times10^{-4}$		1447
$\overline{D}^*(2007)^0 D_{s1}(2536)^+\times$ B($D_{s1}(2536)^+ \to$ $D^*(2007)^0K^+$)	(	5.5	±1.6)	$\times10^{-4}$		1339
$\overline{D}^0 D_{s1}(2536)^+\times$ B($D_{s1}(2536)^+ \to D^{*+}K^0$)	(	2.3	±1.1)	$\times10^{-4}$		1447
$\overline{D}^0 D_{sJ}(2700)^+\times$ B($D_{sJ}(2700)^+ \to D^0K^+$)	(	1.13	$^{+0.26}_{-0.40}$)	$\times10^{-3}$		–

$\overline{D}^{*0} D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*+} K^0$)	(	3.9	± 2.6)	$\times 10^{-4}$		1339
$\overline{D}^{*0} D_{sJ}(2573)^+ \times$ B($D_{sJ}(2573)^+ \to D^0 K^+$)	$<$	2		$\times 10^{-4}$	CL=90%	1306
$\overline{D}^*(2007)^0 D_{sJ}(2573)^+ \times$ B($D_{sJ}(2573)^+ \to D^0 K^+$)	$<$	5		$\times 10^{-4}$	CL=90%	1306
$\overline{D}^0 D_s^{*+}$	(	7.6	± 1.6)	$\times 10^{-3}$		1734
$\overline{D}^*(2007)^0 D_s^+$	(	8.2	± 1.7)	$\times 10^{-3}$		1737
$\overline{D}^*(2007)^0 D_s^{*+}$	(	1.71	± 0.24)	%		1651
$D_s^{(*)+} \overline{D}^{**0}$	(	2.7	± 1.2)	%		–
$\overline{D}^*(2007)^0 D^*(2010)^+$	(	8.1	± 1.7)	$\times 10^{-4}$		1713
$\overline{D}^0 D^*(2010)^+ + \overline{D}^*(2007)^0 D^+$	$<$	1.30		%	CL=90%	1792
$\overline{D}^0 D^*(2010)^+$	(	3.9	± 0.5)	$\times 10^{-4}$		1792
$\overline{D}^0 D^+$	(	3.8	± 0.4)	$\times 10^{-4}$		1866
$\overline{D}^0 D^+ K^0$	(	1.55	± 0.21)	$\times 10^{-3}$		1571
$D^+ \overline{D}^*(2007)^0$	(	6.3	± 1.7)	$\times 10^{-4}$		1791
$\overline{D}^*(2007)^0 D^+ K^0$	(	2.1	± 0.5)	$\times 10^{-3}$		1474
$\overline{D}^0 \overline{D}^*(2010)^+ K^0$	(	3.8	± 0.4)	$\times 10^{-3}$		1476
$\overline{D}^*(2007)^0 D^*(2010)^+ K^0$	(	9.2	± 1.2)	$\times 10^{-3}$		1362
$\overline{D}^0 D^0 K^+$	(	1.45	± 0.33)	$\times 10^{-3}$	S=2.6	1577
$\overline{D}^*(2007)^0 D^0 K^+$	(	2.26	± 0.23)	$\times 10^{-3}$		1481
$\overline{D}^0 D^*(2007)^0 K^+$	(	6.3	± 0.5)	$\times 10^{-3}$		1481
$\overline{D}^*(2007)^0 D^*(2007)^0 K^+$	(	1.12	± 0.13)	%		1368
$D^- D^+ K^+$	(	2.2	± 0.7)	$\times 10^{-4}$		1571
$D^- D^*(2010)^+ K^+$	(	6.3	± 1.1)	$\times 10^{-4}$		1475
$D^*(2010)^- D^+ K^+$	(	6.0	± 1.3)	$\times 10^{-4}$		1475
$D^*(2010)^- D^*(2010)^+ K^+$	(	1.32	± 0.18)	$\times 10^{-3}$		1363
$(\overline{D}+\overline{D}^*)(D+D^*)K$	(	4.05	± 0.30)	%		–
$D_s^+ \pi^0$	(	1.6	± 0.5)	$\times 10^{-5}$		2270
$D_s^{*+} \pi^0$	$<$	2.6		$\times 10^{-4}$	CL=90%	2215
$D_s^+ \eta$	$<$	4		$\times 10^{-4}$	CL=90%	2235
$D_s^{*+} \eta$	$<$	6		$\times 10^{-4}$	CL=90%	2178
$D_s^+ \rho^0$	$<$	3.0		$\times 10^{-4}$	CL=90%	2197
$D_s^{*+} \rho^0$	$<$	4		$\times 10^{-4}$	CL=90%	2138
$D_s^+ \omega$	$<$	4		$\times 10^{-4}$	CL=90%	2195
$D_s^{*+} \omega$	$<$	6		$\times 10^{-4}$	CL=90%	2136
$D_s^+ a_1(1260)^0$	$<$	1.8		$\times 10^{-3}$	CL=90%	2079
$D_s^{*+} a_1(1260)^0$	$<$	1.3		$\times 10^{-3}$	CL=90%	2015
$D_s^+ \phi$	(	1.7	$^{+1.2}_{-0.7}$)	$\times 10^{-6}$		2141
$D_s^{*+} \phi$	$<$	1.2		$\times 10^{-5}$	CL=90%	2079
$D_s^+ \overline{K}^0$	$<$	8		$\times 10^{-4}$	CL=90%	2242
$D_s^{*+} \overline{K}^0$	$<$	9		$\times 10^{-4}$	CL=90%	2185
$D_s^+ \overline{K}^*(892)^0$	$<$	4.4		$\times 10^{-6}$	CL=90%	2172
$D_s^+ K^{*0}$	$<$	3.5		$\times 10^{-6}$	CL=90%	2172
$D_s^{*+} \overline{K}^*(892)^0$	$<$	3.5		$\times 10^{-4}$	CL=90%	2112
$D_s^- \pi^+ K^+$	(	1.80	± 0.22)	$\times 10^{-4}$		2222
$D_s^{*-} \pi^+ K^+$	(	1.45	± 0.24)	$\times 10^{-4}$		2164
$D_s^- \pi^+ K^*(892)^+$	$<$	5		$\times 10^{-3}$	CL=90%	2138
$D_s^{*-} \pi^+ K^*(892)^+$	$<$	7		$\times 10^{-3}$	CL=90%	2076
$D_s^- K^+ K^+$	(	1.1	± 0.4)	$\times 10^{-5}$		2149
$D_s^{*-} K^+ K^+$	$<$	1.5		$\times 10^{-5}$	CL=90%	2088

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$\eta_c K^+$		(	9.6	± 1.1	) $\times 10^{-4}$		1751
$\eta_c K^+,\ \eta_c \to K^0_S K^\mp \pi^\pm$		(	2.7	± 0.6	) $\times 10^{-5}$		–
$\eta_c K^*(892)^+$		(	1.0	$^{+0.5}_{-0.4}$	) $\times 10^{-3}$		1646
$\eta_c(2S) K^+$		(	3.4	± 1.8	) $\times 10^{-4}$		1319
$\eta_c(2S) K^+,\ \eta_c \to p\overline{p}$		<	1.06		$\times 10^{-7}$	CL=95%	–
$\eta_c(2S) K^+,\ \eta_c \to K^0_S K^\mp \pi^\pm$		(	3.4	$^{+2.3}_{-1.6}$	) $\times 10^{-6}$		–
$h_c(1P) K^+,\ h_c \to J/\psi \pi^+ \pi^-$		<	3.4		$\times 10^{-6}$	CL=90%	1401
$X(3872) K^+$		<	3.2		$\times 10^{-4}$	CL=90%	1141
$X(3872) K^+,\ X \to p\overline{p}$		<	1.7		$\times 10^{-8}$	CL=95%	–
$X(3872) K^+,\ X \to J/\psi \pi^+ \pi^-$		(	8.6	± 0.8	) $\times 10^{-6}$		1141
$X(3872) K^+,\ X \to J/\psi\gamma$		(	2.1	± 0.4	) $\times 10^{-6}$	S=1.1	1141
$X(3872) K^+,\ X \to \psi(2S)\gamma$		(	4	± 4	) $\times 10^{-6}$	S=2.5	1141
$X(3872) K^+,\ X \to J/\psi(1S)\eta$		<	7.7		$\times 10^{-6}$	CL=90%	1141
$X(3872) K^+,\ X \to D^0 \overline{D}^0$		<	6.0		$\times 10^{-5}$	CL=90%	1141
$X(3872) K^+,\ X \to D^+ D^-$		<	4.0		$\times 10^{-5}$	CL=90%	1141
$X(3872) K^+,\ X \to D^0 \overline{D}^0 \pi^0$		(	1.0	± 0.4	) $\times 10^{-4}$		1141
$X(3872) K^+,\ X \to \overline{D}^{*0} D^0$		(	8.5	± 2.6	) $\times 10^{-5}$	S=1.4	1141
$X(3872) K^*(892)^+,\ X \to J/\psi\gamma$		<	4.8		$\times 10^{-6}$	CL=90%	939
$X(3872) K^*(892)^+,\ X \to \psi(2S)\gamma$		<	2.8		$\times 10^{-5}$	CL=90%	939
$X(3872)^+ K^0,\ X^+ \to J/\psi(1S)\pi^+ \pi^0$	[yyy]	<	6.1		$\times 10^{-6}$	CL=90%	–
$X(4430)^+ K^0,\ X^+ \to J/\psi \pi^+$		<	1.5		$\times 10^{-5}$	CL=95%	–
$X(4430)^+ K^0,\ X^+ \to \psi(2S)\pi^+$		<	4.7		$\times 10^{-5}$	CL=95%	–
$X(4260)^0 K^+,\ X^0 \to J/\psi \pi^+ \pi^-$		<	2.9		$\times 10^{-5}$	CL=95%	–
$\chi_{c0}(2P) K^+,\ X^0 \to J/\psi\gamma$		<	1.4		$\times 10^{-5}$	CL=90%	–
$X(3930)^0 K^+,\ X^0 \to J/\psi\gamma$		<	2.5		$\times 10^{-6}$	CL=90%	–
$J/\psi(1S) K^+$		(	1.027	± 0.031	) $\times 10^{-3}$		1683
$J/\psi(1S) K^+ \pi^+ \pi^-$		(	8.1	± 1.3	) $\times 10^{-4}$	S=2.5	1612
$\chi_{c0}(2P) K^+,\ \chi_{c0} \to p\overline{p}$		<	7.1		$\times 10^{-8}$	CL=95%	–
$J/\psi(1S) K^*(892)^+$		(	1.44	± 0.08	) $\times 10^{-3}$		1571
$J/\psi(1S) K(1270)^+$		(	1.8	± 0.5	) $\times 10^{-3}$		1390
$J/\psi(1S) K(1400)^+$		<	5		$\times 10^{-4}$	CL=90%	1308
$J/\psi(1S) \eta K^+$		(	1.08	± 0.33	) $\times 10^{-4}$		1510
$J/\psi(1S) \eta' K^+$		<	8.8		$\times 10^{-5}$	CL=90%	1273
$J/\psi(1S) \phi K^+$		(	5.2	± 1.7	) $\times 10^{-5}$	S=1.2	1227
$X(4140) K^+,\ X \to J/\psi(1S)\phi$		(	10	± 5	) $\times 10^{-6}$		–
$X(4274) K^+,\ X \to J/\psi(1S)\phi$		<	4		$\times 10^{-6}$	CL=90%	–
$J/\psi(1S) \omega K^+$		(	3.20	$^{+0.60}_{-0.32}$	) $\times 10^{-4}$		1388
$X(3872) K^+,\ X \to J/\psi\omega$		(	6.0	± 2.2	) $\times 10^{-6}$		1141
$\chi_{c0}(2P) K^+,\ \chi_{c0} \to J/\psi\omega$		(	3.0	$^{+0.9}_{-0.7}$	) $\times 10^{-5}$		1103
$J/\psi(1S) \pi^+$		(	4.1	± 0.4	) $\times 10^{-5}$	S=2.6	1727
$J/\psi(1S) \rho^+$		(	5.0	± 0.8	) $\times 10^{-5}$		1611
$J/\psi(1S) \pi^+ \pi^0$ nonresonant		<	7.3		$\times 10^{-6}$	CL=90%	1717
$J/\psi(1S) a_1(1260)^+$		<	1.2		$\times 10^{-3}$	CL=90%	1415
$J/\psi p \overline{p} \pi^+$		<	5.0		$\times 10^{-7}$	CL=90%	643

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$J/\psi(1S)\,p\overline{\Lambda}$	(	1.18	± 0.31)	$\times 10^{-5}$		567
$J/\psi(1S)\,\overline{\Sigma}^0 p$	$<$	1.1		$\times 10^{-5}$	CL=90%	–
$J/\psi(1S)\,D^+$	$<$	1.2		$\times 10^{-4}$	CL=90%	870
$J/\psi(1S)\,\overline{D}^0\pi^+$	$<$	2.5		$\times 10^{-5}$	CL=90%	665
$\psi(2S)\,\pi^+$	(	2.44	± 0.30)	$\times 10^{-5}$		1347
$\psi(2S)\,K^+$	(	6.27	± 0.24)	$\times 10^{-4}$		1284
$\psi(2S)\,K^*(892)^+$	(	6.7	± 1.4)	$\times 10^{-4}$	S=1.3	1115
$\psi(2S)\,K^+\pi^+\pi^-$	(	4.3	± 0.5)	$\times 10^{-4}$		1179
$\psi(3770)\,K^+$	(	4.9	± 1.3)	$\times 10^{-4}$		1218
$\psi(3770)\,K+, \psi \to D^0\overline{D}^0$	(	1.6	± 0.4)	$\times 10^{-4}$	S=1.1	1218
$\psi(3770)\,K+, \psi \to D^+D^-$	(	9.4	± 3.5)	$\times 10^{-5}$		1218
$\chi_{c0}\pi^+,\ \chi_{c0} \to \pi^+\pi^-$	$<$	1		$\times 10^{-7}$	CL=90%	1531
$\chi_{c0}(1P)\,K^+$	(	1.50	$^{+0.15}_{-0.14}$)	$\times 10^{-4}$		1478
$\chi_{c0}\,K^*(892)^+$	$<$	2.1		$\times 10^{-4}$	CL=90%	1341
$\chi_{c2}\pi^+,\ \chi_{c2} \to \pi^+\pi^-$	$<$	1		$\times 10^{-7}$	CL=90%	1437
$\chi_{c2}\,K^+$	(	1.1	± 0.4)	$\times 10^{-5}$		1379
$\chi_{c2}\,K^*(892)^+$	$<$	1.2		$\times 10^{-4}$	CL=90%	1227
$\chi_{c1}(1P)\,\pi^+$	(	2.2	± 0.5)	$\times 10^{-5}$		1468
$\chi_{c1}(1P)\,K^+$	(	4.79	± 0.23)	$\times 10^{-4}$		1412
$\chi_{c1}(1P)\,K^*(892)^+$	(	3.0	± 0.6)	$\times 10^{-4}$	S=1.1	1265
$h_c(1P)\,K^+$	$<$	3.8		$\times 10^{-5}$		1401
$h_c(1P)\,K^+,\ h_c \to p\overline{p}$	$<$	6.4		$\times 10^{-8}$	CL=95%	–

K* or *K* **modes**

$K^0\pi^+$	(	2.37	± 0.08)	$\times 10^{-5}$		2614
$K^+\pi^0$	(	1.29	± 0.05)	$\times 10^{-5}$		2615
$\eta' K^+$	(	7.06	± 0.25)	$\times 10^{-5}$		2528
$\eta' K^*(892)^+$	(	4.8	$^{+1.8}_{-1.6}$)	$\times 10^{-6}$		2472
$\eta' K_0^*(1430)^+$	(	5.2	± 2.1)	$\times 10^{-6}$		–
$\eta' K_2^*(1430)^+$	(	2.8	± 0.5)	$\times 10^{-5}$		2346
ηK^+	(	2.4	± 0.4)	$\times 10^{-6}$	S=1.7	2588
$\eta K^*(892)^+$	(	1.93	± 0.16)	$\times 10^{-5}$		2534
$\eta K_0^*(1430)^+$	(	1.8	± 0.4)	$\times 10^{-5}$		–
$\eta K_2^*(1430)^+$	(	9.1	± 3.0)	$\times 10^{-6}$		2414
$\eta(1295)\,K^+ \times$ B($\eta(1295) \to \eta\pi\pi$)	(	2.9	$^{+0.8}_{-0.7}$)	$\times 10^{-6}$		2455
$\eta(1405)\,K^+ \times$ B($\eta(1405) \to \eta\pi\pi$)	$<$	1.3		$\times 10^{-6}$	CL=90%	2425
$\eta(1405)\,K^+ \times$ B($\eta(1405) \to K^*K$)	$<$	1.2		$\times 10^{-6}$	CL=90%	2425
$\eta(1475)\,K^+ \times$ B($\eta(1475) \to K^*K$)	(	1.38	$^{+0.21}_{-0.18}$)	$\times 10^{-5}$		2406
$f_1(1285)\,K^+$	$<$	2.0		$\times 10^{-6}$	CL=90%	2458
$f_1(1420)\,K^+ \times$ B($f_1(1420) \to \eta\pi\pi$)	$<$	2.9		$\times 10^{-6}$	CL=90%	2420
$f_1(1420)\,K^+ \times$ B($f_1(1420) \to K^*K$)	$<$	4.1		$\times 10^{-6}$	CL=90%	2420
$\phi(1680)\,K^+ \times$ B($\phi(1680) \to K^*K$)	$<$	3.4		$\times 10^{-6}$	CL=90%	2344
$f_0(1500)\,K^+$	(	3.7	± 2.2)	$\times 10^{-6}$		2398
ωK^+	(	6.7	± 0.8)	$\times 10^{-6}$	S=1.8	2557
$\omega K^*(892)^+$	$<$	7.4		$\times 10^{-6}$	CL=90%	2503

$\omega(K\pi)_0^{*+}$	(	2.8	±0.4)	$\times10^{-5}$		–
$\omega K_0^*(1430)^+$	(	2.4	±0.5)	$\times10^{-5}$		–
$\omega K_2^*(1430)^+$	(	2.1	±0.4)	$\times10^{-5}$		2380
$a_0(980)^+ K^0 \times$B($a_0(980)^+ \to \eta\pi^+$)	$<$	3.9		$\times10^{-6}$	CL=90%	–
$a_0(980)^0 K^+ \times$B($a_0(980)^0 \to \eta\pi^0$)	$<$	2.5		$\times10^{-6}$	CL=90%	–
$K^*(892)^0\pi^+$	(	1.01	±0.09)	$\times10^{-5}$		2562
$K^*(892)^+\pi^0$	(	8.2	±1.9)	$\times10^{-6}$		2563
$K^+\pi^-\pi^+$	(	5.10	±0.29)	$\times10^{-5}$		2609
$K^+\pi^-\pi^+$ nonresonant	(	1.63	$^{+0.21}_{-0.15}$)	$\times10^{-5}$		2609
$\omega(782)K^+$	(	6	±9)	$\times10^{-6}$		2557
$K^+ f_0(980) \times$ B($f_0(980) \to \pi^+\pi^-$)	(	9.4	$^{+1.0}_{-1.2}$)	$\times10^{-6}$		2522
$f_2(1270)^0 K^+$	(	1.07	±0.27)	$\times10^{-6}$		–
$f_0(1370)^0 K^+ \times$ B($f_0(1370)^0 \to \pi^+\pi^-$)	$<$	1.07		$\times10^{-5}$	CL=90%	–
$\rho^0(1450)K^+ \times$ B($\rho^0(1450) \to \pi^+\pi^-$)	$<$	1.17		$\times10^{-5}$	CL=90%	–
$f_2'(1525)K^+ \times$ B($f_2'(1525) \to \pi^+\pi^-$)	$<$	3.4		$\times10^{-6}$	CL=90%	2392
$K^+\rho^0$	(	3.7	±0.5)	$\times10^{-6}$		2559
$K_0^*(1430)^0\pi^+$	(	4.5	$^{+0.9}_{-0.7}$)	$\times10^{-5}$	S=1.5	2445
$K_2^*(1430)^0\pi^+$	(	5.6	$^{+2.2}_{-1.5}$)	$\times10^{-6}$		2445
$K^*(1410)^0\pi^+$	$<$	4.5		$\times10^{-5}$	CL=90%	2448
$K^*(1680)^0\pi^+$	$<$	1.2		$\times10^{-5}$	CL=90%	2358
$K^+\pi^0\pi^0$	(	1.62	±0.19)	$\times10^{-5}$		2610
$f_0(980)K^+ \times$ B($f_0 \to \pi^0\pi^0$)	(	2.8	±0.8)	$\times10^{-6}$		2522
$K^-\pi^+\pi^+$	$<$	9.5		$\times10^{-7}$	CL=90%	2609
$K^-\pi^+\pi^+$ nonresonant	$<$	5.6		$\times10^{-5}$	CL=90%	2609
$K_1(1270)^0\pi^+$	$<$	4.0		$\times10^{-5}$	CL=90%	2484
$K_1(1400)^0\pi^+$	$<$	3.9		$\times10^{-5}$	CL=90%	2451
$K^0\pi^+\pi^0$	$<$	6.6		$\times10^{-5}$	CL=90%	2609
$K^0\rho^+$	(	8.0	±1.5)	$\times10^{-6}$		2558
$K^*(892)^+\pi^+\pi^-$	(	7.5	±1.0)	$\times10^{-5}$		2557
$K^*(892)^+\rho^0$	(	4.6	±1.1)	$\times10^{-6}$		2504
$K^*(892)^+ f_0(980)$	(	4.2	±0.7)	$\times10^{-6}$		2466
$a_1^+ K^0$	(	3.5	±0.7)	$\times10^{-5}$		–
$b_1^+ K^0 \times$ B($b_1^+ \to \omega\pi^+$)	(	9.6	±1.9)	$\times10^{-6}$		–
$K^*(892)^0\rho^+$	(	9.2	±1.5)	$\times10^{-6}$		2504
$K_1(1400)^+\rho^0$	$<$	7.8		$\times10^{-4}$	CL=90%	2388
$K_2^*(1430)^+\rho^0$	$<$	1.5		$\times10^{-3}$	CL=90%	2381
$b_1^0 K^+ \times$ B($b_1^0 \to \omega\pi^0$)	(	9.1	±2.0)	$\times10^{-6}$		–
$b_1^+ K^{*0} \times$ B($b_1^+ \to \omega\pi^+$)	$<$	5.9		$\times10^{-6}$	CL=90%	–
$b_1^0 K^{*+} \times$ B($b_1^0 \to \omega\pi^0$)	$<$	6.7		$\times10^{-6}$	CL=90%	–
$K^+\overline{K}{}^0$	(	1.31	±0.17)	$\times10^{-6}$	S=1.2	2593
$\overline{K}{}^0 K^+\pi^0$	$<$	2.4		$\times10^{-5}$	CL=90%	2578
$K^+ K_S^0 K_S^0$	(	1.08	±0.06)	$\times10^{-5}$		2521
$f_0(980)K^+,\ f_0 \to K_S^0 K_S^0$	(	1.47	±0.33)	$\times10^{-5}$		–
$f_0(1710)K^+,\ f_0 \to K_S^0 K_S^0$	(	4.8	$^{+4.0}_{-2.6}$)	$\times10^{-7}$		–
$K^+ K_S^0 K_S^0$ nonresonant	(	2.0	±0.4)	$\times10^{-5}$		2521

$K^0_S K^0_S \pi^+$	$<$	5.1		$\times 10^{-7}$	CL=90%	2577
$K^+ K^- \pi^+$	(	5.0	± 0.7	) $\times 10^{-6}$		2578
$K^+ K^- \pi^+$ nonresonant	$<$	7.5		$\times 10^{-5}$	CL=90%	2578
$K^+ \overline{K}^*(892)^0$	$<$	1.1		$\times 10^{-6}$	CL=90%	2540
$K^+ \overline{K}^*_0(1430)^0$	$<$	2.2		$\times 10^{-6}$	CL=90%	2421
$K^+ K^+ \pi^-$	$<$	1.6		$\times 10^{-7}$	CL=90%	2578
$K^+ K^+ \pi^-$ nonresonant	$<$	8.79		$\times 10^{-5}$	CL=90%	2578
$f'_2(1525) K^+$	(	1.8	± 0.5	) $\times 10^{-6}$	S=1.1	2392
$K^{*+} \pi^+ K^-$	$<$	1.18		$\times 10^{-5}$	CL=90%	2524
$K^*(892)^+ K^*(892)^0$	(	1.2	± 0.5	) $\times 10^{-6}$		2484
$K^{*+} K^+ \pi^-$	$<$	6.1		$\times 10^{-6}$	CL=90%	2524
$K^+ K^- K^+$	(	3.40	± 0.14	) $\times 10^{-5}$	S=1.4	2523
$K^+ \phi$	(	8.8	$^{+0.7}_{-0.6}$	) $\times 10^{-6}$	S=1.1	2516
$f_0(980) K^+ \times$ B($f_0(980) \to K^+ K^-$)	(	9.4	± 3.2	) $\times 10^{-6}$		2522
$a_2(1320) K^+ \times$ B($a_2(1320) \to K^+ K^-$)	$<$	1.1		$\times 10^{-6}$	CL=90%	2449
$X_0(1550) K^+ \times$ B($X_0(1550) \to K^+ K^-$)	(	4.3	± 0.7	) $\times 10^{-6}$		–
$\phi(1680) K^+ \times$ B($\phi(1680) \to K^+ K^-$)	$<$	8		$\times 10^{-7}$	CL=90%	2344
$f_0(1710) K^+ \times$ B($f_0(1710) \to K^+ K^-$)	(	1.1	± 0.6	) $\times 10^{-6}$		2330
$K^+ K^- K^+$ nonresonant	(	2.38	$^{+0.28}_{-0.50}$	) $\times 10^{-5}$		2523
$K^*(892)^+ K^+ K^-$	(	3.6	± 0.5	) $\times 10^{-5}$		2466
$K^*(892)^+ \phi$	(	10.0	± 2.0	) $\times 10^{-6}$	S=1.7	2460
$\phi (K\pi)^{*+}_0$	(	8.3	± 1.6	) $\times 10^{-6}$		–
$\phi K_1(1270)^+$	(	6.1	± 1.9	) $\times 10^{-6}$		2375
$\phi K_1(1400)^+$	$<$	3.2		$\times 10^{-6}$	CL=90%	2339
$\phi K^*(1410)^+$	$<$	4.3		$\times 10^{-6}$	CL=90%	–
$\phi K^*_0(1430)^+$	(	7.0	± 1.6	) $\times 10^{-6}$		–
$\phi K^*_2(1430)^+$	(	8.4	± 2.1	) $\times 10^{-6}$		2333
$\phi K^*_2(1770)^+$	$<$	1.50		$\times 10^{-5}$	CL=90%	–
$\phi K^*_2(1820)^+$	$<$	1.63		$\times 10^{-5}$	CL=90%	–
$a_1^+ K^{*0}$	$<$	3.6		$\times 10^{-6}$	CL=90%	–
$K^+ \phi\phi$	(	5.0	± 1.2	) $\times 10^{-6}$	S=2.3	2306
$\eta' \eta' K^+$	$<$	2.5		$\times 10^{-5}$	CL=90%	2338
$\omega \phi K^+$	$<$	1.9		$\times 10^{-6}$	CL=90%	2374
$X(1812) K^+ \times$ B($X \to \omega\phi$)	$<$	3.2		$\times 10^{-7}$	CL=90%	–
$K^*(892)^+ \gamma$	(	4.21	± 0.18	) $\times 10^{-5}$		2564
$K_1(1270)^+ \gamma$	(	4.3	± 1.3	) $\times 10^{-5}$		2486
$\eta K^+ \gamma$	(	7.9	± 0.9	) $\times 10^{-6}$		2588
$\eta' K^+ \gamma$	(	2.9	$^{+1.0}_{-0.9}$	) $\times 10^{-6}$		2528
$\phi K^+ \gamma$	(	2.7	± 0.4	) $\times 10^{-6}$	S=1.2	2516
$K^+ \pi^- \pi^+ \gamma$	(	2.76	± 0.22	) $\times 10^{-5}$	S=1.2	2609
$K^*(892)^0 \pi^+ \gamma$	(	2.0	$^{+0.7}_{-0.6}$	) $\times 10^{-5}$		2562
$K^+ \rho^0 \gamma$	$<$	2.0		$\times 10^{-5}$	CL=90%	2559
$K^+ \pi^- \pi^+ \gamma$ nonresonant	$<$	9.2		$\times 10^{-6}$	CL=90%	2609
$K^0 \pi^+ \pi^0 \gamma$	(	4.6	± 0.5	) $\times 10^{-5}$		2609
$K_1(1400)^+ \gamma$	$<$	1.5		$\times 10^{-5}$	CL=90%	2453
$K^*_2(1430)^+ \gamma$	(	1.4	± 0.4	) $\times 10^{-5}$		2447

$K^*(1680)^+\gamma$	$<$	1.9		$\times 10^{-3}$	CL=90%	2360
$K_3^*(1780)^+\gamma$	$<$	3.9		$\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)^+\gamma$	$<$	9.9		$\times 10^{-3}$	CL=90%	2244

Light unflavored meson modes

$\rho^+\gamma$	(	9.8	± 2.5	) $\times 10^{-7}$		2583
$\pi^+\pi^0$	(	5.5	± 0.4	) $\times 10^{-6}$	S=1.2	2636
$\pi^+\pi^+\pi^-$	(	1.52	± 0.14	) $\times 10^{-5}$		2630
$\rho^0\pi^+$	(	8.3	± 1.2	) $\times 10^{-6}$		2581
$\pi^+ f_0(980)$, $f_0 \to \pi^+\pi^-$	$<$	1.5		$\times 10^{-6}$	CL=90%	2545
$\pi^+ f_2(1270)$	(	1.6	$^{+0.7}_{-0.4}$	) $\times 10^{-6}$		2484
$\rho(1450)^0 pi+, \rho^0 \to \pi^+\pi^-$	(	1.4	$^{+0.6}_{-0.9}$	) $\times 10^{-6}$		2434
$f_0(1370)\pi^+$, $f_0 \to \pi^+\pi^-$	$<$	4.0		$\times 10^{-6}$	CL=90%	2460
$f_0(500)\pi^+$, $f_0 \to \pi^+\pi^-$	$<$	4.1		$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^-\pi^+$ nonresonant	(	5.3	$^{+1.5}_{-1.1}$	) $\times 10^{-6}$		2630
$\pi^+\pi^0\pi^0$	$<$	8.9		$\times 10^{-4}$	CL=90%	2631
$\rho^+\pi^0$	(	1.09	± 0.14	) $\times 10^{-5}$		2581
$\pi^+\pi^-\pi^+\pi^0$	$<$	4.0		$\times 10^{-3}$	CL=90%	2622
$\rho^+\rho^0$	(	2.40	± 0.19	) $\times 10^{-5}$		2523
$\rho^+ f_0(980)$, $f_0 \to \pi^+\pi^-$	$<$	2.0		$\times 10^{-6}$	CL=90%	2486
$a_1(1260)^+\pi^0$	(	2.6	± 0.7	) $\times 10^{-5}$		2494
$a_1(1260)^0\pi^+$	(	2.0	± 0.6	) $\times 10^{-5}$		2494
$\omega\pi^+$	(	6.9	± 0.5	) $\times 10^{-6}$		2580
$\omega\rho^+$	(	1.59	± 0.21	) $\times 10^{-5}$		2522
$\eta\pi^+$	(	4.02	± 0.27	) $\times 10^{-6}$		2609
$\eta\rho^+$	(	7.0	± 2.9	) $\times 10^{-6}$	S=2.8	2553
$\eta'\pi^+$	(	2.7	± 0.9	) $\times 10^{-6}$	S=1.9	2551
$\eta'\rho^+$	(	9.7	± 2.2	) $\times 10^{-6}$		2492
$\phi\pi^+$	$<$	1.5		$\times 10^{-7}$	CL=90%	2539
$\phi\rho^+$	$<$	3.0		$\times 10^{-6}$	CL=90%	2480
$a_0(980)^0\pi^+$, $a_0^0 \to \eta\pi^0$	$<$	5.8		$\times 10^{-6}$	CL=90%	–
$a_0(980)^+\pi^0$, $a_0^+ \to \eta\pi^+$	$<$	1.4		$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^+\pi^+\pi^-\pi^-$	$<$	8.6		$\times 10^{-4}$	CL=90%	2608
$\rho^0 a_1(1260)^+$	$<$	6.2		$\times 10^{-4}$	CL=90%	2433
$\rho^0 a_2(1320)^+$	$<$	7.2		$\times 10^{-4}$	CL=90%	2410
$b_1^0\pi^+$, $b_1^0 \to \omega\pi^0$	(	6.7	± 2.0	) $\times 10^{-6}$		–
$b_1^+\pi^0$, $b_1^+ \to \omega\pi^+$	$<$	3.3		$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	$<$	6.3		$\times 10^{-3}$	CL=90%	2592
$b_1^+\rho^0$, $b_1^+ \to \omega\pi^+$	$<$	5.2		$\times 10^{-6}$	CL=90%	–
$a_1(1260)^+ a_1(1260)^0$	$<$	1.3		%	CL=90%	2336
$b_1^0\rho^+$, $b_1^0 \to \omega\pi^0$	$<$	3.3		$\times 10^{-6}$	CL=90%	–

Charged particle ($h^\pm$) modes

$h^\pm = K^\pm$ or $\pi^\pm$

$h^+\pi^0$	(	1.6	$^{+0.7}_{-0.6}$	) $\times 10^{-5}$		2636
ωh^+	(	1.38	$^{+0.27}_{-0.24}$	) $\times 10^{-5}$		2580
$h^+ X^0$ (Familon)	$<$	4.9		$\times 10^{-5}$	CL=90%	–

Baryon modes

$p\overline{p}\pi^+$		(	1.62	± 0.20)	$\times 10^{-6}$		2439
$p\overline{p}\pi^+$ nonresonant		$<$	5.3		$\times 10^{-5}$	CL=90%	2439
$p\overline{p}K^+$		(	5.9	± 0.5)	$\times 10^{-6}$	S=1.5	2348
$\Theta(1710)^{++}\overline{p}$, $\Theta^{++} \to pK^+$	[zzz]	$<$	9.1		$\times 10^{-8}$	CL=90%	–
$f_J(2220)K^+$, $f_J \to p\overline{p}$	[zzz]	$<$	4.1		$\times 10^{-7}$	CL=90%	2135
$p\overline{\Lambda}(1520)$		(	3.9	± 1.0)	$\times 10^{-7}$		2322
$p\overline{p}K^+$ nonresonant		$<$	8.9		$\times 10^{-5}$	CL=90%	2348
$p\overline{p}K^*(892)^+$		(	3.6	$^{+0.8}_{-0.7}$)	$\times 10^{-6}$		2215
$f_J(2220)K^{*+}$, $f_J \to p\overline{p}$		$<$	7.7		$\times 10^{-7}$	CL=90%	2059
$p\overline{\Lambda}$		$<$	3.2		$\times 10^{-7}$	CL=90%	2430
$p\overline{\Lambda}\gamma$		(	2.4	$^{+0.5}_{-0.4}$)	$\times 10^{-6}$		2430
$p\overline{\Lambda}\pi^0$		(	3.0	$^{+0.7}_{-0.6}$)	$\times 10^{-6}$		2402
$p\overline{\Sigma}(1385)^0$		$<$	4.7		$\times 10^{-7}$	CL=90%	2362
$\Delta^+\overline{\Lambda}$		$<$	8.2		$\times 10^{-7}$	CL=90%	–
$p\overline{\Sigma}\gamma$		$<$	4.6		$\times 10^{-6}$	CL=90%	2413
$p\overline{\Lambda}\pi^+\pi^-$		(	5.9	± 1.1)	$\times 10^{-6}$		2367
$p\overline{\Lambda}\rho^0$		(	4.8	± 0.9)	$\times 10^{-6}$		2214
$p\overline{\Lambda}f_2(1270)$		(	2.0	± 0.8)	$\times 10^{-6}$		2026
$\Lambda\overline{\Lambda}\pi^+$		$<$	9.4		$\times 10^{-7}$	CL=90%	2358
$\Lambda\overline{\Lambda}K^+$		(	3.4	± 0.6)	$\times 10^{-6}$		2251
$\Lambda\overline{\Lambda}K^{*+}$		(	2.2	$^{+1.2}_{-0.9}$)	$\times 10^{-6}$		2098
$\overline{\Delta}^0 p$		$<$	1.38		$\times 10^{-6}$	CL=90%	2403
$\Delta^{++}\overline{p}$		$<$	1.4		$\times 10^{-7}$	CL=90%	2403
$D^+ p\overline{p}$		$<$	1.5		$\times 10^{-5}$	CL=90%	1860
$D^*(2010)^+ p\overline{p}$		$<$	1.5		$\times 10^{-5}$	CL=90%	1786
$\overline{D}^0 p\overline{p}\pi^+$		(	3.72	± 0.27)	$\times 10^{-4}$		1789
$\overline{D}^{*0} p\overline{p}\pi^+$		(	3.73	± 0.32)	$\times 10^{-4}$		1709
$D^- p\overline{p}\pi^+\pi^-$		(	1.66	± 0.30)	$\times 10^{-4}$		1705
$D^{*-} p\overline{p}\pi^+\pi^-$		(	1.86	± 0.25)	$\times 10^{-4}$		1621
$p\overline{\Lambda}^0\overline{D}^0$		(	1.43	± 0.32)	$\times 10^{-5}$		–
$p\overline{\Lambda}^0\overline{D}^*(2007)^0$		$<$	5		$\times 10^{-5}$	CL=90%	–
$\overline{\Lambda}_c^- p\pi^+$		(	2.8	± 0.8)	$\times 10^{-4}$		1980
$\overline{\Lambda}_c^- \Delta(1232)^{++}$		$<$	1.9		$\times 10^{-5}$	CL=90%	1928
$\overline{\Lambda}_c^- \Delta_X(1600)^{++}$		(	5.9	± 1.9)	$\times 10^{-5}$		–
$\overline{\Lambda}_c^- \Delta_X(2420)^{++}$		(	4.7	± 1.6)	$\times 10^{-5}$		–
$(\overline{\Lambda}_c^- p)_s\pi^+$	[aaaa]	(	3.9	± 1.3)	$\times 10^{-5}$		–
$\overline{\Sigma}_c(2520)^0 p$		$<$	3		$\times 10^{-6}$	CL=90%	1904
$\overline{\Sigma}_c(2800)^0 p$		(	3.3	± 1.3)	$\times 10^{-5}$		–
$\overline{\Lambda}_c^- p\pi^+\pi^0$		(	1.8	± 0.6)	$\times 10^{-3}$		1935
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-$		(	2.2	± 0.7)	$\times 10^{-3}$		1880
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-\pi^0$		$<$	1.34		%	CL=90%	1823
$\Lambda_c^+\Lambda_c^- K^+$		(	8.7	± 3.5)	$\times 10^{-4}$		–
$\overline{\Sigma}_c(2455)^0 p$		(	3.7	± 1.3)	$\times 10^{-5}$		1938
$\overline{\Sigma}_c(2455)^0 p\pi^0$		(	4.4	± 1.8)	$\times 10^{-4}$		1896
$\overline{\Sigma}_c(2455)^0 p\pi^-\pi^+$		(	4.4	± 1.7)	$\times 10^{-4}$		1845
$\overline{\Sigma}_c(2455)^{--} p\pi^+\pi^+$		(	3.0	± 0.8)	$\times 10^{-4}$		1845
$\overline{\Lambda}_c(2593)^-/\overline{\Lambda}_c(2625)^- p\pi^+$		$<$	1.9		$\times 10^{-4}$	CL=90%	–
$\overline{\Xi}_c^0\Lambda_c^+$, $\overline{\Xi}_c^0 \to \overline{\Xi}^+\pi^-$		(	3.0	± 1.1)	$\times 10^{-5}$		1144
$\overline{\Xi}_c^0\Lambda_c^+$, $\overline{\Xi}_c^0 \to \Lambda K^+\pi^-$		(	2.6	± 1.1)	$\times 10^{-5}$	S=1.1	1144

Lepton Family number (LF) or Lepton number (L) or Baryon number (B) violating modes, or/and $\Delta B = 1$ weak neutral current ($B1$) modes

$\pi^+ \ell^+ \ell^-$	$B1$		$<$	4.9	$\times 10^{-8}$	CL=90%	2638
$\pi^+ e^+ e^-$	$B1$		$<$	8.0	$\times 10^{-8}$	CL=90%	2638
$\pi^+ \mu^+ \mu^-$	$B1$		$<$	5.5	$\times 10^{-8}$	CL=90%	2634
$\pi^+ \nu \overline{\nu}$	$B1$		$<$	9.8	$\times 10^{-5}$	CL=90%	2638
$K^+ \ell^+ \ell^-$	$B1$	[sss]	(	4.51 ± 0.23)	$\times 10^{-7}$	S=1.1	2617
$K^+ e^+ e^-$	$B1$		(	5.5 ± 0.7)	$\times 10^{-7}$		2617
$K^+ \mu^+ \mu^-$	$B1$		(	4.49 ± 0.23)	$\times 10^{-7}$	S=1.1	2612
$\psi(4040) K^+$			$<$	1.3	$\times 10^{-4}$	CL=90%	1003
$\psi(4160) K^+$			(	5.1 ± 2.7)	$\times 10^{-4}$		868
$K^+ \overline{\nu} \nu$	$B1$		$<$	1.6	$\times 10^{-5}$	CL=90%	2617
$\rho^+ \nu \overline{\nu}$	$B1$		$<$	2.13	$\times 10^{-4}$	CL=90%	2583
$K^*(892)^+ \ell^+ \ell^-$	$B1$	[sss]	(	1.29 ± 0.21)	$\times 10^{-6}$		2564
$K^*(892)^+ e^+ e^-$	$B1$		(	1.55 $^{+0.40}_{-0.31}$)	$\times 10^{-6}$		2564
$K^*(892)^+ \mu^+ \mu^-$	$B1$		(	1.12 ± 0.15)	$\times 10^{-6}$		2560
$K^*(892)^+ \nu \overline{\nu}$	$B1$		$<$	4.0	$\times 10^{-5}$	CL=90%	2564
$\pi^+ e^+ \mu^-$	LF		$<$	6.4	$\times 10^{-3}$	CL=90%	2637
$\pi^+ e^- \mu^+$	LF		$<$	6.4	$\times 10^{-3}$	CL=90%	2637
$\pi^+ e^\pm \mu^\mp$	LF		$<$	1.7	$\times 10^{-7}$	CL=90%	2637
$\pi^+ e^+ \tau^-$	LF		$<$	7.4	$\times 10^{-5}$	CL=90%	2338
$\pi^+ e^- \tau^+$	LF		$<$	2.0	$\times 10^{-5}$	CL=90%	2338
$\pi^+ e^\pm \tau^\mp$	LF		$<$	7.5	$\times 10^{-5}$	CL=90%	2338
$\pi^+ \mu^+ \tau^-$	LF		$<$	6.2	$\times 10^{-5}$	CL=90%	2333
$\pi^+ \mu^- \tau^+$	LF		$<$	4.5	$\times 10^{-5}$	CL=90%	2333
$\pi^+ \mu^\pm \tau^\mp$	LF		$<$	7.2	$\times 10^{-5}$	CL=90%	2333
$K^+ e^+ \mu^-$	LF		$<$	9.1	$\times 10^{-8}$	CL=90%	2615
$K^+ e^- \mu^+$	LF		$<$	1.3	$\times 10^{-7}$	CL=90%	2615
$K^+ e^\pm \mu^\mp$	LF		$<$	9.1	$\times 10^{-8}$	CL=90%	2615
$K^+ e^+ \tau^-$	LF		$<$	4.3	$\times 10^{-5}$	CL=90%	2312
$K^+ e^- \tau^+$	LF		$<$	1.5	$\times 10^{-5}$	CL=90%	2312
$K^+ e^\pm \tau^\mp$	LF		$<$	3.0	$\times 10^{-5}$	CL=90%	2312
$K^+ \mu^+ \tau^-$	LF		$<$	4.5	$\times 10^{-5}$	CL=90%	2298
$K^+ \mu^- \tau^+$	LF		$<$	2.8	$\times 10^{-5}$	CL=90%	2298
$K^+ \mu^\pm \tau^\mp$	LF		$<$	4.8	$\times 10^{-5}$	CL=90%	2298
$K^*(892)^+ e^+ \mu^-$	LF		$<$	1.3	$\times 10^{-6}$	CL=90%	2563
$K^*(892)^+ e^- \mu^+$	LF		$<$	9.9	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^+ e^\pm \mu^\mp$	LF		$<$	1.4	$\times 10^{-6}$	CL=90%	2563
$\pi^- e^+ e^+$	L		$<$	2.3	$\times 10^{-8}$	CL=90%	2638
$\pi^- \mu^+ \mu^+$	L		$<$	1.3	$\times 10^{-8}$	CL=95%	2634
$\pi^- e^+ \mu^+$	L		$<$	1.5	$\times 10^{-7}$	CL=90%	2637
$\rho^- e^+ e^+$	L		$<$	1.7	$\times 10^{-7}$	CL=90%	2583
$\rho^- \mu^+ \mu^+$	L		$<$	4.2	$\times 10^{-7}$	CL=90%	2578
$\rho^- e^+ \mu^+$	L		$<$	4.7	$\times 10^{-7}$	CL=90%	2582
$K^- e^+ e^+$	L		$<$	3.0	$\times 10^{-8}$	CL=90%	2617
$K^- \mu^+ \mu^+$	L		$<$	4.1	$\times 10^{-8}$	CL=90%	2612
$K^- e^+ \mu^+$	L		$<$	1.6	$\times 10^{-7}$	CL=90%	2615
$K^*(892)^- e^+ e^+$	L		$<$	4.0	$\times 10^{-7}$	CL=90%	2564
$K^*(892)^- \mu^+ \mu^+$	L		$<$	5.9	$\times 10^{-7}$	CL=90%	2560
$K^*(892)^- e^+ \mu^+$	L		$<$	3.0	$\times 10^{-7}$	CL=90%	2563
$D^- e^+ e^+$	L		$<$	2.6	$\times 10^{-6}$	CL=90%	2309
$D^- e^+ \mu^+$	L		$<$	1.8	$\times 10^{-6}$	CL=90%	2307
$D^- \mu^+ \mu^+$	L		$<$	6.9	$\times 10^{-7}$	CL=95%	2303
$D^{*-} \mu^+ \mu^+$	L		$<$	2.4	$\times 10^{-6}$	CL=95%	2251
$D_s^- \mu^+ \mu^+$	L		$<$	5.8	$\times 10^{-7}$	CL=95%	2267

$\overline{D}^0\pi^-\mu^+\mu^+$	L	$<$	1.5	$\times 10^{-6}$	CL=95%	2295
$\Lambda^0\mu^+$	L,B	$<$	6	$\times 10^{-8}$	CL=90%	–
$\Lambda^0 e^+$	L,B	$<$	3.2	$\times 10^{-8}$	CL=90%	–
$\overline{\Lambda}^0\mu^+$	L,B	$<$	6	$\times 10^{-8}$	CL=90%	–
$\overline{\Lambda}^0 e^+$	L,B	$<$	8	$\times 10^{-8}$	CL=90%	–

B^0

$I(J^P) = \frac{1}{2}(0^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

Mass $m_{B^0} = 5279.58 \pm 0.17$ MeV
$m_{B^0} - m_{B^\pm} = 0.32 \pm 0.06$ MeV
Mean life $\tau_{B^0} = (1.519 \pm 0.005) \times 10^{-12}$ s
$c\tau = 455.4\ \mu$m
$\tau_{B^+}/\tau_{B^0} = 1.076 \pm 0.004$ (direct measurements)

B^0-$\overline{B}^0$ mixing parameters

$\chi_d = 0.1874 \pm 0.0018$
$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L} = (0.510 \pm 0.003) \times 10^{12}\ \hbar\ \mathrm{s}^{-1}$
$= (3.337 \pm 0.033) \times 10^{-10}$ MeV
$x_d = \Delta m_{B^0}/\Gamma_{B^0} = 0.774 \pm 0.006$
$\mathrm{Re}(\lambda_{CP}\ /\ |\lambda_{CP}|)$ Re(z) $= 0.01 \pm 0.05$
$\Delta\Gamma$ Re(z) $= -0.007 \pm 0.004$
Re(z) $= (2 \pm 5) \times 10^{-2}$
Im(z) $= (-0.8 \pm 0.4) \times 10^{-2}$

CP violation parameters

$\mathrm{Re}(\epsilon_{B^0})/(1+|\epsilon_{B^0}|^2) = (0.1 \pm 0.8) \times 10^{-3}$
$A_{T/CP} = 0.005 \pm 0.018$
$A_{CP}(B^0 \to D^*(2010)^+ D^-) = 0.037 \pm 0.034$
$A_{CP}(B^0 \to [K^+K^-]_D K^*(892)^0) = -0.45 \pm 0.23$
$A_{CP}(B^0 \to [K^+\pi^-]_D K^*(892)^0) = -0.08 \pm 0.08$
$A_{CP}(B^0 \to K^+\pi^-) = -0.082 \pm 0.006$
$A_{CP}(B^0 \to \eta' K^*(892)^0) = 0.02 \pm 0.23$
$A_{CP}(B^0 \to \eta' K_0^*(1430)^0) = -0.19 \pm 0.17$
$A_{CP}(B^0 \to \eta' K_2^*(1430)^0) = 0.14 \pm 0.18$
$A_{CP}(B^0 \to \eta K^*(892)^0) = 0.19 \pm 0.05$
$A_{CP}(B^0 \to \eta K_0^*(1430)^0) = 0.06 \pm 0.13$
$A_{CP}(B^0 \to \eta K_2^*(1430)^0) = -0.07 \pm 0.19$
$A_{CP}(B^0 \to b_1 K^+) = -0.07 \pm 0.12$
$A_{CP}(B^0 \to \omega K^{*0}) = 0.45 \pm 0.25$
$A_{CP}(B^0 \to \omega (K\pi)_0^{*0}) = -0.07 \pm 0.09$
$A_{CP}(B^0 \to \omega K_2^*(1430)^0) = -0.37 \pm 0.17$
$A_{CP}(B^0 \to K^+\pi^-\pi^0) = (0 \pm 6) \times 10^{-2}$
$A_{CP}(B^0 \to \rho^- K^+) = 0.20 \pm 0.11$
$A_{CP}(B^0 \to \rho(1450)^- K^+) = -0.10 \pm 0.33$
$A_{CP}(B^0 \to \rho(1700)^- K^+) = -0.4 \pm 0.6$
$A_{CP}(B^0 \to K^+\pi^-\pi^0\ \text{nonresonant}) = 0.10 \pm 0.18$
$A_{CP}(B^0 \to K^0\pi^+\pi^-) = -0.01 \pm 0.05$
$A_{CP}(B^0 \to K^*(892)^+\pi^-) = -0.22 \pm 0.06$

$A_{CP}(B^0 \to (K\pi)_0^{*+}\pi^-) = 0.09 \pm 0.07$
$A_{CP}(B^0 \to (K\pi)_0^{*0}\pi^0) = -0.15 \pm 0.11$
$A_{CP}(B^0 \to K^{*0}\pi^0) = -0.15 \pm 0.13$
$A_{CP}(B^0 \to K^*(892)^0\pi^+\pi^-) = 0.07 \pm 0.05$
$A_{CP}(B^0 \to K^*(892)^0\rho^0) = -0.06 \pm 0.09$
$A_{CP}(B^0 \to K^{*0}f_0(980)) = 0.07 \pm 0.10$
$A_{CP}(B^0 \to K^{*+}\rho^-) = 0.21 \pm 0.15$
$A_{CP}(B^0 \to K^*(892)^0K^+K^-) = 0.01 \pm 0.05$
$A_{CP}(B^0 \to a_1^- K^+) = -0.16 \pm 0.12$
$A_{CP}(B^0 \to K^0K^0) = -0.6 \pm 0.7$
$A_{CP}(B^0 \to K^*(892)^0\phi) = (0 \pm 4) \times 10^{-2}$
$A_{CP}(B^0 \to K^*(892)^0K^-\pi^+) = 0.2 \pm 0.4$
$A_{CP}(B^0 \to \phi(K\pi)_0^{*0}) = 0.12 \pm 0.08$
$A_{CP}(B^0 \to \phi K_2^*(1430)^0) = -0.11 \pm 0.10$
$A_{CP}(B^0 \to K^*(892)^0\gamma) = -0.002 \pm 0.015$
$A_{CP}(B^0 \to K_2^*(1430)^0\gamma) = -0.08 \pm 0.15$
$A_{CP}(B^0 \to \rho^+\pi^-) = 0.13 \pm 0.06$ (S = 1.1)
$A_{CP}(B^0 \to \rho^-\pi^+) = -0.08 \pm 0.08$
$A_{CP}(B^0 \to a_1(1260)^\pm\pi^\mp) = -0.07 \pm 0.06$
$A_{CP}(B^0 \to b_1^-\pi^+) = -0.05 \pm 0.10$
$A_{CP}(B^0 \to p\overline{p}K^*(892)^0) = 0.05 \pm 0.12$
$A_{CP}(B^0 \to p\overline{\Lambda}\pi^-) = 0.04 \pm 0.07$
$A_{CP}(B^0 \to K^{*0}\ell^+\ell^-) = -0.05 \pm 0.10$
$A_{CP}(B^0 \to K^{*0}e^+e^-) = -0.21 \pm 0.19$
$A_{CP}(B^0 \to K^{*0}\mu^+\mu^-) = -0.07 \pm 0.04$
$C_{D^{*-}D^+}$ $(B^0 \to D^*(2010)^-D^+) = -0.01 \pm 0.11$
$S_{D^{*-}D^+}$ $(B^0 \to D^*(2010)^-D^+) = -0.72 \pm 0.15$
$C_{D^{*+}D^-}$ $(B^0 \to D^*(2010)^+D^-) = 0.00 \pm 0.13$ (S = 1.3)
$S_{D^{*+}D^-}$ $(B^0 \to D^*(2010)^+D^-) = -0.73 \pm 0.14$
$C_{D^{*+}D^{*-}}$ $(B^0 \to D^{*+}D^{*-}) = 0.01 \pm 0.09$ (S = 1.6)
$S_{D^{*+}D^{*-}}$ $(B^0 \to D^{*+}D^{*-}) = -0.59 \pm 0.14$ (S = 1.8)
C_+ $(B^0 \to D^{*+}D^{*-}) = 0.00 \pm 0.10$ (S = 1.6)
S_+ $(B^0 \to D^{*+}D^{*-}) = -0.73 \pm 0.09$
C_- $(B^0 \to D^{*+}D^{*-}) = 0.19 \pm 0.31$
S_- $(B^0 \to D^{*+}D^{*-}) = 0.1 \pm 1.6$ (S = 3.5)
C $(B^0 \to D^*(2010)^+D^*(2010)^-K_S^0) = 0.01 \pm 0.29$
S $(B^0 \to D^*(2010)^+D^*(2010)^-K_S^0) = 0.1 \pm 0.4$
$C_{D^+D^-}$ $(B^0 \to D^+D^-) = -0.46 \pm 0.21$ (S = 1.8)
$S_{D^+D^-}$ $(B^0 \to D^+D^-) = -0.99^{+0.17}_{-0.14}$
$C_{J/\psi(1S)\pi^0}$ $(B^0 \to J/\psi(1S)\pi^0) = -0.13 \pm 0.13$
$S_{J/\psi(1S)\pi^0}$ $(B^0 \to J/\psi(1S)\pi^0) = -0.94 \pm 0.29$ (S = 1.9)
$C_{D_{CP}^{(*)}h^0}$ $(B^0 \to D_{CP}^{(*)}h^0) = -0.23 \pm 0.16$
$S_{D_{CP}^{(*)}h^0}$ $(B^0 \to D_{CP}^{(*)}h^0) = -0.56 \pm 0.24$
$C_{K^0\pi^0}$ $(B^0 \to K^0\pi^0) = 0.00 \pm 0.13$ (S = 1.4)
$S_{K^0\pi^0}$ $(B^0 \to K^0\pi^0) = 0.58 \pm 0.17$
$C_{\eta'(958)K_S^0}$ $(B^0 \to \eta'(958)K_S^0) = -0.04 \pm 0.20$ (S = 2.5)
$S_{\eta'(958)K_S^0}$ $(B^0 \to \eta'(958)K_S^0) = 0.43 \pm 0.17$ (S = 1.5)
$C_{\eta'K^0}$ $(B^0 \to \eta'K^0) = -0.05 \pm 0.05$

$\boldsymbol{S_{\eta' K^0}}$ $\boldsymbol{(B^0 \to \eta' K^0)}$ $= 0.60 \pm 0.07$
$C_{\omega K^0_S}$ $(B^0 \to \omega K^0_S) = -0.30 \pm 0.28$ (S = 1.6)
$S_{\omega K^0_S}$ $(B^0 \to \omega K^0_S) = 0.43 \pm 0.24$
$C\,(B^0 \to K^0_S \pi^0 \pi^0) = 0.2 \pm 0.5$
$S\,(B^0 \to K^0_S \pi^0 \pi^0) = 0.7 \pm 0.7$
$C_{\rho^0 K^0_S}$ $(B^0 \to \rho^0 K^0_S) = -0.04 \pm 0.20$
$S_{\rho^0 K^0_S}$ $(B^0 \to \rho^0 K^0_S) = 0.50^{+0.17}_{-0.21}$
$C_{f_0 K^0_S}$ $(B^0 \to f_0(980) K^0_S) = 0.29 \pm 0.20$
$\boldsymbol{S_{f_0 K^0_S}}$ $\boldsymbol{(B^0 \to f_0(980) K^0_S)}$ $= -0.50 \pm 0.16$
$S_{f_2 K^0_S}$ $(B^0 \to f_2(1270) K^0_S) = -0.5 \pm 0.5$
$C_{f_2 K^0_S}$ $(B^0 \to f_2(1270) K^0_S) = 0.3 \pm 0.4$
$S_{f_x K^0_S}$ $(B^0 \to f_x(1300) K^0_S) = -0.2 \pm 0.5$
$C_{f_x K^0_S}$ $(B^0 \to f_x(1300) K^0_S) = 0.13 \pm 0.35$
$S_{K^0 \pi^+ \pi^-}$ $(B^0 \to K^0 \pi^+ \pi^-$ nonresonant$) = -0.01 \pm 0.33$
$C_{K^0 \pi^+ \pi^-}$ $(B^0 \to K^0 \pi^+ \pi^-$ nonresonant$) = 0.01 \pm 0.26$
$C_{K^0_S K^0_S}$ $(B^0 \to K^0_S K^0_S) = 0.0 \pm 0.4$ (S = 1.4)
$S_{K^0_S K^0_S}$ $(B^0 \to K^0_S K^0_S) = -0.8 \pm 0.5$
$C_{K^+ K^- K^0_S}$ $(B^0 \to K^+ K^- K^0_S$ nonresonant$) = 0.06 \pm 0.08$
$\boldsymbol{S_{K^+ K^- K^0_S}}$ $\boldsymbol{(B^0 \to K^+ K^- K^0_S}$ **nonresonant**$\boldsymbol{)}$ $= -0.66 \pm 0.11$
$C_{K^+ K^- K^0_S}$ $(B^0 \to K^+ K^- K^0_S$ inclusive$) = 0.01 \pm 0.09$
$\boldsymbol{S_{K^+ K^- K^0_S}}$ $\boldsymbol{(B^0 \to K^+ K^- K^0_S}$ **inclusive**$\boldsymbol{)}$ $= -0.65 \pm 0.12$
$C_{\phi K^0_S}$ $(B^0 \to \phi K^0_S) = 0.01 \pm 0.14$
$\boldsymbol{S_{\phi K^0_S}}$ $\boldsymbol{(B^0 \to \phi K^0_S)}$ $= 0.59 \pm 0.14$
$C_{K_S K_S K_S}(B^0 \to K_S K_S K_S) = -0.23 \pm 0.14$
$S_{K_S K_S K_S}(B^0 \to K_S K_S K_S) = -0.5 \pm 0.6$ (S = 3.0)
$C_{K^0_S \pi^0 \gamma}(B^0 \to K^0_S \pi^0 \gamma) = 0.36 \pm 0.33$
$S_{K^0_S \pi^0 \gamma}(B^0 \to K^0_S \pi^0 \gamma) = -0.8 \pm 0.6$
$C_{K^{*0}\gamma}$ $(B^0 \to K^*(892)^0 \gamma) = -0.04 \pm 0.16$ (S = 1.2)
$S_{K^{*0}\gamma}$ $(B^0 \to K^*(892)^0 \gamma) = -0.15 \pm 0.22$
$C_{\eta K^0 \gamma}$ $(B^0 \to \eta K^0 \gamma) = -0.3 \pm 0.4$
$S_{\eta K^0 \gamma}$ $(B^0 \to \eta K^0 \gamma) = -0.2 \pm 0.5$
$C_{K^0 \phi \gamma}$ $(B^0 \to K^0 \phi \gamma) = -0.3 \pm 0.6$
$S_{K^0 \phi \gamma}$ $(B^0 \to K^0 \phi \gamma) = 0.7^{+0.7}_{-1.1}$
$C(B^0 \to K^0_S \rho^0 \gamma) = -0.05 \pm 0.19$
$S(B^0 \to K^0_S \rho^0 \gamma) = 0.11 \pm 0.34$
$C\,(B^0 \to \rho^0 \gamma) = 0.4 \pm 0.5$
$S\,(B^0 \to \rho^0 \gamma) = -0.8 \pm 0.7$
$\boldsymbol{C_{\pi\pi}}$ $\boldsymbol{(B^0 \to \pi^+ \pi^-)}$ $= -0.31 \pm 0.05$
$\boldsymbol{S_{\pi\pi}}$ $\boldsymbol{(B^0 \to \pi^+ \pi^-)}$ $= -0.67 \pm 0.06$
$C_{\pi^0 \pi^0}(B^0 \to \pi^0 \pi^0) = -0.43 \pm 0.24$
$C_{\rho\pi}$ $(B^0 \to \rho^+ \pi^-) = -0.03 \pm 0.07$ (S = 1.2)

$S_{\rho\pi}$ $(B^0 \to \rho^+\pi^-) = 0.05 \pm 0.07$

$\Delta C_{\rho\pi}$ $(B^0 \to \rho^+\pi^-) = 0.27 \pm 0.06$

$\Delta S_{\rho\pi}$ $(B^0 \to \rho^+\pi^-) = 0.01 \pm 0.08$

$C_{\rho^0\pi^0}$ $(B^0 \to \rho^0\pi^0) = 0.27 \pm 0.24$

$S_{\rho^0\pi^0}$ $(B^0 \to \rho^0\pi^0) = -0.23 \pm 0.34$

$C_{a_1\pi}$ $(B^0 \to a_1(1260)^+\pi^-) = -0.05 \pm 0.11$

$S_{a_1\pi}$ $(B^0 \to a_1(1260)^+\pi^-) = -0.2 \pm 0.4$ (S = 3.2)

$\Delta C_{a_1\pi}$ $(B^0 \to a_1(1260)^+\pi^-) = 0.43 \pm 0.14$ (S = 1.3)

$\Delta S_{a_1\pi}$ $(B^0 \to a_1(1260)^+\pi^-) = -0.11 \pm 0.12$

C $(B^0 \to b_1^- K^+) = -0.22 \pm 0.24$

ΔC $(B^0 \to b_1^-\pi^+) = -1.04 \pm 0.24$

$C_{\rho^0\rho^0}$ $(B^0 \to \rho^0\rho^0) = 0.2 \pm 0.9$

$S_{\rho^0\rho^0}$ $(B^0 \to \rho^0\rho^0) = 0.3 \pm 0.7$

$C_{\rho\rho}$ $(B^0 \to \rho^+\rho^-) = -0.05 \pm 0.13$

$S_{\rho\rho}$ $(B^0 \to \rho^+\rho^-) = -0.06 \pm 0.17$

$|\lambda|$ $(B^0 \to J/\psi K^*(892)^0) < 0.25$, CL = 95%

$\cos 2\beta$ $(B^0 \to J/\psi K^*(892)^0) = 1.7^{+0.7}_{-0.9}$ (S = 1.6)

$\cos 2\beta$ $(B^0 \to [K^0_S\pi^+\pi^-]_{D^{(*)}}\, h^0) = 1.0^{+0.6}_{-0.7}$ (S = 1.8)

$(S_+ + S_-)/2$ $(B^0 \to D^{*-}\pi^+) = -0.039 \pm 0.011$

$(S_- - S_+)/2$ $(B^0 \to D^{*-}\pi^+) = -0.009 \pm 0.015$

$(S_+ + S_-)/2$ $(B^0 \to D^-\pi^+) = -0.046 \pm 0.023$

$(S_- - S_+)/2$ $(B^0 \to D^-\pi^+) = -0.022 \pm 0.021$

$(S_+ + S_-)/2$ $(B^0 \to D^-\rho^+) = -0.024 \pm 0.032$

$(S_- - S_+)/2$ $(B^0 \to D^-\rho^+) = -0.10 \pm 0.06$

$C_{\eta_c K^0_S}$ $(B^0 \to \eta_c K^0_S) = 0.08 \pm 0.13$

$S_{\eta_c K^0_S}$ $(B^0 \to \eta_c K^0_S) = 0.93 \pm 0.17$

$C_{c\overline{c}K^{(*)0}}$ $(B^0 \to c\overline{c}K^{(*)0}) = (0.5 \pm 1.7) \times 10^{-2}$

$\sin(2\beta) = 0.682 \pm 0.019$

$C_{J/\psi(\mathrm{nS})K^0}$ $(B^0 \to J/\psi(\mathrm{nS})K^0) = (0.5 \pm 2.0) \times 10^{-2}$

$S_{J/\psi(\mathrm{nS})K^0}$ $(B^0 \to J/\psi(\mathrm{nS})K^0) = 0.676 \pm 0.021$

$C_{J/\psi K^{*0}}$ $(B^0 \to J/\psi K^{*0}) = 0.03 \pm 0.10$

$S_{J/\psi K^{*0}}$ $(B^0 \to J/\psi K^{*0}) = 0.60 \pm 0.25$

$C_{\chi_{c0}K^0_S}$ $(B^0 \to \chi_{c0}K^0_S) = -0.3^{+0.5}_{-0.4}$

$S_{\chi_{c0}K^0_S}$ $(B^0 \to \chi_{c0}K^0_S) = -0.7 \pm 0.5$

$C_{\chi_{c1}K^0_S}$ $(B^0 \to \chi_{c1}K^0_S) = 0.06 \pm 0.07$

$S_{\chi_{c1}K^0_S}$ $(B^0 \to \chi_{c1}K^0_S) = 0.63 \pm 0.10$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to \phi K^0) = 0.22 \pm 0.30$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to \phi K^*_0(1430)^0) = 0.97^{+0.03}_{-0.52}$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to K^+K^-K^0_S) = 0.77^{+0.13}_{-0.12}$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to [K^0_S\pi^+\pi^-]_{D^{(*)}}\, h^0) = 0.45 \pm 0.28$

$|\lambda|$ $(B^0 \to [K^0_S\pi^+\pi^-]_{D^{(*)}}\, h^0) = 1.01 \pm 0.08$

$|\sin(2\beta+\gamma)| > 0.40$, CL = 90%

$2\beta + \gamma = (83 \pm 60)^\circ$

$\gamma(B^0 \to D^0K^{*0}) = (162 \pm 60)^\circ$

$\alpha = (90 \pm 5)^\circ$

$\overline{B}^0$ modes are charge conjugates of the modes below. Reactions indicate the weak decay vertex and do not include mixing. Modes which do not identify the charge state of the B are listed in the $B^{\pm}/B^0$ ADMIXTURE section.

The branching fractions listed below assume 50% $B^0\overline{B}^0$ and 50% B^+B^- production at the $\Upsilon(4S)$. We have attempted to bring older measurements up to date by rescaling their assumed $\Upsilon(4S)$ production ratio to 50:50 and their assumed D, D_s, D^*, and ψ branching ratios to current values whenever this would affect our averages and best limits significantly.

Indentation is used to indicate a subchannel of a previous reaction. All resonant subchannels have been corrected for resonance branching fractions to the final state so the sum of the subchannel branching fractions can exceed that of the final state.

For inclusive branching fractions, *e.g.*, $B \rightarrow D^{\pm}$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

B^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\ell^+\nu_\ell$ anything	[sss]	(10.33± 0.28) %		–
$e^+\nu_e X_c$		(10.1 ± 0.4) %		–
$D\ell^+\nu_\ell$ anything		(9.2 ± 0.8) %		–
$D^-\ell^+\nu_\ell$	[sss]	(2.19± 0.12) %		2309
$D^-\tau^+\nu_\tau$		(1.03± 0.22) %		1909
$D^*(2010)^-\ell^+\nu_\ell$	[sss]	(4.93± 0.11) %		2257
$D^*(2010)^-\tau^+\nu_\tau$		(1.84± 0.22) %		1837
$\overline{D}^0\pi^-\ell^+\nu_\ell$		(4.3 ± 0.6) $\times 10^{-3}$		2308
$D_0^*(2400)^-\ell^+\nu_\ell$, $D_0^{*-} \rightarrow \overline{D}^0\pi^-$		(3.0 ± 1.2) $\times 10^{-3}$	S=1.8	–
$D_2^*(2460)^-\ell^+\nu_\ell$, $D_2^{*-} \rightarrow \overline{D}^0\pi^-$		(1.21± 0.33) $\times 10^{-3}$	S=1.8	2065
$\overline{D}^{(*)}\,n\pi\ell^+\nu_\ell$(n $\geq$ 1)		(2.3 ± 0.5) %		–
$\overline{D}^{*0}\pi^-\ell^+\nu_\ell$		(4.9 ± 0.8) $\times 10^{-3}$		2256
$D_1(2420)^-\ell^+\nu_\ell$, $D_1^- \rightarrow \overline{D}^{*0}\pi^-$		(2.80± 0.28) $\times 10^{-3}$		–
$D_1'(2430)^-\ell^+\nu_\ell$, $D_1'^- \rightarrow \overline{D}^{*0}\pi^-$		(3.1 ± 0.9) $\times 10^{-3}$		–
$D_2^*(2460)^-\ell^+\nu_\ell$, $D_2^{*-} \rightarrow \overline{D}^{*0}\pi^-$		(6.8 ± 1.2) $\times 10^{-4}$		2065
$\rho^-\ell^+\nu_\ell$	[sss]	(2.94± 0.21) $\times 10^{-4}$		2583
$\pi^-\ell^+\nu_\ell$	[sss]	(1.45± 0.05) $\times 10^{-4}$		2638
Inclusive modes				
$K^{\pm}$ anything		(78 ± 8) %		–
D^0X		(8.1 ± 1.5) %		–
$\overline{D}^0X$		(47.4 ± 2.8) %		–
D^+X		< 3.9 %	CL=90%	–
D^-X		(36.9 ± 3.3) %		–
D_s^+X		(10.3 $^{+\ 2.1}_{-\ 1.8}$) %		–
D_s^-X		< 2.6 %	CL=90%	–
Λ_c^+X		< 3.1 %	CL=90%	–
$\overline{\Lambda}_c^-X$		(5.0 $^{+\ 2.1}_{-\ 1.5}$) %		–
$\overline{c}X$		(95 ± 5) %		–
cX		(24.6 ± 3.1) %		–
$\overline{c}cX$		(119 ± 6) %		–

D, D^*, or D_s modes

$D^-\pi^+$		(2.68 ± 0.13) × 10^{-3}			2306
$D^-\rho^+$		(7.8 ± 1.3) × 10^{-3}			2235
$D^-K^0\pi^+$		(4.9 ± 0.9) × 10^{-4}			2259
$D^-K^*(892)^+$		(4.5 ± 0.7) × 10^{-4}			2211
$D^-\omega\pi^+$		(2.8 ± 0.6) × 10^{-3}			2204
D^-K^+		(1.97 ± 0.21) × 10^{-4}			2279
$D^-K^+\pi^+\pi^-$		(3.8 ± 0.9) × 10^{-4}			2236
$D^-K^+\overline{K}^0$		< 3.1 × 10^{-4}		CL=90%	2188
$D^-K^+\overline{K}^*(892)^0$		(8.8 ± 1.9) × 10^{-4}			2070
$\overline{D}^0\pi^+\pi^-$		(8.4 ± 0.9) × 10^{-4}			2301
$D^*(2010)^-\pi^+$		(2.76 ± 0.13) × 10^{-3}			2255
$\overline{D}^0K^+K^-$		(4.7 ± 1.2) × 10^{-5}			2191
$D^-\pi^+\pi^+\pi^-$		(6.4 ± 0.7) × 10^{-3}			2287
($D^-\pi^+\pi^+\pi^-$) nonresonant		(3.9 ± 1.9) × 10^{-3}			2287
$D^-\pi^+\rho^0$		(1.1 ± 1.0) × 10^{-3}			2206
$D^-a_1(1260)^+$		(6.0 ± 3.3) × 10^{-3}			2121
$D^*(2010)^-\pi^+\pi^0$		(1.5 ± 0.5) %			2248
$D^*(2010)^-\rho^+$		(6.8 ± 0.9) × 10^{-3}			2180
$D^*(2010)^-K^+$		(2.14 ± 0.16) × 10^{-4}			2226
$D^*(2010)^-K^0\pi^+$		(3.0 ± 0.8) × 10^{-4}			2205
$D^*(2010)^-K^*(892)^+$		(3.3 ± 0.6) × 10^{-4}			2155
$D^*(2010)^-K^+\overline{K}^0$		< 4.7 × 10^{-4}		CL=90%	2131
$D^*(2010)^-K^+\overline{K}^*(892)^0$		(1.29 ± 0.33) × 10^{-3}			2007
$D^*(2010)^-\pi^+\pi^+\pi^-$		(7.0 ± 0.8) × 10^{-3}		S=1.3	2235
($D^*(2010)^-\pi^+\pi^+\pi^-$) nonresonant		(0.0 ± 2.5) × 10^{-3}			2235
$D^*(2010)^-\pi^+\rho^0$		(5.7 ± 3.2) × 10^{-3}			2150
$D^*(2010)^-a_1(1260)^+$		(1.30 ± 0.27) %			2061
$\overline{D}_1(2420)^0\pi^-\pi^+$, $\overline{D}_1^0 \to D^{*-}\pi^+$		(1.4 ± 0.4) × 10^{-4}			–
$D^*(2010)^-K^+\pi^-\pi^+$		(4.5 ± 0.7) × 10^{-4}			2181
$D^*(2010)^-\pi^+\pi^+\pi^-\pi^0$		(1.76 ± 0.27) %			2218
$D^{*-}3\pi^+2\pi^-$		(4.7 ± 0.9) × 10^{-3}			2195
$\overline{D}^*(2010)^-\omega\pi^+$		(2.89 ± 0.30) × 10^{-3}			2148
$D_1(2430)^0\omega\times$ B($D_1(2430)^0 \to D^{*-}\pi^+$)		(4.1 ± 1.6) × 10^{-4}			1992
$\overline{D}^{**-}\pi^+$	[xxx]	(2.1 ± 1.0) × 10^{-3}			–
$D_1(2420)^-\pi^+\times$ B($D_1^- \to D^-\pi^+\pi^-$)		($1.00^{+\ 0.21}_{-\ 0.25}$) × 10^{-4}			–
$D_1(2420)^-\pi^+\times$ B($D_1^- \to D^{*-}\pi^+\pi^-$)		< 3.3 × 10^{-5}		CL=90%	–
$\overline{D}_2^*(2460)^-\pi^+\times$ B($D_2^*(2460)^- \to D^0\pi^-$)		(2.15 ± 0.35) × 10^{-4}			2062
$\overline{D}_0^*(2400)^-\pi^+\times$ B($D_0^*(2400)^- \to D^0\pi^-$)		(6.0 ± 3.0) × 10^{-5}			2090
$D_2^*(2460)^-\pi^+\times$ B($(D_2^*)^- \to D^{*-}\pi^+\pi^-$)		< 2.4 × 10^{-5}		CL=90%	–
$\overline{D}_2^*(2460)^-\rho^+$		< 4.9 × 10^{-3}		CL=90%	1975
$D^0\overline{D}^0$		(1.4 ± 0.7) × 10^{-5}			1868
$D^{*0}\overline{D}^0$		< 2.9 × 10^{-4}		CL=90%	1794
D^-D^+		(2.11 ± 0.18) × 10^{-4}			1864
$D^\pm D^{*\mp}$ (CP-averaged)		(6.1 ± 0.6) × 10^{-4}			–
$D^-D_s^+$		(7.2 ± 0.8) × 10^{-3}			1812

$D^*(2010)^- D_s^+$	(	8.0 ± 1.1) $\times 10^{-3}$			1735
$D^- D_s^{*+}$	(	7.4 ± 1.6) $\times 10^{-3}$			1732
$D^*(2010)^- D_s^{*+}$	(	1.77± 0.14) %			1649
$D_{s0}(2317)^- K^+ \times$ B($D_{s0}(2317)^- \to D_s^- \pi^0$)	(	4.2 ± 1.4) $\times 10^{-5}$			2097
$D_{s0}(2317)^- \pi^+ \times$ B($D_{s0}(2317)^- \to D_s^- \pi^0$)	<	2.5	$\times 10^{-5}$	CL=90%	2128
$D_{sJ}(2457)^- K^+ \times$ B($D_{sJ}(2457)^- \to D_s^- \pi^0$)	<	9.4	$\times 10^{-6}$	CL=90%	–
$D_{sJ}(2457)^- \pi^+ \times$ B($D_{sJ}(2457)^- \to D_s^- \pi^0$)	<	4.0	$\times 10^{-6}$	CL=90%	–
$D_s^- D_s^+$	<	3.6	$\times 10^{-5}$	CL=90%	1759
$D_s^{*-} D_s^+$	<	1.3	$\times 10^{-4}$	CL=90%	1674
$D_s^{*-} D_s^{*+}$	<	2.4	$\times 10^{-4}$	CL=90%	1583
$D_{s0}(2317)^+ D^- \times$ B($D_{s0}(2317)^+ \to D_s^+ \pi^0$)	(	$9.7\ ^{+\ 4.0}_{-\ 3.3}$) $\times 10^{-4}$		S=1.5	1602
$D_{s0}(2317)^+ D^- \times$ B($D_{s0}(2317)^+ \to D_s^{*+} \gamma$)	<	9.5	$\times 10^{-4}$	CL=90%	–
$D_{s0}(2317)^+ D^*(2010)^- \times$ B($D_{s0}(2317)^+ \to D_s^+ \pi^0$)	(	1.5 ± 0.6) $\times 10^{-3}$			1509
$D_{sJ}(2457)^+ D^-$	(	3.5 ± 1.1) $\times 10^{-3}$			–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \to D_s^+ \gamma$)	(	$6.5\ ^{+\ 1.7}_{-\ 1.4}$) $\times 10^{-4}$			–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \to D_s^{*+} \gamma$)	<	6.0	$\times 10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \to D_s^+ \pi^+ \pi^-$)	<	2.0	$\times 10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \to D_s^+ \pi^0$)	<	3.6	$\times 10^{-4}$	CL=90%	–
$D^*(2010)^- D_{sJ}(2457)^+$	(	9.3 ± 2.2) $\times 10^{-3}$			–
$D_{sJ}(2457)^+ D^*(2010) \times$ B($D_{sJ}(2457)^+ \to D_s^+ \gamma$)	(	$2.3\ ^{+\ 0.9}_{-\ 0.7}$) $\times 10^{-3}$			–
$D^- D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*0} K^+ + D^{*+} K^0$)	(	2.8 ± 0.7) $\times 10^{-4}$			1444
$D^- D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*0} K^+$)	(	1.7 ± 0.6) $\times 10^{-4}$			1444
$D^- D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*+} K^0$)	(	2.6 ± 1.1) $\times 10^{-4}$			1444
$D^*(2010)^- D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*0} K^+ + D^{*+} K^0$)	(	5.0 ± 1.4) $\times 10^{-4}$			1336
$D^*(2010)^- D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*0} K^+$)	(	3.3 ± 1.1) $\times 10^{-4}$			1336
$D^{*-} D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*+} K^0$)	(	5.0 ± 1.7) $\times 10^{-4}$			1336
$D^- D_{sJ}(2573)^+ \times$ B($D_{sJ}(2573)^+ \to D^0 K^+$)	<	1	$\times 10^{-4}$	CL=90%	1414
$D^*(2010)^- D_{sJ}(2573)^+ \times$ B($D_{sJ}(2573)^+ \to D^0 K^+$)	<	2	$\times 10^{-4}$	CL=90%	1304

$D^+\pi^-$	(	7.8 ± 1.4)	$\times 10^{-7}$		2306
$D_s^+\pi^-$	(	2.16± 0.26)	$\times 10^{-5}$		2270
$D_s^{*+}\pi^-$	(	2.1 ± 0.4)	$\times 10^{-5}$	S=1.4	2215
$D_s^+\rho^-$	<	2.4	$\times 10^{-5}$	CL=90%	2197
$D_s^{*+}\rho^-$	(	4.1 ± 1.3)	$\times 10^{-5}$		2138
$D_s^+ a_0^-$	<	1.9	$\times 10^{-5}$	CL=90%	–
$D_s^{*+} a_0^-$	<	3.6	$\times 10^{-5}$	CL=90%	–
$D_s^+ a_1(1260)^-$	<	2.1	$\times 10^{-3}$	CL=90%	2080
$D_s^{*+} a_1(1260)^-$	<	1.7	$\times 10^{-3}$	CL=90%	2015
$D_s^+ a_2^-$	<	1.9	$\times 10^{-4}$	CL=90%	–
$D_s^{*+} a_2^-$	<	2.0	$\times 10^{-4}$	CL=90%	–
$D_s^- K^+$	(	2.2 ± 0.5)	$\times 10^{-5}$	S=1.8	2242
$D_s^{*-} K^+$	(	2.19± 0.30)	$\times 10^{-5}$		2185
$D_s^- K^*(892)^+$	(	3.5 ± 1.0)	$\times 10^{-5}$		2172
$D_s^{*-} K^*(892)^+$	(	$3.2\ ^{+\ 1.5}_{-\ 1.3}$)	$\times 10^{-5}$		2112
$D_s^-\pi^+ K^0$	(	1.10± 0.33)	$\times 10^{-4}$		2222
$D_s^{*-}\pi^+ K^0$	<	1.10	$\times 10^{-4}$	CL=90%	2164
$D_s^- K^+\pi^+\pi^-$	(	1.8 ± 0.5)	$\times 10^{-4}$		2198
$D_s^-\pi^+ K^*(892)^0$	<	3.0	$\times 10^{-3}$	CL=90%	2138
$D_s^{*-}\pi^+ K^*(892)^0$	<	1.6	$\times 10^{-3}$	CL=90%	2076
$\overline{D}{}^0 K^0$	(	5.2 ± 0.7)	$\times 10^{-5}$		2280
$\overline{D}{}^0 K^+\pi^-$	(	8.8 ± 1.7)	$\times 10^{-5}$		2261
$\overline{D}{}^0 K^*(892)^0$	(	4.2 ± 0.6)	$\times 10^{-5}$		2213
$D_2^*(2460)^- K^+ \times$ B$(D_2^*(2460)^- \to \overline{D}{}^0\pi^-)$	(	1.8 ± 0.5)	$\times 10^{-5}$		2029
$\overline{D}{}^0 K^+\pi^-$ non-resonant	<	3.7	$\times 10^{-5}$	CL=90%	–
$[K^+K^-]_D K^*(892)^0$	(	$5.8\ ^{+\ 1.8}_{-\ 1.6}$)	$\times 10^{-5}$		–
$\overline{D}{}^0\pi^0$	(	2.63± 0.14)	$\times 10^{-4}$		2308
$\overline{D}{}^0\rho^0$	(	3.2 ± 0.5)	$\times 10^{-4}$		2237
$\overline{D}{}^0 f_2$	(	1.2 ± 0.4)	$\times 10^{-4}$		–
$\overline{D}{}^0\eta$	(	2.36± 0.32)	$\times 10^{-4}$	S=2.5	2274
$\overline{D}{}^0\eta'$	(	1.38± 0.16)	$\times 10^{-4}$	S=1.3	2198
$\overline{D}{}^0\omega$	(	2.53± 0.16)	$\times 10^{-4}$		2235
$D^0\phi$	<	1.16	$\times 10^{-5}$	CL=90%	2183
$D^0 K^+\pi^-$	(	5.3 ± 3.2)	$\times 10^{-6}$		2261
$D^0 K^*(892)^0$	<	1.1	$\times 10^{-5}$	CL=90%	2213
$\overline{D}{}^{*0}\gamma$	<	2.5	$\times 10^{-5}$	CL=90%	2258
$\overline{D}{}^*(2007)^0\pi^0$	(	2.2 ± 0.6)	$\times 10^{-4}$	S=2.6	2256
$\overline{D}{}^*(2007)^0\rho^0$	<	5.1	$\times 10^{-4}$	CL=90%	2182
$\overline{D}{}^*(2007)^0\eta$	(	2.3 ± 0.6)	$\times 10^{-4}$	S=2.8	2220
$\overline{D}{}^*(2007)^0\eta'$	(	1.40± 0.22)	$\times 10^{-4}$		2141
$\overline{D}{}^*(2007)^0\pi^+\pi^-$	(	6.2 ± 2.2)	$\times 10^{-4}$		2248
$\overline{D}{}^*(2007)^0 K^0$	(	3.6 ± 1.2)	$\times 10^{-5}$		2227
$\overline{D}{}^*(2007)^0 K^*(892)^0$	<	6.9	$\times 10^{-5}$	CL=90%	2157
$D^*(2007)^0 K^*(892)^0$	<	4.0	$\times 10^{-5}$	CL=90%	2157
$D^*(2007)^0\pi^+\pi^+\pi^-\pi^-$	(	2.7 ± 0.5)	$\times 10^{-3}$		2219
$D^*(2010)^+ D^*(2010)^-$	(	8.0 ± 0.6)	$\times 10^{-4}$		1711
$\overline{D}{}^*(2007)^0\omega$	(	3.6 ± 1.1)	$\times 10^{-4}$	S=3.1	2180
$D^*(2010)^+ D^-$	(	6.1 ± 1.5)	$\times 10^{-4}$	S=1.6	1790
$D^*(2007)^0\overline{D}{}^*(2007)^0$	<	9	$\times 10^{-5}$	CL=90%	1715
$D^- D^0 K^+$	(	1.07± 0.11)	$\times 10^{-3}$		1574

$D^- D^*(2007)^0 K^+$	(3.5 ± 0.4) × 10^{-3}			1478
$D^*(2010)^- D^0 K^+$	(2.47± 0.21) × 10^{-3}			1479
$D^*(2010)^- D^*(2007)^0 K^+$	(1.06± 0.09) %			1366
$D^- D^+ K^0$	(7.5 ± 1.7) × 10^{-4}			1568
$D^*(2010)^- D^+ K^0$ + $D^- D^*(2010)^+ K^0$	(6.4 ± 0.5) × 10^{-3}			1473
$D^*(2010)^- D^*(2010)^+ K^0$	(8.1 ± 0.7) × 10^{-3}			1360
$D^{*-} D_{s1}(2536)^+ \times$ B($D_{s1}(2536)^+ \to D^{*+} K^0$)	(8.0 ± 2.4) × 10^{-4}			1336
$\overline{D}^0 D^0 K^0$	(2.7 ± 1.1) × 10^{-4}			1574
$\overline{D}^0 D^*(2007)^0 K^0$ + $\overline{D}^*(2007)^0 D^0 K^0$	(1.1 ± 0.5) × 10^{-3}			1478
$\overline{D}^*(2007)^0 D^*(2007)^0 K^0$	(2.4 ± 0.9) × 10^{-3}			1365
$(\overline{D}+\overline{D}^*)(D+D^*)K$	(3.68± 0.26) %			–

Charmonium modes

$\eta_c K^0$	(7.9 ± 1.2) × 10^{-4}			1751
$\eta_c K^*(892)^0$	(6.3 ± 0.9) × 10^{-4}			1646
$\eta_c(2S) K^{*0}$	< 3.9 × 10^{-4}		CL=90%	1157
$h_c(1P) K^{*0}$	< 4 × 10^{-4}		CL=90%	1253
$J/\psi(1S) K^0$	(8.73± 0.32) × 10^{-4}			1683
$J/\psi(1S) K^+ \pi^-$	(1.2 ± 0.6) × 10^{-3}			1652
$J/\psi(1S) K^*(892)^0$	(1.32± 0.06) × 10^{-3}			1571
$J/\psi(1S) \eta K^0_S$	(8 ± 4) × 10^{-5}			1508
$J/\psi(1S) \eta' K^0_S$	< 2.5 × 10^{-5}		CL=90%	1271
$J/\psi(1S) \phi K^0$	(9.4 ± 2.6) × 10^{-5}			1224
$J/\psi(1S) \omega K^0$	(2.3 ± 0.4) × 10^{-4}			1386
$X(3872) K^0 \times$ B($X \to J/\psi\omega$)	(6.0 ± 3.2) × 10^{-6}			1140
$\chi_{c0}(2P)$, $\chi_{c0} \to J/\psi\omega$	(2.1 ± 0.9) × 10^{-5}			1102
$J/\psi(1S) K(1270)^0$	(1.3 ± 0.5) × 10^{-3}			1390
$J/\psi(1S) \pi^0$	(1.76± 0.16) × 10^{-5}		S=1.1	1728
$J/\psi(1S) \eta$	(1.23± 0.19) × 10^{-5}			1672
$J/\psi(1S) \pi^+ \pi^-$	(4.03± 0.18) × 10^{-5}			1716
$J/\psi(1S) \pi^+ \pi^-$ nonresonant	< 1.2 × 10^{-5}		CL=90%	1716
$J/\psi(1S) f_0(500)$, $f_0 \to \pi\pi$	(6.5 $^{+\ 2.6}_{-\ 1.1}$) × 10^{-6}			–
$J/\psi(1S) f_2$	(4.2 ± 0.7) × 10^{-6}			–
$J/\psi(1S) \rho^0$	(2.58± 0.21) × 10^{-5}			1612
$J/\psi(1S) f_0(980)$, $f_0 \to \pi^+\pi^-$	< 1.1 × 10^{-6}		CL=90%	–
$J/\psi(1S) \rho(1450)^0$, $\rho^0 \to \pi\pi$	(2.1 $^{+\ 2.5}_{-\ 0.7}$) × 10^{-6}			–
$J/\psi(1S) \omega$	(2.3 ± 0.6) × 10^{-5}			1609
$J/\psi(1S) K^+ K^-$	(2.6 ± 0.4) × 10^{-6}			1533
$J/\psi(1S) a_0(980)$, $a_0 \to K^+ K^-$	(4.7 ± 3.4) × 10^{-7}			–
$J/\psi(1S) \phi$	< 1.9 × 10^{-7}		CL=90%	1520
$J/\psi(1S) \eta'(958)$	< 7.4 × 10^{-6}		CL=90%	1546
$J/\psi(1S) K^0 \pi^+ \pi^-$	(1.0 ± 0.4) × 10^{-3}			1611
$J/\psi(1S) K^0 \rho^0$	(5.4 ± 3.0) × 10^{-4}			1390
$J/\psi(1S) K^*(892)^+ \pi^-$	(8 ± 4) × 10^{-4}			1514
$J/\psi(1S) K^*(892)^0 \pi^+ \pi^-$	(6.6 ± 2.2) × 10^{-4}			1447
$X(3872)^- K^+$	< 5 × 10^{-4}		CL=90%	–
$X(3872)^- K^+ \times$ B($X(3872)^- \to J/\psi(1S)\pi^-\pi^0$) [yyy]	< 4.2 × 10^{-6}		CL=90%	–
$X(3872) K^0 \times$ B($X \to J/\psi\pi^+\pi^-$)	(4.3 ± 1.3) × 10^{-6}			1140

$X(3872)\,K^0 \times$ B($X \to J/\psi\gamma$)	$<$ 2.4	$\times 10^{-6}$	CL=90%	1140
$X(3872)\,K^*(892)^0 \times$ B($X \to J/\psi\gamma$)	$<$ 2.8	$\times 10^{-6}$	CL=90%	940
$X(3872)\,K^0 \times$ B($X \to \psi(2S)\gamma$)	$<$ 6.62	$\times 10^{-6}$	CL=90%	1140
$X(3872)\,K^*(892)^0 \times$ B($X \to \psi(2S)\gamma$)	$<$ 4.4	$\times 10^{-6}$	CL=90%	940
$X(3872)\,K^0 \times$ B($X \to D^0\overline{D}{}^0\pi^0$)	(1.7 $\pm$ 0.8)	$\times 10^{-4}$		1140
$X(3872)\,K^0 \times$ B($X \to \overline{D}{}^{*0} D^0$)	(1.2 $\pm$ 0.4)	$\times 10^{-4}$		1140
$X(4430)^{\pm}\,K^{\mp} \times$ B($X^{\pm} \to \psi(2S)\pi^{\pm}$)	($6.0\ ^{+\ 3.0}_{-\ 2.4}$)	$\times 10^{-5}$		575
$X(4430)^{\pm}\,K^{\mp} \times$ B($X^{\pm} \to J/\psi\pi^{\pm}$)	$<$ 4	$\times 10^{-6}$	CL=95%	575
$J/\psi(1S)\,p\overline{p}$	$<$ 5.2	$\times 10^{-7}$	CL=90%	862
$J/\psi(1S)\gamma$	$<$ 1.6	$\times 10^{-6}$	CL=90%	1731
$J/\psi(1S)\overline{D}{}^0$	$<$ 1.3	$\times 10^{-5}$	CL=90%	877
$\psi(2S)\,K^0$	(6.2 $\pm$ 0.5)	$\times 10^{-4}$		1283
$\psi(3770)\,K^0 \times$ B($\psi \to \overline{D}{}^0 D^0$)	$<$ 1.23	$\times 10^{-4}$	CL=90%	1217
$\psi(3770)\,K^0 \times$ B($\psi \to D^- D^+$)	$<$ 1.88	$\times 10^{-4}$	CL=90%	1217
$\psi(2S)\,\pi^+\pi^-$	(2.3 $\pm$ 0.4)	$\times 10^{-5}$		1331
$\psi(2S)\,K^+\pi^-$	(5.8 $\pm$ 0.4)	$\times 10^{-4}$		1238
$\psi(2S)\,K^*(892)^0$	(6.0 $\pm$ 0.4)	$\times 10^{-4}$	S=1.1	1116
$\chi_{c0}\,K^0$	(1.47 $\pm$ 0.27)	$\times 10^{-4}$		1477
$\chi_{c0}\,K^*(892)^0$	(1.7 $\pm$ 0.4)	$\times 10^{-4}$		1341
$\chi_{c2}\,K^0$	$<$ 1.5	$\times 10^{-5}$	CL=90%	1378
$\chi_{c2}\,K^*(892)^0$	(5.0 $\pm$ 1.2)	$\times 10^{-5}$	S=1.1	1228
$\chi_{c1}\,\pi^0$	(1.12 $\pm$ 0.28)	$\times 10^{-5}$		1468
$\chi_{c1}\,K^0$	(3.93 $\pm$ 0.27)	$\times 10^{-4}$		1411
$\chi_{c1}\,K^-\pi^+$	(3.8 $\pm$ 0.4)	$\times 10^{-4}$		1371
$\chi_{c1}\,K^*(892)^0$	(2.42 $\pm$ 0.21)	$\times 10^{-4}$	S=1.3	1265
$X(4051)^+\,K^- \times$B($X^+ \to \chi_{c1}\,\pi^+$)	($3.0\ ^{+\ 4.0}_{-\ 1.8}$)	$\times 10^{-5}$		–
$X(4248)^+\,K^- \times$B($X^+ \to \chi_{c1}\,\pi^+$)	($4.0\ ^{+20.0}_{-\ 1.0}$)	$\times 10^{-5}$		–

K or K^* modes

$K^+\pi^-$	(1.96 $\pm$ 0.05)	$\times 10^{-5}$		2615
$K^0\pi^0$	(9.9 $\pm$ 0.5)	$\times 10^{-6}$		2615
$\eta' K^0$	(6.6 $\pm$ 0.4)	$\times 10^{-5}$	S=1.4	2528
$\eta' K^*(892)^0$	(3.1 $\pm$ 0.9)	$\times 10^{-6}$		2472
$\eta' K_0^*(1430)^0$	(6.3 $\pm$ 1.6)	$\times 10^{-6}$		2346
$\eta' K_2^*(1430)^0$	(1.37 $\pm$ 0.32)	$\times 10^{-5}$		2346
ηK^0	($1.23^{+\ 0.27}_{-\ 0.24}$)	$\times 10^{-6}$		2587
$\eta K^*(892)^0$	(1.59 $\pm$ 0.10)	$\times 10^{-5}$		2534
$\eta K_0^*(1430)^0$	(1.10 $\pm$ 0.22)	$\times 10^{-5}$		2415
$\eta K_2^*(1430)^0$	(9.6 $\pm$ 2.1)	$\times 10^{-6}$		2414
ωK^0	(5.0 $\pm$ 0.6)	$\times 10^{-6}$		2557
$a_0(980)^0 K^0 \times$ B($a_0(980)^0 \to \eta\pi^0$)	$<$ 7.8	$\times 10^{-6}$	CL=90%	–
$b_1^0\,K^0 \times$ B($b_1^0 \to \omega\pi^0$)	$<$ 7.8	$\times 10^{-6}$	CL=90%	–
$a_0(980)^{\pm} K^{\mp} \times$ B($a_0(980)^{\pm} \to \eta\pi^{\pm}$)	$<$ 1.9	$\times 10^{-6}$	CL=90%	–
$b_1^-\,K^+ \times$ B($b_1^- \to \omega\pi^-$)	(7.4 $\pm$ 1.4)	$\times 10^{-6}$		–
$b_1^0\,K^{*0} \times$ B($b_1^0 \to \omega\pi^0$)	$<$ 8.0	$\times 10^{-6}$	CL=90%	–

$b_1^- K^{*+} \times$ B($b_1^- \to \omega\pi^-$)		<	5.0	$\times 10^{-6}$	CL=90%	–
$a_0(1450)^\pm K^\mp \times$ B($a_0(1450)^\pm \to \eta\pi^\pm$)		<	3.1	$\times 10^{-6}$	CL=90%	–
$K_S^0 X^0$ (Familon)		<	5.3	$\times 10^{-5}$	CL=90%	–
$\omega K^*(892)^0$		(	2.0 ± 0.5)	$\times 10^{-6}$		2503
$\omega(K\pi)_0^{*0}$		(	1.84± 0.25)	$\times 10^{-5}$		–
$\omega K_0^*(1430)^0$		(	1.60± 0.34)	$\times 10^{-5}$		2380
$\omega K_2^*(1430)^0$		(	1.01± 0.23)	$\times 10^{-5}$		2380
$\omega K^+\pi^-$ nonresonant		(	5.1 ± 1.0)	$\times 10^{-6}$		2542
$K^+\pi^-\pi^0$		(	3.78± 0.32)	$\times 10^{-5}$		2609
$K^+\rho^-$		(	7.0 ± 0.9)	$\times 10^{-6}$		2559
$K^+\rho(1450)^-$		(	2.4 ± 1.2)	$\times 10^{-6}$		–
$K^+\rho(1700)^-$		(	6 ± 7)	$\times 10^{-7}$		–
($K^+\pi^-\pi^0$) non-resonant		(	2.8 ± 0.6)	$\times 10^{-6}$		–
$(K\pi)_0^{*+}\pi^- \times$ B($(K\pi)_0^{*+} \to K^+\pi^0$)		(	3.4 ± 0.5)	$\times 10^{-5}$		–
$(K\pi)_0^{*0}\pi^0 \times$B($(K\pi)_0^{*0} \to K^+\pi^-$)		(	8.6 ± 1.7)	$\times 10^{-6}$		–
$K_2^*(1430)^0\pi^0$		<	4.0	$\times 10^{-6}$	CL=90%	2445
$K^*(1680)^0\pi^0$		<	7.5	$\times 10^{-6}$	CL=90%	2358
$K_x^{*0}\pi^0$	[*bbaa*]	(	6.1 ± 1.6)	$\times 10^{-6}$		–
$K^0\pi^+\pi^-$		(	6.5 ± 0.8)	$\times 10^{-5}$	S=1.2	2609
$K^0\pi^+\pi^-$ non-resonant		(	$1.47^{+\ 0.40}_{-\ 0.26}$)	$\times 10^{-5}$	S=2.1	–
$K^0\rho^0$		(	4.7 ± 0.6)	$\times 10^{-6}$		2558
$K^*(892)^+\pi^-$		(	8.4 ± 0.8)	$\times 10^{-6}$		2563
$K_0^*(1430)^+\pi^-$		(	3.3 ± 0.7)	$\times 10^{-5}$	S=2.0	–
$K_x^{*+}\pi^-$	[*bbaa*]	(	5.1 ± 1.6)	$\times 10^{-6}$		–
$K^*(1410)^+\pi^- \times$ B($K^*(1410)^+ \to K^0\pi^+$)		<	3.8	$\times 10^{-6}$	CL=90%	–
$f_0(980)K^0 \times$ B($f_0(980) \to \pi^+\pi^-$)		(	7.0 ± 0.9)	$\times 10^{-6}$		2522
$f_2(1270)K^0$		(	$2.7\ ^{+\ 1.3}_{-\ 1.2}$)	$\times 10^{-6}$		2459
$f_x(1300)K^0 \times$ B($f_x \to \pi^+\pi^-$)		(	1.8 ± 0.7)	$\times 10^{-6}$		–
$K^*(892)^0\pi^0$		(	3.3 ± 0.6)	$\times 10^{-6}$		2563
$K_2^*(1430)^+\pi^-$		<	6	$\times 10^{-6}$	CL=90%	2445
$K^*(1680)^+\pi^-$		<	1.0	$\times 10^{-5}$	CL=90%	2358
$K^+\pi^-\pi^+\pi^-$	[*ccaa*]	<	2.3	$\times 10^{-4}$	CL=90%	2600
$\rho^0 K^+\pi^-$		(	2.8 ± 0.7)	$\times 10^{-6}$		2543
$f_0(980)K^+\pi^-$, $f_0 \to \pi\pi$		(	$1.4\ ^{+\ 0.5}_{-\ 0.6}$)	$\times 10^{-6}$		2506
$K^+\pi^-\pi^+\pi^-$ nonresonant		<	2.1	$\times 10^{-6}$	CL=90%	2600
$K^*(892)^0\pi^+\pi^-$		(	5.5 ± 0.5)	$\times 10^{-5}$		2557
$K^*(892)^0\rho^0$		(	3.9 ± 1.3)	$\times 10^{-6}$	S=1.9	2504
$K^*(892)^0 f_0(980)$, $f_0 \to \pi\pi$		(	$3.9\ ^{+\ 2.1}_{-\ 1.8}$)	$\times 10^{-6}$	S=3.9	2466
$K_1(1270)^+\pi^-$		<	3.0	$\times 10^{-5}$	CL=90%	2484
$K_1(1400)^+\pi^-$		<	2.7	$\times 10^{-5}$	CL=90%	2451
$a_1(1260)^- K^+$	[*ccaa*]	(	1.6 ± 0.4)	$\times 10^{-5}$		2471
$K^*(892)^+\rho^-$		(	1.03± 0.26)	$\times 10^{-5}$		2504
$K_0^*(1430)^+\rho^-$		(	2.8 ± 1.2)	$\times 10^{-5}$		–
$K_1(1400)^0\rho^0$		<	3.0	$\times 10^{-3}$	CL=90%	2388
$K_0^*(1430)^0\rho^0$		(	2.7 ± 0.6)	$\times 10^{-5}$		2381
$K_0^*(1430)^0 f_0(980)$, $f_0 \to \pi\pi$		(	2.7 ± 0.9)	$\times 10^{-6}$		–

$K_2^*(1430)^0 f_0(980)$, $f_0 \to \pi\pi$	(8.6 ± 2.0) $\times 10^{-6}$			–
$K^+ K^-$	(1.3 ± 0.5) $\times 10^{-7}$			2593
$K^0 \overline{K}^0$	(1.21 ± 0.16) $\times 10^{-6}$			2592
$K^0 K^- \pi^+$	(7.3 ± 1.1) $\times 10^{-6}$		S=1.2	2578
$\overline{K}^{*0} K^0 + K^{*0} \overline{K}^0$	< 1.9	$\times 10^{-6}$		–
$K^+ K^- \pi^0$	(2.2 ± 0.6) $\times 10^{-6}$			2579
$K_S^0 K_S^0 \pi^0$	< 9	$\times 10^{-7}$	CL=90%	2578
$K_S^0 K_S^0 \eta$	< 1.0	$\times 10^{-6}$	CL=90%	2515
$K_S^0 K_S^0 \eta'$	< 2.0	$\times 10^{-6}$	CL=90%	2452
$K^0 K^+ K^-$	(2.63 ± 0.15) $\times 10^{-5}$		S=1.3	2522
$K^0 \phi$	(7.3 ± 0.7) $\times 10^{-6}$			2516
$f_0(980) K^0$, $f_0 \to K^+ K^-$	($7.0 \,^{+\,3.5}_{-\,3.0}$) $\times 10^{-6}$			–
$f_0(1500) K^0$	($1.3 \,^{+\,0.7}_{-\,0.5}$) $\times 10^{-5}$			2398
$f_2'(1525)^0 K^0$	($3 \,^{+\,5}_{-\,4}$) $\times 10^{-7}$			–
$f_0(1710) K^0$, $f_0 \to K^+ K^-$	(4.4 ± 0.9) $\times 10^{-6}$			–
$K^0 K^+ K^-$ nonresonant	(3.3 ± 1.0) $\times 10^{-5}$			2522
$K_S^0 K_S^0 K_S^0$	(6.0 ± 0.5) $\times 10^{-6}$		S=1.1	2521
$f_0(980) K^0$, $f_0 \to K_S^0 K_S^0$	(2.7 ± 1.8) $\times 10^{-6}$			–
$f_0(1710) K^0$, $f_0 \to K_S^0 K_S^0$	($5.0 \,^{+\,5.0}_{-\,2.6}$) $\times 10^{-7}$			–
$f_0(2010) K^0$, $f_0 \to K_S^0 K_S^0$	(5 ± 6) $\times 10^{-7}$			–
$K_S^0 K_S^0 K_S^0$ nonresonant	(1.33 ± 0.31) $\times 10^{-5}$			2521
$K_S^0 K_S^0 K_L^0$	< 1.6	$\times 10^{-5}$	CL=90%	2521
$K^*(892)^0 K^+ K^-$	(2.75 ± 0.26) $\times 10^{-5}$			2467
$K^*(892)^0 \phi$	(1.00 ± 0.05) $\times 10^{-5}$			2460
$K^+ K^- \pi^+ \pi^-$ nonresonant	< 7.17	$\times 10^{-5}$	CL=90%	2559
$K^*(892)^0 K^- \pi^+$	(4.5 ± 1.3) $\times 10^{-6}$			2524
$K^*(892)^0 \overline{K}^*(892)^0$	(8 ± 5) $\times 10^{-7}$		S=2.2	2485
$K^+ K^+ \pi^- \pi^-$ nonresonant	< 6.0	$\times 10^{-6}$	CL=90%	2559
$K^*(892)^0 K^+ \pi^-$	< 2.2	$\times 10^{-6}$	CL=90%	2524
$K^*(892)^0 K^*(892)^0$	< 2	$\times 10^{-7}$	CL=90%	2485
$K^*(892)^+ K^*(892)^-$	< 2.0	$\times 10^{-6}$	CL=90%	2485
$K_1(1400)^0 \phi$	< 5.0	$\times 10^{-3}$	CL=90%	2339
$\phi (K\pi)_0^{*0}$	(4.3 ± 0.4) $\times 10^{-6}$			–
$\phi (K\pi)_0^{*0}$ $(1.60 < m_{K\pi} < 2.15)$ [ddaa]	< 1.7	$\times 10^{-6}$	CL=90%	–
$K_0^*(1430)^0 K^- \pi^+$	< 3.18	$\times 10^{-5}$	CL=90%	2403
$K_0^*(1430)^0 \overline{K}^*(892)^0$	< 3.3	$\times 10^{-6}$	CL=90%	2360
$K_0^*(1430)^0 \overline{K}_0^*(1430)^0$	< 8.4	$\times 10^{-6}$	CL=90%	2222
$K_0^*(1430)^0 \phi$	(3.9 ± 0.8) $\times 10^{-6}$			2333
$K_0^*(1430)^0 K^*(892)^0$	< 1.7	$\times 10^{-6}$	CL=90%	2360
$K_0^*(1430)^0 K_0^*(1430)^0$	< 4.7	$\times 10^{-6}$	CL=90%	2222
$K^*(1680)^0 \phi$	< 3.5	$\times 10^{-6}$	CL=90%	2238
$K^*(1780)^0 \phi$	< 2.7	$\times 10^{-6}$	CL=90%	–
$K^*(2045)^0 \phi$	< 1.53	$\times 10^{-5}$	CL=90%	–
$K_2^*(1430)^0 \rho^0$	< 1.1	$\times 10^{-3}$	CL=90%	2381
$K_2^*(1430)^0 \phi$	(6.8 ± 0.9) $\times 10^{-6}$		S=1.2	2333
$K^0 \phi \phi$	(4.5 ± 0.9) $\times 10^{-6}$			2305
$\eta' \eta' K^0$	< 3.1	$\times 10^{-5}$	CL=90%	2337
$\eta K^0 \gamma$	(7.6 ± 1.8) $\times 10^{-6}$			2587
$\eta' K^0 \gamma$	< 6.4	$\times 10^{-6}$	CL=90%	2528
$K^0 \phi \gamma$	(2.7 ± 0.7) $\times 10^{-6}$			2516
$K^+ \pi^- \gamma$	(4.6 ± 1.4) $\times 10^{-6}$			2615

$K^*(892)^0\gamma$		(4.33± 0.15) $\times 10^{-5}$			2564
$K^*(1410)\gamma$		< 1.3	$\times 10^{-4}$	CL=90%	2451
$K^+\pi^-\gamma$ nonresonant		< 2.6	$\times 10^{-6}$	CL=90%	2615
$K^*(892)^0 X(214)\times$ B($X \to \mu^+\mu^-$)	[eeaa]	< 2.26	$\times 10^{-8}$	CL=90%	–
$K^0\pi^+\pi^-\gamma$		(1.95± 0.22) $\times 10^{-5}$			2609
$K^+\pi^-\pi^0\gamma$		(4.1 ± 0.4) $\times 10^{-5}$			2609
$K_1(1270)^0\gamma$		< 5.8	$\times 10^{-5}$	CL=90%	2486
$K_1(1400)^0\gamma$		< 1.2	$\times 10^{-5}$	CL=90%	2453
$K_2^*(1430)^0\gamma$		(1.24± 0.24) $\times 10^{-5}$			2447
$K^*(1680)^0\gamma$		< 2.0	$\times 10^{-3}$	CL=90%	2361
$K_3^*(1780)^0\gamma$		< 8.3	$\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)^0\gamma$		< 4.3	$\times 10^{-3}$	CL=90%	2244

Light unflavored meson modes

$\rho^0\gamma$		(8.6 ± 1.5) $\times 10^{-7}$			2583
$\rho^0 X(214)\times$ B($X \to \mu^+\mu^-$)	[eeaa]	< 1.73	$\times 10^{-8}$	CL=90%	–
$\omega\gamma$		(4.4 $^{+\ 1.8}_{-\ 1.6}$) $\times 10^{-7}$			2582
$\phi\gamma$		< 8.5	$\times 10^{-7}$	CL=90%	2541
$\pi^+\pi^-$		(5.12± 0.19) $\times 10^{-6}$			2636
$\pi^0\pi^0$		(1.91± 0.22) $\times 10^{-6}$			2636
$\eta\pi^0$		< 1.5	$\times 10^{-6}$	CL=90%	2610
$\eta\eta$		< 1.0	$\times 10^{-6}$	CL=90%	2582
$\eta'\pi^0$		(1.2 ± 0.6) $\times 10^{-6}$		S=1.7	2551
$\eta'\eta'$		< 1.7	$\times 10^{-6}$	CL=90%	2460
$\eta'\eta$		< 1.2	$\times 10^{-6}$	CL=90%	2523
$\eta'\rho^0$		< 1.3	$\times 10^{-6}$	CL=90%	2492
$\eta' f_0(980)\times$ B($f_0(980) \to \pi^+\pi^-$)		< 9	$\times 10^{-7}$	CL=90%	2454
$\eta\rho^0$		< 1.5	$\times 10^{-6}$	CL=90%	2553
$\eta f_0(980)\times$ B($f_0(980) \to \pi^+\pi^-$)		< 4	$\times 10^{-7}$	CL=90%	2516
$\omega\eta$		(9.4 $^{+\ 4.0}_{-\ 3.1}$) $\times 10^{-7}$			2552
$\omega\eta'$		(1.0 $^{+\ 0.5}_{-\ 0.4}$) $\times 10^{-6}$			2491
$\omega\rho^0$		< 1.6	$\times 10^{-6}$	CL=90%	2522
$\omega f_0(980)\times$ B($f_0(980) \to \pi^+\pi^-$)		< 1.5	$\times 10^{-6}$	CL=90%	2485
$\omega\omega$		(1.2 ± 0.4) $\times 10^{-6}$			2521
$\phi\pi^0$		< 1.5	$\times 10^{-7}$	CL=90%	2540
$\phi\eta$		< 5	$\times 10^{-7}$	CL=90%	2511
$\phi\eta'$		< 5	$\times 10^{-7}$	CL=90%	2448
$\phi\rho^0$		< 3.3	$\times 10^{-7}$	CL=90%	2480
$\phi f_0(980)\times$ B($f_0 \to \pi^+\pi^-$)		< 3.8	$\times 10^{-7}$	CL=90%	2441
$\phi\omega$		< 7	$\times 10^{-7}$	CL=90%	2479
$\phi\phi$		< 2	$\times 10^{-7}$	CL=90%	2435
$a_0(980)^\pm\pi^\mp\times$ B($a_0(980)^\pm \to \eta\pi^\pm$)		< 3.1	$\times 10^{-6}$	CL=90%	–
$a_0(1450)^\pm\pi^\mp\times$ B($a_0(1450)^\pm \to \eta\pi^\pm$)		< 2.3	$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^-\pi^0$		< 7.2	$\times 10^{-4}$	CL=90%	2631
$\rho^0\pi^0$		(2.0 ± 0.5) $\times 10^{-6}$			2581
$\rho^\mp\pi^\pm$	[gg]	(2.30± 0.23) $\times 10^{-5}$			2581
$\pi^+\pi^-\pi^+\pi^-$		< 1.93	$\times 10^{-5}$	CL=90%	2621
$\rho^0\pi^+\pi^-$		< 8.8	$\times 10^{-6}$	CL=90%	2575
$\rho^0\rho^0$		(7.3 ± 2.8) $\times 10^{-7}$			2523

$f_0(980)\pi^+\pi^-$		$<$	3.8	$\times 10^{-6}$	CL=90%	2539
$\rho^0 f_0(980) \times$ B($f_0(980) \rightarrow \pi^+\pi^-$)		$<$	3	$\times 10^{-7}$	CL=90%	2486
$f_0(980) f_0(980) \times$ B^2($f_0(980) \rightarrow \pi^+\pi^-$)		$<$	1	$\times 10^{-7}$	CL=90%	2447
$f_0(980) f_0(980) \times$ B($f_0 \rightarrow \pi^+\pi^-$) $\times$ B($f_0 \rightarrow K^+K^-$)		$<$	2.3	$\times 10^{-7}$	CL=90%	2447
$a_1(1260)^\mp\pi^\pm$	[gg]	(	2.6 $\pm$ 0.5)	$\times 10^{-5}$	S=1.9	2494
$a_2(1320)^\mp\pi^\pm$	[gg]	$<$	6.3	$\times 10^{-6}$	CL=90%	2473
$\pi^+\pi^-\pi^0\pi^0$		$<$	3.1	$\times 10^{-3}$	CL=90%	2622
$\rho^+\rho^-$		(	2.42 $\pm$ 0.31)	$\times 10^{-5}$		2523
$a_1(1260)^0\pi^0$		$<$	1.1	$\times 10^{-3}$	CL=90%	2495
$\omega\pi^0$		$<$	5	$\times 10^{-7}$	CL=90%	2580
$\pi^+\pi^+\pi^-\pi^-\pi^0$		$<$	9.0	$\times 10^{-3}$	CL=90%	2609
$a_1(1260)^+\rho^-$		$<$	6.1	$\times 10^{-5}$	CL=90%	2433
$a_1(1260)^0\rho^0$		$<$	2.4	$\times 10^{-3}$	CL=90%	2433
$b_1^\mp\pi^\pm \times$ B($b_1^\mp \rightarrow \omega\pi^\mp$)		(	1.09 $\pm$ 0.15)	$\times 10^{-5}$		–
$b_1^0\pi^0 \times$ B($b_1^0 \rightarrow \omega\pi^0$)		$<$	1.9	$\times 10^{-6}$	CL=90%	–
$b_1^-\rho^+ \times$ B($b_1^- \rightarrow \omega\pi^-$)		$<$	1.4	$\times 10^{-6}$	CL=90%	–
$b_1^0\rho^0 \times$ B($b_1^0 \rightarrow \omega\pi^0$)		$<$	3.4	$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$		$<$	3.0	$\times 10^{-3}$	CL=90%	2592
$a_1(1260)^+ a_1(1260)^- \times$ B^2($a_1^+ \rightarrow 2\pi^+\pi^-$)		(	1.18 $\pm$ 0.31)	$\times 10^{-5}$		2336
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\pi^0$		$<$	1.1	%	CL=90%	2572

Baryon modes

$p\overline{p}$		(	$1.5 \,^{+\,0.7}_{-\,0.5}$)	$\times 10^{-8}$		2467
$p\overline{p}\pi^+\pi^-$		$<$	2.5	$\times 10^{-4}$	CL=90%	2406
$p\overline{p}K^0$		(	2.66 $\pm$ 0.32)	$\times 10^{-6}$		2347
$\Theta(1540)^+\overline{p}$, $\Theta^+ \rightarrow pK_S^0$	[ffaa]	$<$	5	$\times 10^{-8}$	CL=90%	2318
$f_J(2220)K^0$, $f_J \rightarrow p\overline{p}$		$<$	4.5	$\times 10^{-7}$	CL=90%	2135
$p\overline{p}K^*(892)^0$		(	$1.24^{+\,0.28}_{-\,0.25}$)	$\times 10^{-6}$		2216
$f_J(2220)K_0^*$, $f_J \rightarrow p\overline{p}$		$<$	1.5	$\times 10^{-7}$	CL=90%	–
$p\overline{\Lambda}\pi^-$		(	3.14 $\pm$ 0.29)	$\times 10^{-6}$		2401
$p\overline{\Sigma}(1385)^-$		$<$	2.6	$\times 10^{-7}$	CL=90%	2363
$\Delta^0\overline{\Lambda}$		$<$	9.3	$\times 10^{-7}$	CL=90%	2364
$p\overline{\Lambda}K^-$		$<$	8.2	$\times 10^{-7}$	CL=90%	2308
$p\overline{\Sigma}^0\pi^-$		$<$	3.8	$\times 10^{-6}$	CL=90%	2383
$\overline{\Lambda}\Lambda$		$<$	3.2	$\times 10^{-7}$	CL=90%	2392
$\overline{\Lambda}\Lambda K^0$		(	$4.8 \,^{+\,1.0}_{-\,0.9}$)	$\times 10^{-6}$		2250
$\overline{\Lambda}\Lambda K^{*0}$		(	$2.5 \,^{+\,0.9}_{-\,0.8}$)	$\times 10^{-6}$		2098
$\overline{\Lambda}\Lambda D^0$		(	$1.1 \,^{+\,0.6}_{-\,0.5}$)	$\times 10^{-5}$		1661
$\Delta^0\overline{\Delta}^0$		$<$	1.5	$\times 10^{-3}$	CL=90%	2335
$\Delta^{++}\overline{\Delta}^{--}$		$<$	1.1	$\times 10^{-4}$	CL=90%	2335
$\overline{D}^0 p\overline{p}$		(	1.04 $\pm$ 0.07)	$\times 10^{-4}$		1863
$D_s^-\overline{\Lambda}p$		(	2.8 $\pm$ 0.9)	$\times 10^{-5}$		1710
$\overline{D}^*(2007)^0 p\overline{p}$		(	9.9 $\pm$ 1.1)	$\times 10^{-5}$		1788
$D^*(2010)^- p\overline{n}$		(	1.4 $\pm$ 0.4)	$\times 10^{-3}$		1785
$D^- p\overline{p}\pi^+$		(	3.32 $\pm$ 0.31)	$\times 10^{-4}$		1786
$D^*(2010)^- p\overline{p}\pi^+$		(	4.7 $\pm$ 0.5)	$\times 10^{-4}$	S=1.2	1707
$\overline{D}^0 p\overline{p}\pi^+\pi^-$		(	3.0 $\pm$ 0.5)	$\times 10^{-4}$		1708

$\overline{D}^{*0} p \overline{p} \pi^+ \pi^-$		(1.9 ± 0.5) × 10^{-4}			1623
$\Theta_c \overline{p} \pi^+$, $\Theta_c \to D^- p$		< 9	× 10^{-6}	CL=90%	–
$\Theta_c \overline{p} \pi^+$, $\Theta_c \to D^{*-} p$		< 1.4	× 10^{-5}	CL=90%	–
$\overline{\Sigma}_c^{--} \Delta^{++}$		< 1.0	× 10^{-3}	CL=90%	1839
$\overline{\Lambda}_c^- p \pi^+ \pi^-$		(1.3 ± 0.4) × 10^{-3}			1934
$\overline{\Lambda}_c^- p$		(2.0 ± 0.4) × 10^{-5}			2021
$\overline{\Lambda}_c^- p \pi^0$		(1.9 ± 0.5) × 10^{-4}			1982
$\Sigma_c(2455)^- p$		< 3.0	× 10^{-5}		–
$\overline{\Lambda}_c^- p \pi^+ \pi^- \pi^0$		< 5.07	× 10^{-3}	CL=90%	1882
$\overline{\Lambda}_c^- p \pi^+ \pi^- \pi^+ \pi^-$		< 2.74	× 10^{-3}	CL=90%	1821
$\overline{\Lambda}_c^- p \pi^+ \pi^-$		(1.17± 0.23) × 10^{-3}			1934
$\overline{\Lambda}_c^- p \pi^+ \pi^-$ (nonresonant)		(7.1 ± 1.4) × 10^{-4}			1934
$\overline{\Sigma}_c(2520)^{--} p \pi^+$		(1.17± 0.25) × 10^{-4}			1860
$\overline{\Sigma}_c(2520)^0 p \pi^-$		< 3.1	× 10^{-5}	CL=90%	1860
$\overline{\Sigma}_c(2455)^0 p \pi^-$		(1.04± 0.22) × 10^{-4}			1895
$\overline{\Sigma}_c(2455)^0 N^0$, $N^0 \to p \pi^-$		(8.0 ± 2.9) × 10^{-5}			–
$\overline{\Sigma}_c(2455)^{--} p \pi^+$		(2.2 ± 0.4) × 10^{-4}			1895
$\Lambda_c^- p K^+ \pi^-$		(4.3 ± 1.4) × 10^{-5}			–
$\overline{\Sigma}_c(2455)^{--} p K^+$, $\overline{\Sigma}_c^{--} \to \overline{\Lambda}_c^- \pi^-$		(1.1 ± 0.4) × 10^{-5}			1754
$\Lambda_c^- p K^*(892)^0$		< 2.42	× 10^{-5}	CL=90%	–
$\overline{\Lambda}_c^- \Lambda K^+$		(3.8 ± 1.3) × 10^{-5}			1767
$\overline{\Lambda}_c^- \Lambda_c^+$		< 6.2	× 10^{-5}	CL=90%	1319
$\overline{\Lambda}_c(2593)^- / \overline{\Lambda}_c(2625)^- p$		< 1.1	× 10^{-4}	CL=90%	–
$\overline{\Xi}_c^- \Lambda_c^+$, $\overline{\Xi}_c^- \to \overline{\Xi}^+ \pi^- \pi^-$		(2.2 ± 2.3) × 10^{-5}		S=1.9	1147
$\Lambda_c^+ \Lambda_c^- K^0$		(5.4 ± 3.2) × 10^{-4}			–

Lepton Family number (LF) or Lepton number (L) or Baryon number (B) violating modes, or/and $\Delta B = 1$ weak neutral current ($B1$) modes

$\gamma\gamma$	$B1$		< 3.2	× 10^{-7}	CL=90%	2640
$e^+ e^-$	$B1$		< 8.3	× 10^{-8}	CL=90%	2640
$e^+ e^- \gamma$	$B1$		< 1.2	× 10^{-7}	CL=90%	2640
$\mu^+ \mu^-$	$B1$		< 6.3	× 10^{-10}	CL=90%	2638
$\mu^+ \mu^- \gamma$	$B1$		< 1.6	× 10^{-7}	CL=90%	2638
$\mu^+ \mu^- \mu^+ \mu^-$			< 5.3	× 10^{-9}	CL=90%	2629
SP, $S \to \mu^+ \mu^-$, $P \to \mu^+ \mu^-$		[$ggaa$]	< 5.1	× 10^{-9}	CL=90%	–
$\tau^+ \tau^-$	$B1$		< 4.1	× 10^{-3}	CL=90%	1952
$\pi^0 \ell^+ \ell^-$	$B1$		< 5.3	× 10^{-8}	CL=90%	2638
$\pi^0 e^+ e^-$	$B1$		< 8.4	× 10^{-8}	CL=90%	2638
$\pi^0 \mu^+ \mu^-$	$B1$		< 6.9	× 10^{-8}	CL=90%	2634
$\eta \ell^+ \ell^-$			< 6.4	× 10^{-8}	CL=90%	2611
$\eta e^+ e^-$			< 1.08	× 10^{-7}	CL=90%	2611
$\eta \mu^+ \mu^-$			< 1.12	× 10^{-7}	CL=90%	2607
$\pi^0 \nu \overline{\nu}$	$B1$		< 6.9	× 10^{-5}	CL=90%	2638
$K^0 \ell^+ \ell^-$	$B1$	[sss]	($3.1 \pm \begin{smallmatrix}0.8\\0.7\end{smallmatrix}$) × 10^{-7}			2616
$K^0 e^+ e^-$	$B1$		($1.6 \pm \begin{smallmatrix}1.0\\0.8\end{smallmatrix}$) × 10^{-7}			2616
$K^0 \mu^+ \mu^-$	$B1$		(3.4 ± 0.5) × 10^{-7}			2612
$K^0 \nu \overline{\nu}$	$B1$		< 4.9	× 10^{-5}	CL=90%	2616
$\rho^0 \nu \overline{\nu}$	$B1$		< 2.08	× 10^{-4}	CL=90%	2583
$K^*(892)^0 \ell^+ \ell^-$	$B1$	[sss]	($9.9 \pm \begin{smallmatrix}1.2\\1.1\end{smallmatrix}$) × 10^{-7}			2564

$K^*(892)^0 e^+ e^-$	B1	(	$1.03^{+0.19}_{-0.17}$	$\times 10^{-6}$		2564
$K^*(892)^0 \mu^+ \mu^-$	B1	(	1.05 ± 0.10	$\times 10^{-6}$		2560
$K^*(892)^0 \nu\overline{\nu}$	B1	<	5.5	$\times 10^{-5}$	CL=90%	2564
$\phi\nu\overline{\nu}$	B1	<	1.27	$\times 10^{-4}$	CL=90%	2541
$e^\pm \mu^\mp$	LF	[gg] <	2.8	$\times 10^{-9}$	CL=90%	2639
$\pi^0 e^\pm \mu^\mp$	LF	<	1.4	$\times 10^{-7}$	CL=90%	2637
$K^0 e^\pm \mu^\mp$	LF	<	2.7	$\times 10^{-7}$	CL=90%	2615
$K^*(892)^0 e^+ \mu^-$	LF	<	5.3	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^0 e^- \mu^+$	LF	<	3.4	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^0 e^\pm \mu^\mp$	LF	<	5.8	$\times 10^{-7}$	CL=90%	2563
$e^\pm \tau^\mp$	LF	[gg] <	2.8	$\times 10^{-5}$	CL=90%	2341
$\mu^\pm \tau^\mp$	LF	[gg] <	2.2	$\times 10^{-5}$	CL=90%	2339
invisible	B1	<	2.4	$\times 10^{-5}$	CL=90%	–
$\nu\overline{\nu}\gamma$	B1	<	1.7	$\times 10^{-5}$	CL=90%	2640
$\Lambda_c^+ \mu^-$	L,B	<	1.8	$\times 10^{-6}$	CL=90%	2143
$\Lambda_c^+ e^-$	L,B	<	5	$\times 10^{-6}$	CL=90%	2145

$B^\pm/B^0$ ADMIXTURE

CP violation

$A_{CP}(B \to K^*(892)\gamma) = -0.003 \pm 0.017$
$A_{CP}(b \to s\gamma) = -0.008 \pm 0.029$
$A_{CP}(b \to (s+d)\gamma) = -0.01 \pm 0.05$
$A_{CP}(B \to X_s \ell^+ \ell^-) = -0.22 \pm 0.26$
$A_{CP}(B \to K^* e^+ e^-) = -0.18 \pm 0.15$
$A_{CP}(B \to K^* \mu^+ \mu^-) = -0.03 \pm 0.13$
$A_{CP}(B \to K^* \ell^+ \ell^-) = -0.04 \pm 0.07$
$A_{CP}(B \to \eta \text{anything}) = -0.13^{+0.04}_{-0.05}$

The branching fraction measurements are for an admixture of B mesons at the $\Upsilon(4S)$. The values quoted assume that B($\Upsilon(4S) \to B\overline{B}$) = 100%.

For inclusive branching fractions, *e.g.*, $B \to D^\pm$ *anything*, the treatment of multiple D's in the final state must be defined. One possibility would be to count the number of events with one-or-more D's and divide by the total number of B's. Another possibility would be to count the total number of D's and divide by the total number of B's, which is the definition of average multiplicity. The two definitions are identical if only one D is allowed in the final state. Even though the "one-or-more" definition seems sensible, for practical reasons inclusive branching fractions are almost always measured using the multiplicity definition. For heavy final state particles, authors call their results inclusive branching fractions while for light particles some authors call their results multiplicities. In the B sections, we list all results as inclusive branching fractions, adopting a multiplicity definition. This means that inclusive branching fractions can exceed 100% and that inclusive partial widths can exceed total widths, just as inclusive cross sections can exceed total cross section.

$\overline{B}$ modes are charge conjugates of the modes below. Reactions indicate the weak decay vertex and do not include mixing.

B DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Semileptonic and leptonic modes				
$e^+\nu_e$ anything	[hhaa]	(10.86 ± 0.16) %		–
$\overline{p}e^+\nu_e$ anything		< 5.9	$\times 10^{-4}$ CL=90%	–
$\mu^+\nu_\mu$ anything	[hhaa]	(10.86 ± 0.16) %		–
$\ell^+\nu_\ell$ anything	[sss,hhaa]	(10.86 ± 0.16) %		–
$D^-\ell^+\nu_\ell$ anything	[sss]	(2.8 ± 0.9) %		–
$\overline{D}^0\ell^+\nu_\ell$ anything	[sss]	(7.3 ± 1.5) %		–
$\overline{D}\ell^+\nu_\ell$		(2.42 ± 0.12) %		2310
$\overline{D}\tau^+\nu_\tau$		(1.07 ± 0.18) %		1911
$D^{*-}\ell^+\nu_\ell$ anything	[iiaa]	(6.7 ± 1.3) $\times 10^{-3}$		–
$D^*\ell^+\nu_\ell$	[jjaa]	(4.95 ± 0.11) %		2257
$D^*\tau^+\nu_\tau$		(1.64 ± 0.15) %		1837
$\overline{D}^{**}\ell^+\nu_\ell$	[sss,kkaa]	(2.7 ± 0.7) %		–
$\overline{D}_1(2420)\ell^+\nu_\ell$ anything		(3.8 ± 1.3) $\times 10^{-3}$	S=2.4	–
$D\pi\ell^+\nu_\ell$ anything + $D^*\pi\ell^+\nu_\ell$ anything		(2.6 ± 0.5) %	S=1.5	–
$D\pi\ell^+\nu_\ell$ anything		(1.5 ± 0.6) %		–
$D^*\pi\ell^+\nu_\ell$ anything		(1.9 ± 0.4) %		–
$\overline{D}_2^*(2460)\ell^+\nu_\ell$ anything		(4.4 ± 1.6) $\times 10^{-3}$		–
$D^{*-}\pi^+\ell^+\nu_\ell$ anything		(1.00 ± 0.34) %		–
$D_s^-\ell^+\nu_\ell$ anything	[sss]	< 7 $\times 10^{-3}$	CL=90%	–
$D_s^-\ell^+\nu_\ell K^+$ anything	[sss]	< 5 $\times 10^{-3}$	CL=90%	–
$D_s^-\ell^+\nu_\ell K^0$ anything	[sss]	< 7 $\times 10^{-3}$	CL=90%	–
$X_c\ell^+\nu_\ell$		(10.65 ± 0.16) %		–
$X_u\ell^+\nu_\ell$		(2.14 ± 0.31) $\times 10^{-3}$		–
$K^+\ell^+\nu_\ell$ anything	[sss]	(6.3 ± 0.6) %		–
$K^-\ell^+\nu_\ell$ anything	[sss]	(10 ± 4) $\times 10^{-3}$		–
$K^0/\overline{K}^0\ell^+\nu_\ell$ anything	[sss]	(4.6 ± 0.5) %		–
***D*, *D**, or D_s modes**				
$D^\pm$ anything		(23.7 ± 1.3) %		–
$D^0/\overline{D}^0$ anything		(62.7 ± 2.9) %	S=1.3	–
$D^*(2010)^\pm$ anything		(22.5 ± 1.5) %		–
$D^*(2007)^0$ anything		(26.0 ± 2.7) %		–
$D_s^\pm$ anything	[gg]	(8.3 ± 0.8) %		–
$D_s^{*\pm}$ anything		(6.3 ± 1.0) %		–
$D_s^{*\pm}\overline{D}^{(*)}$		(3.4 ± 0.6) %		–
$D^{(*)}\overline{D}^{(*)}K^0 + D^{(*)}\overline{D}^{(*)}K^\pm$	[gg,llaa]	(7.1 $^{+2.7}_{-1.7}$) %		–
$b\to c\overline{c}s$		(22 ± 4) %		–
$D_s^{(*)}\overline{D}^{(*)}$	[gg,llaa]	(3.9 ± 0.4) %		–
$D^*D^*(2010)^\pm$	[gg]	< 5.9 $\times 10^{-3}$	CL=90%	1711
$DD^*(2010)^\pm + D^*D^\pm$	[gg]	< 5.5 $\times 10^{-3}$	CL=90%	–
$DD^\pm$	[gg]	< 3.1 $\times 10^{-3}$	CL=90%	1866
$D_s^{(*)\pm}\overline{D}^{(*)}X(n\pi^\pm)$	[gg,llaa]	(9 $^{+5}_{-4}$) %		–

$D^*(2010)\gamma$		$<$	1.1		$\times 10^{-3}$	CL=90%	2257
$D_s^+\pi^-$, $D_s^{*+}\pi^-$, $D_s^+\rho^-$, $D_s^{*+}\rho^-$, $D_s^+\pi^0$, $D_s^{*+}\pi^0$, $D_s^+\eta$, $D_s^{*+}\eta$, $D_s^+\rho^0$, $D_s^{*+}\rho^0$, $D_s^+\omega$, $D_s^{*+}\omega$	[gg]	$<$	4		$\times 10^{-4}$	CL=90%	–
$D_{s1}(2536)^+$ anything		$<$	9.5		$\times 10^{-3}$	CL=90%	–
Charmonium modes							
$J/\psi(1S)$ anything		(	1.094	$\pm$ 0.032)	%	S=1.1	–
$J/\psi(1S)$ (direct) anything		(	7.8	$\pm$ 0.4)	$\times 10^{-3}$	S=1.1	–
$\psi(2S)$ anything		(	3.07	$\pm$ 0.21)	$\times 10^{-3}$		–
$\chi_{c1}(1P)$ anything		(	3.86	$\pm$ 0.27)	$\times 10^{-3}$		–
$\chi_{c1}(1P)$ (direct) anything		(	3.24	$\pm$ 0.25)	$\times 10^{-3}$		–
$\chi_{c2}(1P)$ anything		(	1.4	$\pm$ 0.4)	$\times 10^{-3}$	S=1.9	–
$\chi_{c2}(1P)$ (direct) anything		(	1.65	$\pm$ 0.31)	$\times 10^{-3}$		–
$\eta_c(1S)$ anything		$<$	9		$\times 10^{-3}$	CL=90%	–
$KX(3872)\times$ B($X \to D^0\overline{D}^0\pi^0$)		(	1.2	$\pm$ 0.4)	$\times 10^{-4}$		1141
$KX(3872)\times$ B($X \to D^{*0}D^0$)		(	8.0	$\pm$ 2.2)	$\times 10^{-5}$		1141
$KX(3940)\times$ B($X \to D^{*0}D^0$)		$<$	6.7		$\times 10^{-5}$	CL=90%	1084
$K\chi_{c0}(2P)$, $\chi_{c0} \to \omega J/\psi$	[nnaa]	(	7.1	$\pm$ 3.4)	$\times 10^{-5}$		1103
K* or *K* **modes**							
$K^\pm$ anything	[gg]	(	78.9	$\pm$ 2.5)	%		–
K^+ anything		(	66	$\pm$ 5)	%		–
K^- anything		(	13	$\pm$ 4)	%		–
$K^0/\overline{K}^0$ anything	[gg]	(	64	$\pm$ 4)	%		–
$K^*(892)^\pm$ anything		(	18	$\pm$ 6)	%		–
$K^*(892)^0/\overline{K}^*(892)^0$ anything	[gg]	(	14.6	$\pm$ 2.6)	%		–
$K^*(892)\gamma$		(	4.2	$\pm$ 0.6)	$\times 10^{-5}$		2564
$\eta K\gamma$		(	8.5	$^{+\ 1.8}_{-\ 1.6}$)	$\times 10^{-6}$		2588
$K_1(1400)\gamma$		$<$	1.27		$\times 10^{-4}$	CL=90%	2453
$K_2^*(1430)\gamma$		(	1.7	$^{+\ 0.6}_{-\ 0.5}$)	$\times 10^{-5}$		2447
$K_2(1770)\gamma$		$<$	1.2		$\times 10^{-3}$	CL=90%	2342
$K_3^*(1780)\gamma$		$<$	3.7		$\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)\gamma$		$<$	1.0		$\times 10^{-3}$	CL=90%	2244
$K\eta'(958)$		(	8.3	$\pm$ 1.1)	$\times 10^{-5}$		2528
$K^*(892)\eta'(958)$		(	4.1	$\pm$ 1.1)	$\times 10^{-6}$		2472
$K\eta$		$<$	5.2		$\times 10^{-6}$	CL=90%	2588
$K^*(892)\eta$		(	1.8	$\pm$ 0.5)	$\times 10^{-5}$		2534
$K\phi\phi$		(	2.3	$\pm$ 0.9)	$\times 10^{-6}$		2306
$\overline{b} \to \overline{s}\gamma$		(	3.40	$\pm$ 0.21)	$\times 10^{-4}$		–
$\overline{b} \to \overline{d}\gamma$		(	9.2	$\pm$ 3.0)	$\times 10^{-6}$		–
$\overline{b} \to \overline{s}$ gluon		$<$	6.8		%	CL=90%	–
η anything		(	2.6	$^{+\ 0.5}_{-\ 0.8}$)	$\times 10^{-4}$		–
η' anything		(	4.2	$\pm$ 0.9)	$\times 10^{-4}$		–
K^+ gluon (charmless)		$<$	1.87		$\times 10^{-4}$	CL=90%	–
K^0 gluon (charmless)		(	1.9	$\pm$ 0.7)	$\times 10^{-4}$		–

Light unflavored meson modes

$\rho\gamma$		(1.39 ± 0.25) $\times 10^{-6}$		S=1.2	2583
$\rho/\omega\gamma$		(1.30 ± 0.23) $\times 10^{-6}$		S=1.2	–
$\pi^\pm$ anything	[gg,ooaa]	(358 ± 7) %			–
π^0 anything		(235 ±11) %			–
η anything		(17.6 ± 1.6) %			–
ρ^0 anything		(21 ± 5) %			–
ω anything		< 81	%	CL=90%	–
ϕ anything		(3.43 ± 0.12) %			–
$\phi K^*(892)$		< 2.2	$\times 10^{-5}$	CL=90%	2460
π^+ gluon (charmless)		(3.7 ± 0.8) $\times 10^{-4}$			–

Baryon modes

Λ_c^+ / $\overline{\Lambda}_c^-$ anything		(4.5 ± 1.2) %			–
Λ_c^+ anything		< 1.7	%	CL=90%	–
$\overline{\Lambda}_c^-$ anything		< 9	%	CL=90%	–
$\overline{\Lambda}_c^- \ell^+$ anything		< 1.1	$\times 10^{-3}$	CL=90%	–
$\overline{\Lambda}_c^- e^+$ anything		< 2.3	$\times 10^{-3}$	CL=90%	–
$\overline{\Lambda}_c^- \mu^+$ anything		< − 1.8	$\times 10^{-3}$	CL=90%	–
$\overline{\Lambda}_c^- p$ anything		(2.6 ± 0.8) %			–
$\overline{\Lambda}_c^- p e^+ \nu_e$		< 1.0	$\times 10^{-3}$	CL=90%	2021
$\overline{\Sigma}_c^{--}$ anything		(4.2 ± 2.4) $\times 10^{-3}$			–
$\overline{\Sigma}_c^-$ anything		< 9.6	$\times 10^{-3}$	CL=90%	–
$\overline{\Sigma}_c^0$ anything		(4.6 ± 2.4) $\times 10^{-3}$			–
$\overline{\Sigma}_c^0 N$ ($N = p$ or n)		< 1.5	$\times 10^{-3}$	CL=90%	1938
Ξ_c^0 anything $\times$ B($\Xi_c^0 \to \Xi^- \pi^+$)		(1.93 ± 0.30) $\times 10^{-4}$		S=1.1	–
Ξ_c^+ anything $\times$ B($\Xi_c^+ \to \Xi^- \pi^+ \pi^+$)		(4.5 $^{+\ 1.3}_{-\ 1.2}$) $\times 10^{-4}$			–
$p/\overline{p}$ anything	[gg]	(8.0 ± 0.4) %			–
$p/\overline{p}$ (direct) anything	[gg]	(5.5 ± 0.5) %			–
$\Lambda/\overline{\Lambda}$ anything	[gg]	(4.0 ± 0.5) %			–
$\Xi^-/\overline{\Xi}^+$ anything	[gg]	(2.7 ± 0.6) $\times 10^{-3}$			–
baryons anything		(6.8 ± 0.6) %			–
$p\overline{p}$ anything		(2.47 ± 0.23) %			–
$\Lambda\overline{p}/\overline{\Lambda}p$ anything	[gg]	(2.5 ± 0.4) %			–
$\Lambda\overline{\Lambda}$ anything		< 5	$\times 10^{-3}$	CL=90%	–

Lepton Family number (LF) violating modes or $\Delta B = 1$ weak neutral current ($B1$) modes

$s e^+ e^-$	$B1$		(4.7 ± 1.3) $\times 10^{-6}$			–
$s \mu^+ \mu^-$	$B1$		(4.3 ± 1.2) $\times 10^{-6}$			–
$s \ell^+ \ell^-$	$B1$	[sss]	(4.5 ± 1.0) $\times 10^{-6}$			–
$\pi \ell^+ \ell^-$	$B1$		< 5.9	$\times 10^{-8}$	CL=90%	2638
$\pi e^+ e^-$			< 1.10	$\times 10^{-7}$	CL=90%	2638
$\pi \mu^+ \mu^-$			< 5.0	$\times 10^{-8}$	CL=90%	2634
$K e^+ e^-$	$B1$		(4.4 ± 0.6) $\times 10^{-7}$			2617
$K^*(892) e^+ e^-$	$B1$		(1.19 ± 0.20) $\times 10^{-6}$		S=1.2	2564
$K \mu^+ \mu^-$	$B1$		(4.4 ± 0.4) $\times 10^{-7}$			2612
$K^*(892) \mu^+ \mu^-$	$B1$		(1.06 ± 0.09) $\times 10^{-6}$			2560
$K \ell^+ \ell^-$	$B1$		(4.8 ± 0.4) $\times 10^{-7}$			2617
$K^*(892) \ell^+ \ell^-$	$B1$		(1.05 ± 0.10) $\times 10^{-6}$			2564

$K\nu\overline{\nu}$	*B1*	<	1.7	$\times 10^{-5}$	CL=90%	2617
$K^*\nu\overline{\nu}$	*B1*	<	7.6	$\times 10^{-5}$	CL=90%	–
$s\,e^{\pm}\mu^{\mp}$	*LF*	[*gg*] <	2.2	$\times 10^{-5}$	CL=90%	–
$\pi\,e^{\pm}\mu^{\mp}$	*LF*	<	9.2	$\times 10^{-8}$	CL=90%	2637
$\rho\,e^{\pm}\mu^{\mp}$	*LF*	<	3.2	$\times 10^{-6}$	CL=90%	2582
$K\,e^{\pm}\mu^{\mp}$	*LF*	<	3.8	$\times 10^{-8}$	CL=90%	2616
$K^*(892)\,e^{\pm}\mu^{\mp}$	*LF*	<	5.1	$\times 10^{-7}$	CL=90%	2563

$B^{\pm}/B^0/B_s^0/b$-baryon ADMIXTURE

These measurements are for an admixture of bottom particles at high energy (LHC, LEP, Tevatron, S$p\overline{p}$S).

Mean life $\tau = (1.568 \pm 0.009) \times 10^{-12}$ s

Mean life $\tau = (1.72 \pm 0.10) \times 10^{-12}$ s Charged b-hadron admixture

Mean life $\tau = (1.58 \pm 0.14) \times 10^{-12}$ s Neutral b-hadron admixture

$\tau_{\text{charged } b\text{-hadron}}/\tau_{\text{neutral } b\text{-hadron}} = 1.09 \pm 0.13$

$|\Delta\tau_b|/\tau_{b,\overline{b}} = -0.001 \pm 0.014$

$\text{Re}(\epsilon_b)\ /\ (1 + |\epsilon_b|^2) = (1.2 \pm 0.4) \times 10^{-3}$

The branching fraction measurements are for an admixture of B mesons and baryons at energies above the $\Upsilon(4S)$. Only the highest energy results (LHC, LEP, Tevatron, S$p\overline{p}$S) are used in the branching fraction averages. In the following, we assume that the production fractions are the same at the LHC, LEP, and at the Tevatron.

For inclusive branching fractions, *e.g.*, $B \to D^{\pm}$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

The modes below are listed for a $\overline{b}$ initial state. b modes are their charge conjugates. Reactions indicate the weak decay vertex and do not include mixing.

$\overline{b}$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)

PRODUCTION FRACTIONS

The production fractions for weakly decaying b-hadrons at high energy have been calculated from the best values of mean lives, mixing parameters, and branching fractions in this edition by the Heavy Flavor Averaging Group (HFAG) as described in the note "B^0-$\overline{B}^0$ Mixing" in the B^0 Particle Listings. The production fractions in b-hadronic Z decay or $p\overline{p}$ collisions at the Tevatron are also listed at the end of the section. Values assume

$\text{B}(\overline{b} \to B^+) = \text{B}(\overline{b} \to B^0)$

$\text{B}(\overline{b} \to B^+) + \text{B}(\overline{b} \to B^0) + \text{B}(\overline{b} \to B_s^0) + \text{B}(b \to b\text{-baryon}) = 100\ \%$.

The correlation coefficients between production fractions are also reported:

$cor(B_s^0, b\text{-baryon}) = -0.291$

$cor(B_s^0, B^{\pm}{=}B^0) = -0.083$

$cor(b\text{-baryon}, B^{\pm}{=}B^0) = -0.929$.

The notation for production fractions varies in the literature (f_d, d_{B^0}, $f(b \to \overline{B}^0)$, Br($b \to \overline{B}^0$)). We use our own branching fraction notation here, B($\overline{b} \to B^0$).

Note these production fractions are b-hadronization fractions, not the conventional branching fractions of b-quark to a B-hadron, which may have considerable dependence on the initial and final state kinematic and production environment.

B^+		(40.2 ± 0.7) %		–
B^0		(40.2 ± 0.7) %		–
B_s^0		(10.5 ± 0.6) %		–
b-baryon		(9.2 ± 1.5) %		–

DECAY MODES

Semileptonic and leptonic modes

ν anything		(23.1 ± 1.5) %		–
$\ell^+ \nu_\ell$ anything	[sss]	(10.69± 0.22) %		–
$e^+ \nu_e$ anything		(10.86± 0.35) %		–
$\mu^+ \nu_\mu$ anything		($10.95^{+\ 0.29}_{-\ 0.25}$) %		–
$D^- \ell^+ \nu_\ell$ anything	[sss]	(2.27± 0.35) %	S=1.7	–
$D^- \pi^+ \ell^+ \nu_\ell$ anything		(4.9 ± 1.9) $\times 10^{-3}$		–
$D^- \pi^- \ell^+ \nu_\ell$ anything		(2.6 ± 1.6) $\times 10^{-3}$		–
$\overline{D}^0 \ell^+ \nu_\ell$ anything	[sss]	(6.84± 0.35) %		–
$\overline{D}^0 \pi^- \ell^+ \nu_\ell$ anything		(1.07± 0.27) %		–
$\overline{D}^0 \pi^+ \ell^+ \nu_\ell$ anything		(2.3 ± 1.6) $\times 10^{-3}$		–
$D^{*-} \ell^+ \nu_\ell$ anything	[sss]	(2.75± 0.19) %		–
$D^{*-} \pi^- \ell^+ \nu_\ell$ anything		(6 ± 7) $\times 10^{-4}$		–
$D^{*-} \pi^+ \ell^+ \nu_\ell$ anything		(4.8 ± 1.0) $\times 10^{-3}$		–
$\overline{D}_j^0 \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}_j^0$ $\to$ $D^{*+} \pi^-$)	[sss,ppaa]	(2.6 ± 0.9) $\times 10^{-3}$		–
$D_j^- \ell^+ \nu_\ell$ anything $\times$ B(D_j^- $\to$ $D^0 \pi^-$)	[sss,ppaa]	(7.0 ± 2.3) $\times 10^{-3}$		–
$\overline{D}_2^*(2460)^0 \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}_2^*(2460)^0$ $\to$ $D^{*-} \pi^+$)		< 1.4 $\times 10^{-3}$	CL=90%	–
$D_2^*(2460)^- \ell^+ \nu_\ell$ anything $\times$ B($D_2^*(2460)^-$ $\to$ $D^0 \pi^-$)		($4.2^{+\ 1.5}_{-\ 1.8}$) $\times 10^{-3}$		–
$\overline{D}_2^*(2460)^0 \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}_2^*(2460)^0$ $\to$ $D^- \pi^+$)		(1.6 ± 0.8) $\times 10^{-3}$		–
charmless $\ell \overline{\nu}_\ell$	[sss]	(1.7 ± 0.5) $\times 10^{-3}$		–
$\tau^+ \nu_\tau$ anything		(2.41± 0.23) %		–
$D^{*-} \tau \nu_\tau$ anything		(9 ± 4) $\times 10^{-3}$		–
$\overline{c}$ $\to$ $\ell^- \overline{\nu}_\ell$ anything	[sss]	(8.02± 0.19) %		–
c $\to$ $\ell^+ \nu$ anything		($1.6^{+\ 0.4}_{-\ 0.5}$) %		–

Charmed meson and baryon modes

$\overline{D}^0$ anything		(59.8 ± 2.9) %		–
$D^0 D_s^\pm$ anything	[gg]	($9.1^{+\ 4.0}_{-\ 2.8}$) %		–
$D^\mp D_s^\pm$ anything	[gg]	($4.0^{+\ 2.3}_{-\ 1.8}$) %		–
$\overline{D}^0 D^0$ anything	[gg]	($5.1^{+\ 2.0}_{-\ 1.8}$) %		–
$D^0 D^\pm$ anything	[gg]	($2.7^{+\ 1.8}_{-\ 1.6}$) %		–
$D^\pm D^\mp$ anything	[gg]	< 9 $\times 10^{-3}$	CL=90%	–
D^- anything		(23.3 ± 1.7) %		–
$D^*(2010)^+$ anything		(17.3 ± 2.0) %		–
$D_1(2420)^0$ anything		(5.0 ± 1.5) %		–
$D^*(2010)^\mp D_s^\pm$ anything	[gg]	($3.3^{+\ 1.6}_{-\ 1.3}$) %		–

$D^0 D^*(2010)^{\pm}$ anything	[gg]	(3.0 $^{+\ 1.1}_{-\ 0.9}$) %		–
$D^*(2010)^{\pm} D^{\mp}$ anything	[gg]	(2.5 $^{+\ 1.2}_{-\ 1.0}$) %		–
$D^*(2010)^{\pm} D^*(2010)^{\mp}$ anything	[gg]	(1.2 ± 0.4) %		–
$\overline{D}\,D$ anything		(10 $^{+11}_{-10}$) %		–
$D_2^*(2460)^0$ anything		(4.7 ± 2.7) %		–
D_s^- anything		(14.7 ± 2.1) %		–
D_s^+ anything		(10.1 ± 3.1) %		–
Λ_c^+ anything		(9.7 ± 2.9) %		–
$\overline{c}/c$ anything	[ooaa]	(116.2 ± 3.2) %		–
Charmonium modes				
$J/\psi(1S)$ anything		(1.16± 0.10) %		–
$\psi(2S)$ anything		(2.83± 0.29) $\times 10^{-3}$		–
$\chi_{c1}(1P)$ anything		(1.4 ± 0.4) %		–
K* or *K* **modes**				
$\overline{s}\gamma$		(3.1 ± 1.1) $\times 10^{-4}$		–
$\overline{s\nu}\nu$	*B1*	< 6.4 $\times 10^{-4}$	CL=90%	–
$K^{\pm}$ anything		(74 ± 6) %		–
K_S^0 anything		(29.0 ± 2.9) %		–
Pion modes				
$\pi^{\pm}$ anything		(397 ±21) %		–
π^0 anything	[ooaa]	(278 ±60) %		–
ϕ anything		(2.82± 0.23) %		–
Baryon modes				
$p/\overline{p}$ anything		(13.1 ± 1.1) %		–
$\Lambda/\overline{\Lambda}$ anything		(5.9 ± 0.6) %		–
b-baryon anything		(10.2 ± 2.8) %		–
Other modes				
charged anything	[ooaa]	(497 ± 7) %		–
hadron$^+$ hadron$^-$		(1.7 $^{+\ 1.0}_{-\ 0.7}$) $\times 10^{-5}$		–
charmless		(7 ±21) $\times 10^{-3}$		–
$\Delta B = 1$ weak neutral current (*B1*) modes				
$\mu^+\mu^-$ anything	*B1*	< 3.2 $\times 10^{-4}$	CL=90%	–

B^*

$I(J^P) = \frac{1}{2}(1^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

Mass $m_{B^*} = 5325.2 \pm 0.4$ MeV
$m_{B^*} - m_B = 45.78 \pm 0.35$ MeV
$m_{B^{*+}} - m_{B^+} = 45.0 \pm 0.4$ MeV

B* **DECAY MODES**	Fraction (Γ_i/Γ)	p (MeV/c)
$B\gamma$	dominant	45

$B_1(5721)^0$

$I(J^P) = \frac{1}{2}(1^+)$
I, J, P need confirmation.

$B_1(5721)^0$ MASS $= 5723.5 \pm 2.0$ MeV (S = 1.1)
$m_{B_1^0} - m_{B^+} = 444.3 \pm 2.0$ MeV (S = 1.1)

$B_1(5721)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+}\pi^-$	dominant	–

$B_2^*(5747)^0$

$I(J^P) = \frac{1}{2}(2^+)$
I, J, P need confirmation.

$B_2^*(5747)^0$ MASS $= 5743 \pm 5$ MeV (S = 2.9)
Full width $\Gamma = 23^{+5}_{-11}$ MeV
$m_{B_2^{*0}} - m_{B_1^0} = 19 \pm 6$ MeV (S = 3.0)

$B_2^*(5747)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+\pi^-$	dominant	424
$B^{*+}\pi^-$	dominant	–

BOTTOM, STRANGE MESONS ($B = \pm 1, S = \mp 1$)

$B_s^0 = s\overline{b}$, $\overline{B}_s^0 = \overline{s}b$, similarly for B_s^*'s

B_s^0

$I(J^P) = 0(0^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

Mass $m_{B_s^0} = 5366.77 \pm 0.24$ MeV
$m_{B_s^0} - m_B = 87.35 \pm 0.23$ MeV
Mean life $\tau = (1.512 \pm 0.007) \times 10^{-12}$ s
$c\tau = 453.3$ μm
$\Delta\Gamma_{B_s^0} = \Gamma_{B_{sL}^0} - \Gamma_{B_{sH}^0} = (0.091 \pm 0.008) \times 10^{12}$ s^{-1}

B_s^0-$\overline{B}_s^0$ mixing parameters

$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0} = (17.761 \pm 0.022) \times 10^{12}$ $\hbar$ s^{-1}
$= (1.1691 \pm 0.0014) \times 10^{-8}$ MeV
$x_s = \Delta m_{B_s^0}/\Gamma_{B_s^0} = 26.85 \pm 0.13$
$\chi_s = 0.499311 \pm 0.000007$

CP violation parameters in B_s^0

$\mathrm{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2) = (-1.9 \pm 1.0) \times 10^{-3}$
$C_{KK}(B_s^0 \to K^+K^-) = 0.14 \pm 0.11$
$S_{KK}(B_s^0 \to K^+K^-) = 0.30 \pm 0.13$
CP Violation phase $\beta_s = (0.0 \pm 3.5) \times 10^{-2}$
$A_{CP}(B_s \to \pi^+K^-) = 0.28 \pm 0.04$
$A_{CP}(B_s^0 \to [K^+K^-]_D \overline{K}^*(892)^0) = 0.04 \pm 0.16$

These branching fractions all scale with $B(\overline{b} \to B_s^0)$.

The branching fraction $B(B_s^0 \to D_s^- \ell^+ \nu_\ell \text{anything})$ is not a pure measurement since the measured product branching fraction $B(\overline{b} \to B_s^0) \times B(B_s^0 \to D_s^- \ell^+ \nu_\ell \text{anything})$ was used to determine $B(\overline{b} \to B_s^0)$, as described in the note on "B^0-$\overline{B}^0$ Mixing"

For inclusive branching fractions, *e.g.*, $B \to D^\pm$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

B_s^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
D_s^- anything		(93 ±25) %		–
$\ell \nu_\ell X$		(10.5 ± 0.8) %		–
$D_s^- \ell^+ \nu_\ell$ anything	[qqaa]	(7.9 ± 2.4) %		–
$D_{s1}(2536)^- \mu^+ \nu_\mu$, $D_{s1}^- \to D^{*-} K_S^0$		(2.5 ± 0.7) $\times 10^{-3}$		–
$D_{s1}(2536)^- X \mu^+ \nu$, $D_{s1}^- \to \overline{D}^0 K^+$		(4.3 ± 1.7) $\times 10^{-3}$		–
$D_{s2}(2573)^- X \mu^+ \nu$, $D_{s2}^- \to \overline{D}^0 K^+$		(2.6 ± 1.2) $\times 10^{-3}$		–
$D_s^- \pi^+$		(3.04± 0.23) $\times 10^{-3}$		2320
$D_s^- \rho^+$		(7.0 ± 1.5) $\times 10^{-3}$		2249
$D_s^- \pi^+ \pi^+ \pi^-$		(6.3 ± 1.1) $\times 10^{-3}$		2301
$D_{s1}(2536)^- \pi^+$, $D_{s1}^- \to D_s^- \pi^+ \pi^-$		(2.5 ± 0.8) $\times 10^{-5}$		–
$D_s^\mp K^\pm$		(2.03± 0.28) $\times 10^{-4}$	S=1.3	2293
$D_s^- K^+ \pi^+ \pi^-$		(3.3 ± 0.7) $\times 10^{-4}$		2249
$D_s^+ D_s^-$		(4.4 ± 0.5) $\times 10^{-3}$		1824
$D_s^- D^+$		(3.6 ± 0.8) $\times 10^{-4}$		1875
$D^+ D^-$		(2.2 ± 0.6) $\times 10^{-4}$		1925
$D^0 \overline{D}^0$		(1.9 ± 0.5) $\times 10^{-4}$		1929
$D_s^{*-} \pi^+$		(2.0 ± 0.5) $\times 10^{-3}$		2265
$D_s^{*-} \rho^+$		(9.7 ± 2.2) $\times 10^{-3}$		2191
$D_s^{*+} D_s^- + D_s^{*-} D_s^+$		(1.28± 0.23) %	S=1.2	1742
$D_s^{*+} D_s^{*-}$		(1.85± 0.30) %		1655
$D_s^{(*)+} D_s^{(*)-}$		(4.5 ± 1.4) %		–
$\overline{D}^0 K^- \pi^+$		(9.9 ± 1.5) $\times 10^{-4}$		2312
$\overline{D}^0 \overline{K}^*(892)^0$		(3.5 ± 0.6) $\times 10^{-4}$		2264
$\overline{D}^0 K^+ K^-$		(4.2 ± 1.9) $\times 10^{-5}$		2242
$\overline{D}^0 \phi$		(2.4 ± 0.7) $\times 10^{-5}$		2235
$D^{*\mp} \pi^\pm$		< 6.1 $\times 10^{-6}$	CL=90%	–
$J/\psi(1S)\phi$		(1.07± 0.09) $\times 10^{-3}$		1588
$J/\psi(1S)\pi^0$		< 1.2 $\times 10^{-3}$	CL=90%	1786

$J/\psi(1S)\eta$			$(4.0 \pm 0.7) \times 10^{-4}$	S=1.3	1733
$J/\psi(1S)K^0_S$			$(1.87 \pm 0.17) \times 10^{-5}$		1743
$J/\psi(1S)K^*(892)^0$			$(4.4 \pm 0.9) \times 10^{-5}$		1637
$J/\psi(1S)\eta'$			$(3.4 \pm 0.5) \times 10^{-4}$		1612
$J/\psi(1S)\pi^+\pi^-$			$(2.12 \pm 0.19) \times 10^{-4}$		1775
$J/\psi(1S)f_0(980)$, $f_0 \to \pi^+\pi^-$			$(1.39 \pm 0.14) \times 10^{-4}$		–
$J/\psi(1S)f_0(1370)$, $f_0 \to \pi^+\pi^-$			$(3.9\ ^{+\ 0.8}_{-\ 1.8}) \times 10^{-5}$		–
$J/\psi(1S)f_2(1270)$, $f_2 \to \pi^+\pi^-$			$(1.1 \pm 0.4) \times 10^{-6}$		–
$J/\psi(1S)\pi^+\pi^-$ (nonresonant)			$(1.8\ ^{+\ 1.1}_{-\ 0.4}) \times 10^{-5}$		1775
$J/\psi(1S)K^+K^-$			$(7.9 \pm 0.7) \times 10^{-4}$		1601
$J/\psi(1S)f'_2(1525)$			$(2.6 \pm 0.6) \times 10^{-4}$		1304
$J/\psi(1S)p\overline{p}$			$< 4.8 \times 10^{-6}$	CL=90%	982
$\psi(2S)\eta$			$(3.3 \pm 0.9) \times 10^{-4}$		1338
$\psi(2S)\pi^+\pi^-$			$(7.2 \pm 1.2) \times 10^{-5}$		1397
$\psi(2S)\phi$			$(5.4 \pm 0.6) \times 10^{-4}$		1120
$\chi_{c1}\phi$			$(2.02 \pm 0.30) \times 10^{-4}$		1274
$\pi^+\pi^-$			$(7.6 \pm 1.9) \times 10^{-7}$	S=1.4	2680
$\pi^0\pi^0$			$< 2.1 \times 10^{-4}$	CL=90%	2680
$\eta\pi^0$			$< 1.0 \times 10^{-3}$	CL=90%	2654
$\eta\eta$			$< 1.5 \times 10^{-3}$	CL=90%	2627
$\rho^0\rho^0$			$< 3.20 \times 10^{-4}$	CL=90%	2569
$\phi\rho^0$			$< 6.17 \times 10^{-4}$	CL=90%	2526
$\phi\phi$			$(1.91 \pm 0.31) \times 10^{-5}$		2482
π^+K^-			$(5.5 \pm 0.6) \times 10^{-6}$		2659
K^+K^-			$(2.49 \pm 0.17) \times 10^{-5}$		2638
$K^0\overline{K}^0$			$< 6.6 \times 10^{-5}$	CL=90%	2637
$K^0\pi^+\pi^-$			$(1.9 \pm 0.5) \times 10^{-5}$		2653
$K^0K^\pm\pi^\mp$			$(9.7 \pm 1.7) \times 10^{-5}$		2622
$K^0K^+K^-$			$< 4 \times 10^{-6}$	CL=90%	2568
$\overline{K}^*(892)^0\rho^0$			$< 7.67 \times 10^{-4}$	CL=90%	2550
$\overline{K}^*(892)^0K^*(892)^0$			$(2.8 \pm 0.7) \times 10^{-5}$		2531
$\phi K^*(892)^0$			$(1.13 \pm 0.30) \times 10^{-6}$		2507
$p\overline{p}$			$(2.8\ ^{+\ 2.2}_{-\ 1.7}) \times 10^{-8}$		2514
$\Lambda_c^-\Lambda\pi^+$			$(3.6 \pm 1.6) \times 10^{-4}$		–
$\gamma\gamma$	$B1$		$< 8.7 \times 10^{-6}$	CL=90%	2683
$\phi\gamma$			$(3.6 \pm 0.4) \times 10^{-5}$		2587

Lepton Family number (LF) violating modes or $\Delta B = 1$ weak neutral current ($B1$) modes

$\mu^+\mu^-$	$B1$		$(3.1 \pm 0.7) \times 10^{-9}$		2681
e^+e^-	$B1$		$< 2.8 \times 10^{-7}$	CL=90%	2683
$e^\pm\mu^\mp$	LF	[gg]	$< 1.1 \times 10^{-8}$	CL=90%	2682
$\mu^+\mu^-\mu^+\mu^-$			$< 1.2 \times 10^{-8}$	CL=90%	2673
SP, $S \to \mu^+\mu^-$, $P \to \mu^+\mu^-$		[ggaa]	$< 1.2 \times 10^{-8}$	CL=90%	–
$\phi(1020)\mu^+\mu^-$	$B1$		$(7.6 \pm 1.5) \times 10^{-7}$		2582
$\phi\nu\overline{\nu}$	$B1$		$< 5.4 \times 10^{-3}$	CL=90%	2587

B_s^*

$I(J^P) = 0(1^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

Mass $m = 5415.4^{+2.4}_{-2.1}$ MeV (S = 3.0)

$m_{B_s^*} - m_{B_s} = 48.7^{+2.3}_{-2.1}$ MeV (S = 2.8)

B_s^* DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B_s\gamma$	dominant	–

$B_{s1}(5830)^0$

$I(J^P) = 0(1^+)$

I, J, P need confirmation.

Mass $m = 5828.7 \pm 0.4$ MeV (S = 1.2)

$m_{B_{s1}^0} - m_{B^{*+}} = 504.41 \pm 0.25$ MeV

$B_{s1}(5830)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+}K^-$	dominant	–

$B_{s2}^*(5840)^0$

$I(J^P) = 0(2^+)$

I, J, P need confirmation.

Mass $m = 5839.96 \pm 0.20$ MeV

$m_{B_{s2}^{*0}} - m_{B_{s1}^0} = 10.5 \pm 0.6$ MeV

Full width $\Gamma = 1.6 \pm 0.5$ MeV

$B_{s2}^*(5840)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
B^+K^-	dominant	253

BOTTOM, CHARMED MESONS ($B = C = \pm 1$)

$B_c^+ = c\bar{b}$, $B_c^- = \bar{c}b$, similarly for B_c^*'s

$B_c^\pm$

$I(J^P) = 0(0^-)$

I, J, P need confirmation.

Quantum numbers shown are quark-model predicitions.

Mass $m = 6.2756 \pm 0.0011$ GeV

Mean life $\tau = (0.452 \pm 0.033) \times 10^{-12}$ s

B_c^- modes are charge conjugates of the modes below.

B_c^+ DECAY MODES × B($\overline{b} \to B_c$)	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
The following quantities are not pure branching ratios; rather the fraction $\Gamma_i/\Gamma \times$ B($\overline{b} \to B_c$).			
$J/\psi(1S)\ell^+\nu_\ell$ anything	$(5.2\ ^{+2.4}_{-2.1}) \times 10^{-5}$		–
$J/\psi(1S)\pi^+$	seen		2371
$J/\psi(1S)K^+$	seen		2342
$J/\psi(1S)\pi^+\pi^+\pi^-$	seen		2351
$J/\psi(1S)a_1(1260)$	$< 1.2 \times 10^{-3}$	90%	2170
$J/\psi(1S)K^+K^-\pi^+$	seen		2203
$\psi(2S)\pi^+$	seen		2052
$J/\psi(1S)D_s^+$	seen		1822
$J/\psi(1S)D_s^{*+}$	seen		1728
$D^*(2010)^+\overline{D}^0$	$< 6.2 \times 10^{-3}$	90%	2467
D^+K^{*0}	$< 0.20 \times 10^{-6}$	90%	2783
$D^+\overline{K}^{*0}$	$< 0.16 \times 10^{-6}$	90%	2783
$D_s^+K^{*0}$	$< 0.28 \times 10^{-6}$	90%	2752
$D_s^+\overline{K}^{*0}$	$< 0.4 \times 10^{-6}$	90%	2752
$D_s^+\phi$	$< 0.32 \times 10^{-6}$	90%	2728
K^+K^0	$< 4.6 \times 10^{-7}$	90%	3098
$B_s^0\pi^+$ / B($\overline{b} \to B_s$)	$(2.37^{+0.37}_{-0.35}) \times 10^{-3}$		–

$c\overline{c}$ MESONS

$\eta_c(1S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 2983.6 \pm 0.7$ MeV (S = 1.3)
Full width $\Gamma = 32.2 \pm 0.9$ MeV

$\eta_c(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Decays involving hadronic resonances			
$\eta'(958)\pi\pi$	(4.1 ±1.7) %		1323
$\rho\rho$	(1.8 ±0.5) %		1275
$K^*(892)^0K^-\pi^+$ + c.c.	(2.0 ±0.7) %		1277
$K^*(892)\overline{K}^*(892)$	(7.0 ±1.3) $\times 10^{-3}$		1196
$K^{*0}\overline{K}^{*0}\pi^+\pi^-$	(1.1 ±0.5) %		1073
ϕK^+K^-	(2.9 ±1.4) $\times 10^{-3}$		1104
$\phi\phi$	(1.76±0.20) $\times 10^{-3}$		1089
$\phi 2(\pi^+\pi^-)$	$< 4 \times 10^{-3}$	90%	1251
$a_0(980)\pi$	< 2 %	90%	1327
$a_2(1320)\pi$	< 2 %	90%	1196
$K^*(892)\overline{K}$ + c.c.	< 1.28 %	90%	1309
$f_2(1270)\eta$	< 1.1 %	90%	1145
$\omega\omega$	$< 3.1 \times 10^{-3}$	90%	1270
$\omega\phi$	$< 1.7 \times 10^{-3}$	90%	1185
$f_2(1270)f_2(1270)$	(9.8 ±2.5) $\times 10^{-3}$		774
$f_2(1270)f_2'(1525)$	(9.7 ±3.2) $\times 10^{-3}$		513

Decays into stable hadrons

$K\overline{K}\pi$	(7.3 $\pm$0.5) %		1381
$\eta\pi^+\pi^-$	(1.7 $\pm$0.5) %		1428
$\eta 2(\pi^+\pi^-)$	(4.4 $\pm$1.3) %		1385
$K^+K^-\pi^+\pi^-$	(6.9 $\pm$1.1) $\times 10^{-3}$		1345
$K^+K^-\pi^+\pi^-\pi^0$	(3.5 $\pm$0.6) %		1304
$K^0K^-\pi^+\pi^-\pi^+$ +c.c.	(5.6 $\pm$1.5) %		–
$K^+K^-2(\pi^+\pi^-)$	(7.5 $\pm$2.4) $\times 10^{-3}$		1253
$2(K^+K^-)$	(1.47$\pm$0.31) $\times 10^{-3}$		1055
$\pi^+\pi^-\pi^0\pi^0$	(4.7 $\pm$1.0) %		1460
$2(\pi^+\pi^-)$	(9.7 $\pm$1.2) $\times 10^{-3}$		1459
$2(\pi^+\pi^-\pi^0)$	(17.4 $\pm$3.3) %		1409
$3(\pi^+\pi^-)$	(1.8 $\pm$0.4) %		1407
$p\overline{p}$	(1.52$\pm$0.16) $\times 10^{-3}$		1160
$p\overline{p}\pi^0$	(3.6 $\pm$1.3) $\times 10^{-3}$		1101
$\Lambda\overline{\Lambda}$	(1.09$\pm$0.24) $\times 10^{-3}$		990
$\Sigma^+\overline{\Sigma}^-$	(2.1 $\pm$0.6) $\times 10^{-3}$		901
$\Xi^-\overline{\Xi}^+$	(8.9 $\pm$2.7) $\times 10^{-4}$		692
$K\overline{K}\eta$	(10 $\pm$5) $\times 10^{-3}$		1265
$\pi^+\pi^- p\overline{p}$	(5.3 $\pm$1.8) $\times 10^{-3}$		1027

Radiative decays

$\gamma\gamma$	(1.57$\pm$0.12) $\times 10^{-4}$		1492

Charge conjugation (C), Parity (P), Lepton family number (LF) violating modes

$\pi^+\pi^-$	P,CP	$<$ 1.1	$\times 10^{-4}$	90%	1485
$\pi^0\pi^0$	P,CP	$<$ 3.5	$\times 10^{-5}$	90%	1486
K^+K^-	P,CP	$<$ 6	$\times 10^{-4}$	90%	1408
$K^0_SK^0_S$	P,CP	$<$ 3.1	$\times 10^{-4}$	90%	1406

$J/\psi(1S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass m = 3096.916 $\pm$ 0.011 MeV
Full width Γ = 92.9 $\pm$ 2.8 keV (S = 1.1)
Γ_{ee} = 5.55 $\pm$ 0.14 $\pm$ 0.02 keV

$J/\psi(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons		(87.7 $\pm$0.5) %		–
virtual $\gamma \rightarrow$ hadrons		(13.50 $\pm$0.30) %		–
ggg		(64.1 $\pm$1.0) %		–
γgg		(8.8 $\pm$1.1) %		–
e^+e^-		(5.971$\pm$0.032) %		1548
$e^+e^-\gamma$	[rraa]	(8.8 $\pm$1.4) $\times 10^{-3}$		1548
$\mu^+\mu^-$		(5.961$\pm$0.033) %		1545

Decays involving hadronic resonances

$\rho\pi$	(1.69 $\pm$0.15) %		S=2.4	1448
$\rho^0\pi^0$	(5.6 $\pm$0.7) $\times 10^{-3}$			1448
$a_2(1320)\rho$	(1.09 $\pm$0.22) %			1123
$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 $\pm$3.4) $\times 10^{-3}$			1392
$\omega\pi^+\pi^-\pi^0$	(4.0 $\pm$0.7) $\times 10^{-3}$			1418
$\omega\pi^+\pi^-$	(8.6 $\pm$0.7) $\times 10^{-3}$		S=1.1	1435
$\omega f_2(1270)$	(4.3 $\pm$0.6) $\times 10^{-3}$			1142
$K^*(892)^0\overline{K}^*(892)^0$	(2.3 $\pm$0.7) $\times 10^{-4}$			1266

$K^*(892)^\pm K^*(892)^\mp$		$(1.00 \ ^{+0.22}_{-0.40}) \times 10^{-3}$		1266
$K^*(892)^\pm K^*(800)^\mp$		$(1.1 \ ^{+1.0}_{-0.6}) \times 10^{-3}$		–
$\eta K^*(892)^0 \overline{K}^*(892)^0$		$(1.15 \pm 0.26) \times 10^{-3}$		1003
$K^*(892)^0 \overline{K}_2^*(1430)^0 +$ c.c.		$(6.0 \pm 0.6) \times 10^{-3}$		1012
$K^*(892)^0 \overline{K}_2(1770)^0 +$ c.c. $\rightarrow$ $K^*(892)^0 K^- \pi^+ +$ c.c.		$(6.9 \pm 0.9) \times 10^{-4}$		–
$\omega K^*(892) \overline{K} +$ c.c.		$(6.1 \pm 0.9) \times 10^{-3}$		1097
$K^+ K^*(892)^- +$ c.c.		$(5.12 \pm 0.30) \times 10^{-3}$		1373
$K^+ K^*(892)^- +$ c.c. $\rightarrow$ $K^+ K^- \pi^0$		$(1.97 \pm 0.20) \times 10^{-3}$		–
$K^+ K^*(892)^- +$ c.c. $\rightarrow$ $K^0 K^\pm \pi^\mp +$ c.c.		$(3.0 \pm 0.4) \times 10^{-3}$		–
$K^0 \overline{K}^*(892)^0 +$ c.c.		$(4.39 \pm 0.31) \times 10^{-3}$		1373
$K^0 \overline{K}^*(892)^0 +$ c.c. $\rightarrow$ $K^0 K^\pm \pi^\mp +$ c.c.		$(3.2 \pm 0.4) \times 10^{-3}$		–
$K_1(1400)^\pm K^\mp$		$(3.8 \pm 1.4) \times 10^{-3}$		1170
$\overline{K}^*(892)^0 K^+ \pi^- +$ c.c.		seen		1343
$\omega \pi^0 \pi^0$		$(3.4 \pm 0.8) \times 10^{-3}$		1436
$b_1(1235)^\pm \pi^\mp$	[gg]	$(3.0 \pm 0.5) \times 10^{-3}$		1300
$\omega K^\pm K_S^0 \pi^\mp$	[gg]	$(3.4 \pm 0.5) \times 10^{-3}$		1210
$b_1(1235)^0 \pi^0$		$(2.3 \pm 0.6) \times 10^{-3}$		1300
$\eta K^\pm K_S^0 \pi^\mp$	[gg]	$(2.2 \pm 0.4) \times 10^{-3}$		1278
$\phi K^*(892) \overline{K} +$ c.c.		$(2.18 \pm 0.23) \times 10^{-3}$		969
$\omega K \overline{K}$		$(1.70 \pm 0.32) \times 10^{-3}$		1268
$\omega f_0(1710) \rightarrow \omega K \overline{K}$		$(4.8 \pm 1.1) \times 10^{-4}$		878
$\phi 2(\pi^+ \pi^-)$		$(1.66 \pm 0.23) \times 10^{-3}$		1318
$\Delta(1232)^{++} \overline{p} \pi^-$		$(1.6 \pm 0.5) \times 10^{-3}$		1030
$\omega \eta$		$(1.74 \pm 0.20) \times 10^{-3}$	S=1.6	1394
$\phi K \overline{K}$		$(1.83 \pm 0.24) \times 10^{-3}$	S=1.5	1179
$\phi f_0(1710) \rightarrow \phi K \overline{K}$		$(3.6 \pm 0.6) \times 10^{-4}$		875
$\phi f_2(1270)$		$(7.2 \pm 1.3) \times 10^{-4}$		1036
$\Delta(1232)^{++} \overline{\Delta}(1232)^{--}$		$(1.10 \pm 0.29) \times 10^{-3}$		938
$\Sigma(1385)^- \overline{\Sigma}(1385)^+$ (or c.c.)	[gg]	$(1.10 \pm 0.12) \times 10^{-3}$		697
$\phi f_2'(1525)$		$(8 \pm 4) \times 10^{-4}$	S=2.7	871
$\phi \pi^+ \pi^-$		$(9.4 \pm 0.9) \times 10^{-4}$	S=1.2	1365
$\phi \pi^0 \pi^0$		$(5.6 \pm 1.6) \times 10^{-4}$		1366
$\phi K^\pm K_S^0 \pi^\mp$	[gg]	$(7.2 \pm 0.8) \times 10^{-4}$		1114
$\omega f_1(1420)$		$(6.8 \pm 2.4) \times 10^{-4}$		1062
$\phi \eta$		$(7.5 \pm 0.8) \times 10^{-4}$	S=1.5	1320
$\Xi^0 \overline{\Xi}^0$		$(1.20 \pm 0.24) \times 10^{-3}$		818
$\Xi(1530)^- \overline{\Xi}^+$		$(5.9 \pm 1.5) \times 10^{-4}$		600
$p K^- \overline{\Sigma}(1385)^0$		$(5.1 \pm 3.2) \times 10^{-4}$		646
$\omega \pi^0$		$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	1446
$\phi \eta'(958)$		$(4.0 \pm 0.7) \times 10^{-4}$	S=2.1	1192
$\phi f_0(980)$		$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	1178
$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$		$(1.8 \pm 0.4) \times 10^{-4}$		–
$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$		$(1.7 \pm 0.7) \times 10^{-4}$		–
$\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-$		$(3.2 \pm 1.0) \times 10^{-4}$		–
$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$		$(5 \pm 4) \times 10^{-6}$		–
$\Xi(1530)^0 \overline{\Xi}^0$		$(3.2 \pm 1.4) \times 10^{-4}$		608
$\Sigma(1385)^- \overline{\Sigma}^+$ (or c.c.)	[gg]	$(3.1 \pm 0.5) \times 10^{-4}$		855
$\phi f_1(1285)$		$(2.6 \pm 0.5) \times 10^{-4}$	S=1.1	1032
$\eta \pi^+ \pi^-$		$(4.0 \pm 1.7) \times 10^{-4}$		1487
$\rho \eta$		$(1.93 \pm 0.23) \times 10^{-4}$		1396

$\omega\eta'(958)$		(1.82	± 0.21)	$\times 10^{-4}$		1279
$\omega f_0(980)$		(1.4	± 0.5)	$\times 10^{-4}$		1267
$\rho\eta'(958)$		(1.05	± 0.18)	$\times 10^{-4}$		1281
$a_2(1320)^{\pm}\pi^{\mp}$	[*gg*]	$<$ 4.3		$\times 10^{-3}$	CL=90%	1263
$K\overline{K}_2^*(1430)+$ c.c.		$<$ 4.0		$\times 10^{-3}$	CL=90%	1159
$K_1(1270)^{\pm}K^{\mp}$		$<$ 3.0		$\times 10^{-3}$	CL=90%	1231
$K_2^*(1430)^0\overline{K}_2^*(1430)^0$		$<$ 2.9		$\times 10^{-3}$	CL=90%	604
$\phi\pi^0$		$<$ 6.4		$\times 10^{-6}$	CL=90%	1377
$\phi\eta(1405) \rightarrow \phi\eta\pi\pi$		$<$ 2.5		$\times 10^{-4}$	CL=90%	946
$\omega f_2'(1525)$		$<$ 2.2		$\times 10^{-4}$	CL=90%	1003
$\omega X(1835) \rightarrow \omega p\overline{p}$		$<$ 3.9		$\times 10^{-6}$	CL=95%	–
$\eta\phi(2170) \rightarrow \eta K^*(892)^0\overline{K}^*(892)^0$		$<$ 2.52		$\times 10^{-4}$	CL=90%	–
$\Sigma(1385)^0\overline{\Lambda}+$ c.c.		$<$ 8.2		$\times 10^{-6}$	CL=90%	912
$\Delta(1232)^+\overline{p}$		$<$ 1		$\times 10^{-4}$	CL=90%	1100
$\Lambda(1520)\overline{\Lambda}+$ c.c. $\rightarrow \gamma\Lambda\overline{\Lambda}$		$<$ 4.1		$\times 10^{-6}$	CL=90%	–
$\Theta(1540)\overline{\Theta}(1540) \rightarrow K_S^0 p K^-\overline{n}+$ c.c.		$<$ 1.1		$\times 10^{-5}$	CL=90%	–
$\Theta(1540)K^-\overline{n} \rightarrow K_S^0 p K^-\overline{n}$		$<$ 2.1		$\times 10^{-5}$	CL=90%	–
$\Theta(1540)K_S^0\overline{p} \rightarrow K_S^0\overline{p}K^+ n$		$<$ 1.6		$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540)K^+ n \rightarrow K_S^0\overline{p}K^+ n$		$<$ 5.6		$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540)K_S^0 p \rightarrow K_S^0 p K^-\overline{n}$		$<$ 1.1		$\times 10^{-5}$	CL=90%	–
$\Sigma^0\overline{\Lambda}$		$<$ 9		$\times 10^{-5}$	CL=90%	1032

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$		(4.1	± 0.5)	%	S=2.4	1496
$3(\pi^+\pi^-)\pi^0$		(2.9	± 0.6)	%		1433
$\pi^+\pi^-\pi^0$		(2.11	± 0.07)	%	S=1.5	1533
$\pi^+\pi^-\pi^0 K^+K^-$		(1.79	± 0.29)	%	S=2.2	1368
$4(\pi^+\pi^-)\pi^0$		(9.0	± 3.0)	$\times 10^{-3}$		1345
$\pi^+\pi^- K^+K^-$		(6.6	± 0.5)	$\times 10^{-3}$		1407
$\pi^+\pi^- K^+K^-\eta$		(1.84	± 0.28)	$\times 10^{-3}$		1221
$\pi^0\pi^0 K^+K^-$		(2.45	± 0.31)	$\times 10^{-3}$		1410
$K\overline{K}\pi$		(6.1	± 1.0)	$\times 10^{-3}$		1442
$2(\pi^+\pi^-)$		(3.57	± 0.30)	$\times 10^{-3}$		1517
$3(\pi^+\pi^-)$		(4.3	± 0.4)	$\times 10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$		(1.62	± 0.21)	%		1468
$2(\pi^+\pi^-)\eta$		(2.29	± 0.24)	$\times 10^{-3}$		1446
$3(\pi^+\pi^-)\eta$		(7.2	± 1.5)	$\times 10^{-4}$		1379
$p\overline{p}$		(2.120	± 0.029)	$\times 10^{-3}$		1232
$p\overline{p}\pi^0$		(1.19	± 0.08)	$\times 10^{-3}$	S=1.1	1176
$p\overline{p}\pi^+\pi^-$		(6.0	± 0.5)	$\times 10^{-3}$	S=1.3	1107
$p\overline{p}\pi^+\pi^-\pi^0$	[*ssaa*]	(2.3	± 0.9)	$\times 10^{-3}$	S=1.9	1033
$p\overline{p}\eta$		(2.00	± 0.12)	$\times 10^{-3}$		948
$p\overline{p}\rho$		$<$ 3.1		$\times 10^{-4}$	CL=90%	774
$p\overline{p}\omega$		(9.8	± 1.0)	$\times 10^{-4}$	S=1.3	768
$p\overline{p}\eta'(958)$		(2.1	± 0.4)	$\times 10^{-4}$		596
$p\overline{p}\phi$		(4.5	± 1.5)	$\times 10^{-5}$		527
$n\overline{n}$		(2.09	± 0.16)	$\times 10^{-3}$		1231
$n\overline{n}\pi^+\pi^-$		(4	± 4)	$\times 10^{-3}$		1106
$\Sigma^+\overline{\Sigma}^-$		(1.50	± 0.24)	$\times 10^{-3}$		992
$\Sigma^0\overline{\Sigma}^0$		(1.29	± 0.09)	$\times 10^{-3}$		988
$2(\pi^+\pi^-)K^+K^-$		(4.7	± 0.7)	$\times 10^{-3}$	S=1.3	1320
$p\overline{n}\pi^-$		(2.12	± 0.09)	$\times 10^{-3}$		1174

$n\,N(1440)$		seen		984
$n\,N(1520)$		seen		928
$n\,N(1535)$		seen		914
$\Xi^-\overline{\Xi}^+$		$(8.6 \pm 1.1) \times 10^{-4}$	S=1.2	807
$\Lambda\overline{\Lambda}$		$(1.61 \pm 0.15) \times 10^{-3}$	S=1.9	1074
$\Lambda\overline{\Sigma}^-\pi^+$ (or c.c.)	[gg]	$(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	950
$p\,K^-\overline{\Lambda}$		$(8.9 \pm 1.6) \times 10^{-4}$		876
$2(K^+K^-)$		$(7.6 \pm 0.9) \times 10^{-4}$		1131
$p\,K^-\overline{\Sigma}^0$		$(2.9 \pm 0.8) \times 10^{-4}$		819
K^+K^-		$(2.70 \pm 0.17) \times 10^{-4}$		1468
$K^0_S\,K^0_L$		$(2.1 \pm 0.4) \times 10^{-4}$	S=3.2	1466
$\Lambda\overline{\Lambda}\pi^+\pi^-$		$(4.3 \pm 1.0) \times 10^{-3}$		903
$\Lambda\overline{\Lambda}\eta$		$(1.62 \pm 0.17) \times 10^{-4}$		672
$\Lambda\overline{\Lambda}\pi^0$		$(3.8 \pm 0.4) \times 10^{-5}$		998
$\overline{\Lambda}\,n\,K^0_S$ + c.c.		$(6.5 \pm 1.1) \times 10^{-4}$		872
$\pi^+\pi^-$		$(1.47 \pm 0.14) \times 10^{-4}$		1542
$\Lambda\overline{\Sigma}$ + c.c.		$(2.83 \pm 0.23) \times 10^{-5}$		1034
$K^0_S\,K^0_S$		$< 1 \times 10^{-6}$	CL=95%	1466

Radiative decays

3γ		$(1.16 \pm 0.22) \times 10^{-5}$		1548
4γ		$< 9 \times 10^{-6}$	CL=90%	1548
5γ		$< 1.5 \times 10^{-5}$	CL=90%	1548
$\gamma\eta_c(1S)$		(1.7 ± 0.4) %	S=1.6	111
$\gamma\eta_c(1S) \rightarrow 3\gamma$		$(3.8 \,^{+1.3}_{-1.0}) \times 10^{-6}$	S=1.1	–
$\gamma\pi^+\pi^-2\pi^0$		$(8.3 \pm 3.1) \times 10^{-3}$		1518
$\gamma\eta\pi\pi$		$(6.1 \pm 1.0) \times 10^{-3}$		1487
$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$		$(6.2 \pm 2.4) \times 10^{-4}$		–
$\gamma\eta(1405/1475) \rightarrow \gamma K\overline{K}\pi$	[o]	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$		$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$		$(3.0 \pm 0.5) \times 10^{-4}$		–
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$		$< 8.2 \times 10^{-5}$	CL=95%	–
$\gamma\rho\rho$		$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma\rho\omega$		$< 5.4 \times 10^{-4}$	CL=90%	1338
$\gamma\rho\phi$		$< 8.8 \times 10^{-5}$	CL=90%	1258
$\gamma\eta'(958)$		$(5.15 \pm 0.16) \times 10^{-3}$	S=1.2	1400
$\gamma 2\pi^+2\pi^-$		$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517
$\gamma f_2(1270) f_2(1270)$		$(9.5 \pm 1.7) \times 10^{-4}$		879
$\gamma f_2(1270) f_2(1270)$(non resonant)		$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma K^+K^-\pi^+\pi^-$		$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma f_4(2050)$		$(2.7 \pm 0.7) \times 10^{-3}$		891
$\gamma\omega\omega$		$(1.61 \pm 0.33) \times 10^{-3}$		1336
$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$		$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223
$\gamma f_2(1270)$		$(1.43 \pm 0.11) \times 10^{-3}$		1286
$\gamma f_0(1710) \rightarrow \gamma K\overline{K}$		$(8.5 \,^{+1.2}_{-0.9}) \times 10^{-4}$	S=1.2	1075
$\gamma f_0(1710) \rightarrow \gamma\pi\pi$		$(4.0 \pm 1.0) \times 10^{-4}$		–
$\gamma f_0(1710) \rightarrow \gamma\omega\omega$		$(3.1 \pm 1.0) \times 10^{-4}$		–
$\gamma\eta$		$(1.104 \pm 0.034) \times 10^{-3}$		1500
$\gamma f_1(1420) \rightarrow \gamma K\overline{K}\pi$		$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1285)$		$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$		$(4.5 \pm 1.2) \times 10^{-4}$		–
$\gamma f'_2(1525)$		$(4.5 \,^{+0.7}_{-0.4}) \times 10^{-4}$		1173

$\gamma f_2(1640) \to \gamma\omega\omega$		$(\ 2.8 \pm 1.8\ ) \times 10^{-4}$			–
$\gamma f_2(1910) \to \gamma\omega\omega$		$(\ 2.0 \pm 1.4\ ) \times 10^{-4}$			–
$\gamma f_0(1800) \to \gamma\omega\phi$		$(\ 2.5 \pm 0.6\ ) \times 10^{-4}$			–
$\gamma f_2(1950) \to \gamma K^*(892)\overline{K}^*(892)$		$(\ 7.0 \pm 2.2\ ) \times 10^{-4}$			–
$\gamma K^*(892)\overline{K}^*(892)$		$(\ 4.0 \pm 1.3\ ) \times 10^{-3}$			1266
$\gamma\phi\phi$		$(\ 4.0 \pm 1.2\ ) \times 10^{-4}$		S=2.1	1166
$\gamma p\overline{p}$		$(\ 3.8 \pm 1.0\ ) \times 10^{-4}$			1232
$\gamma\eta(2225)$		$(\ 3.3 \pm 0.5\ ) \times 10^{-4}$			749
$\gamma\eta(1760) \to \gamma\rho^0\rho^0$		$(\ 1.3 \pm 0.9\ ) \times 10^{-4}$			1048
$\gamma\eta(1760) \to \gamma\omega\omega$		$(\ 1.98 \pm 0.33\ ) \times 10^{-3}$			–
$\gamma X(1835) \to \gamma\pi^+\pi^-\eta'$		$(\ 2.6 \pm 0.4\ ) \times 10^{-4}$			1006
$\gamma X(1835) \to \gamma p\overline{p}$		$(\ 7.7\ ^{+1.5}_{-0.9}\ ) \times 10^{-5}$			–
$\gamma X(1840) \to \gamma 3(\pi^+\pi^-)$		$(\ 2.4\ ^{+0.7}_{-0.8}\ ) \times 10^{-5}$			–
$\gamma(K\overline{K}\pi)\ [J^{PC} = 0^{-+}]$		$(\ 7 \pm 4\ ) \times 10^{-4}$		S=2.1	1442
$\gamma\pi^0$		$(\ 3.49\ ^{+0.33}_{-0.30}\ ) \times 10^{-5}$			1546
$\gamma p\overline{p}\pi^+\pi^-$		< 7.9	$\times 10^{-4}$	CL=90%	1107
$\gamma\Lambda\overline{\Lambda}$		< 1.3	$\times 10^{-4}$	CL=90%	1074
$\gamma f_J(2220)$		> 2.50	$\times 10^{-3}$	CL=99.9%	745
$\gamma f_J(2220) \to \gamma\pi\pi$		$(\ 8 \pm 4\ ) \times 10^{-5}$			–
$\gamma f_J(2220) \to \gamma K\overline{K}$		< 3.6	$\times 10^{-5}$		–
$\gamma f_J(2220) \to \gamma p\overline{p}$		$(\ 1.5 \pm 0.8\ ) \times 10^{-5}$			–
$\gamma f_0(1500)$		$(\ 1.01 \pm 0.32\ ) \times 10^{-4}$			1183
$\gamma A \to \gamma$ invisible	[*ttaa*]	< 6.3	$\times 10^{-6}$	CL=90%	–
$\gamma A^0 \to \gamma\mu^+\mu^-$	[*uuaa*]	< 2.1	$\times 10^{-5}$	CL=90%	–
Weak decays					
$\overline{D}^- e^+\nu_e +$ c.c.		< 1.2	$\times 10^{-5}$	CL=90%	984
$\overline{D}^0 e^+ e^- +$ c.c.		< 1.1	$\times 10^{-5}$	CL=90%	987
$D_s^- e^+\nu_e +$ c.c.		< 3.6	$\times 10^{-5}$	CL=90%	923
$D^-\pi^+ +$ c.c.		< 7.5	$\times 10^{-5}$	CL=90%	977
$\overline{D}^0\overline{K}^0 +$ c.c.		< 1.7	$\times 10^{-4}$	CL=90%	898
$D_s^-\pi^+ +$ c.c.		< 1.3	$\times 10^{-4}$	CL=90%	916
Charge conjugation (*C*), Parity (*P*), Lepton Family number (*LF*) violating modes					
$\gamma\gamma$	*C*	< 5	$\times 10^{-6}$	CL=90%	1548
$e^\pm\mu^\mp$	*LF*	< 1.6	$\times 10^{-7}$	CL=90%	1547
$e^\pm\tau^\mp$	*LF*	< 8.3	$\times 10^{-6}$	CL=90%	1039
$\mu^\pm\tau^\mp$	*LF*	< 2.0	$\times 10^{-6}$	CL=90%	1035
Other decays					
invisible		< 7	$\times 10^{-4}$	CL=90%	–

$\chi_{c0}(1P)$

$I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 3414.75 \pm 0.31$ MeV
Full width $\Gamma = 10.5 \pm 0.6$ MeV

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(2.24±0.18) %		1679
$\rho^0\pi^+\pi^-$	(8.7 ±2.8) × 10^{-3}		1607
$f_0(980)\,f_0(980)$	(6.5 ±2.1) × 10^{-4}		1391
$\pi^+\pi^-\pi^0\pi^0$	(3.3 ±0.4) %		1680
$\rho^+\pi^-\pi^0$ + c.c.	(2.8 ±0.4) %		1607
$4\pi^0$	(3.2 ±0.4) × 10^{-3}		1681
$\pi^+\pi^-K^+K^-$	(1.75±0.14) %		1580
$K_0^*(1430)^0\overline{K}_0^*(1430)^0 \to \pi^+\pi^-K^+K^-$	(9.6 $^{+3.5}_{-2.8}$) × 10^{-4}		–
$K_0^*(1430)^0\overline{K}_2^*(1430)^0$ + c.c. $\to \pi^+\pi^-K^+K^-$	(7.8 $^{+1.9}_{-2.4}$) × 10^{-4}		–
$K_1(1270)^+K^-$ + c.c. $\to \pi^+\pi^-K^+K^-$	(6.1 ±1.9) × 10^{-3}		–
$K_1(1400)^+K^-$ + c.c. $\to \pi^+\pi^-K^+K^-$	< 2.6 × 10^{-3}	CL=90%	–
$f_0(980)\,f_0(980)$	(1.6 $^{+1.0}_{-0.9}$) × 10^{-4}		1391
$f_0(980)\,f_0(2200)$	(7.8 $^{+2.0}_{-2.5}$) × 10^{-4}		584
$f_0(1370)\,f_0(1370)$	< 2.7 × 10^{-4}	CL=90%	1019
$f_0(1370)\,f_0(1500)$	< 1.7 × 10^{-4}	CL=90%	920
$f_0(1370)\,f_0(1710)$	(6.6 $^{+3.5}_{-2.3}$) × 10^{-4}		721
$f_0(1500)\,f_0(1370)$	< 1.3 × 10^{-4}	CL=90%	920
$f_0(1500)\,f_0(1500)$	< 5 × 10^{-5}	CL=90%	805
$f_0(1500)\,f_0(1710)$	< 7 × 10^{-5}	CL=90%	557
$K^+K^-\pi^+\pi^-\pi^0$	(1.11±0.26) %		1545
$K^+K^-\pi^0\pi^0$	(5.4 ±0.9) × 10^{-3}		1582
$K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(2.44±0.33) %		1581
$\rho^+K^-K^0$ + c.c.	(1.18±0.21) %		1458
$K^*(892)^-K^+\pi^0 \to K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(4.5 ±1.1) × 10^{-3}		–
$K_S^0K_S^0\pi^+\pi^-$	(5.6 ±1.0) × 10^{-3}		1579
$K^+K^-\eta\pi^0$	(3.0 ±0.7) × 10^{-3}		1468
$3(\pi^+\pi^-)$	(1.20±0.18) %		1633
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(7.2 ±1.6) × 10^{-3}		1523
$K^*(892)^0\overline{K}^*(892)^0$	(1.7 ±0.6) × 10^{-3}		1456
$\pi\pi$	(8.33±0.35) × 10^{-3}		1702
$\pi^0\eta$	< 1.8 × 10^{-4}		1661
$\pi^0\eta'$	< 1.1 × 10^{-3}		1570
$\eta\eta$	(2.95±0.19) × 10^{-3}		1617
$\eta\eta'$	< 2.3 × 10^{-4}	CL=90%	1521
$\eta'\eta'$	(1.96±0.21) × 10^{-3}		1413
$\omega\omega$	(9.5 ±1.1) × 10^{-4}		1517
$\omega\phi$	(1.16±0.21) × 10^{-4}		1447
K^+K^-	(5.91±0.32) × 10^{-3}		1634
$K_S^0K_S^0$	(3.10±0.18) × 10^{-3}		1633
$\pi^+\pi^-\eta$	< 1.9 × 10^{-4}	CL=90%	1651
$\pi^+\pi^-\eta'$	< 3.5 × 10^{-4}	CL=90%	1560
$\overline{K}^0K^+\pi^-$ + c.c.	< 9 × 10^{-5}	CL=90%	1610
$K^+K^-\pi^0$	< 6 × 10^{-5}	CL=90%	1611
$K^+K^-\eta$	< 2.2 × 10^{-4}	CL=90%	1512

$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		1331
$K^+ K^- K^+ K^-$	$(2.75 \pm 0.28) \times 10^{-3}$		1333
$K^+ K^- \phi$	$(9.5 \pm 2.4) \times 10^{-4}$		1381
$\phi\phi$	$(7.7 \pm 0.7) \times 10^{-4}$		1370
$p\overline{p}$	$(2.25 \pm 0.09) \times 10^{-4}$		1426
$p\overline{p}\pi^0$	$(6.8 \pm 0.7) \times 10^{-4}$	S=1.3	1379
$p\overline{p}\eta$	$(3.5 \pm 0.4) \times 10^{-4}$		1187
$p\overline{p}\omega$	$(5.1 \pm 0.6) \times 10^{-4}$		1043
$p\overline{p}\phi$	$(5.9 \pm 1.4) \times 10^{-5}$		876
$p\overline{p}\pi^+\pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320
$p\overline{p}\pi^0\pi^0$	$(1.02 \pm 0.27) \times 10^{-3}$		1324
$p\overline{p}K^+K^-$ (non-resonant)	$(1.19 \pm 0.26) \times 10^{-4}$		890
$p\overline{p}K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	884
$p\overline{n}\pi^-$	$(1.24 \pm 0.11) \times 10^{-3}$		1376
$\overline{p}n\pi^+$	$(1.34 \pm 0.12) \times 10^{-3}$		1376
$p\overline{n}\pi^-\pi^0$	$(2.29 \pm 0.21) \times 10^{-3}$		1321
$\overline{p}n\pi^+\pi^0$	$(2.16 \pm 0.18) \times 10^{-3}$		1321
$\Lambda\overline{\Lambda}$	$(3.21 \pm 0.25) \times 10^{-4}$		1292
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$(1.15 \pm 0.13) \times 10^{-3}$		1153
$\Lambda\overline{\Lambda}\pi^+\pi^-$ (non-resonant)	$< 5 \times 10^{-4}$	CL=90%	1153
$\Sigma(1385)^+\overline{\Lambda}\pi^- +$ c.c.	$< 5 \times 10^{-4}$	CL=90%	1083
$\Sigma(1385)^-\overline{\Lambda}\pi^+ +$ c.c.	$< 5 \times 10^{-4}$	CL=90%	1083
$K^+\overline{p}\Lambda +$ c.c.	$(1.22 \pm 0.12) \times 10^{-3}$	S=1.3	1132
$K^+\overline{p}\Lambda(1520) +$ c.c.	$(2.9 \pm 0.7) \times 10^{-4}$		858
$\Lambda(1520)\overline{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		779
$\Sigma^0\overline{\Sigma}^0$	$(4.4 \pm 0.4) \times 10^{-4}$		1222
$\Sigma^+\overline{\Sigma}^-$	$(3.9 \pm 0.7) \times 10^{-4}$	S=1.7	1225
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		1001
$\Sigma(1385)^-\overline{\Sigma}(1385)^+$	$(2.3 \pm 0.6) \times 10^{-4}$		1001
$\Xi^0\overline{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		1089
$\Xi^-\overline{\Xi}^+$	$(4.7 \pm 0.7) \times 10^{-4}$		1081

Radiative decays

$\gamma J/\psi(1S)$	(1.27 ± 0.06) %		303
$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	1619
$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	1618
$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	1555
$\gamma\gamma$	$(2.23 \pm 0.13) \times 10^{-4}$		1707

$\chi_{c1}(1P)$

$I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 3510.66 \pm 0.07$ MeV (S = 1.5)
Full width $\Gamma = 0.84 \pm 0.04$ MeV

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)

Hadronic decays

$3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2	1683
$2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		1728
$\pi^+\pi^-\pi^0\pi^0$	(1.22 ± 0.16) %		1729
$\rho^+\pi^-\pi^0 +$ c.c.	(1.48 ± 0.25) %		1658
$\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		1657
$4\pi^0$	$(5.5 \pm 0.8) \times 10^{-4}$		1729
$\pi^+\pi^- K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		1632
$K^+K^-\pi^0\pi^0$	$(1.14 \pm 0.28) \times 10^{-3}$		1634

$K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(8.7 ±1.4)	$\times10^{-3}$		1632
$\rho^-K^+\overline{K}^0$ + c.c.	(5.1 ±1.2)	$\times10^{-3}$		1514
$K^*(892)^0\overline{K}^0\pi^0 \to$ $K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(2.4 ±0.7)	$\times10^{-3}$		–
$K^+K^-\eta\pi^0$	(1.14±0.35)	$\times10^{-3}$		1523
$\pi^+\pi^-K^0_SK^0_S$	(7.0 ±3.0)	$\times10^{-4}$		1630
$K^+K^-\eta$	(3.2 ±1.0)	$\times10^{-4}$		1566
$\overline{K}^0K^+\pi^-$ + c.c.	(7.1 ±0.6)	$\times10^{-3}$		1661
$K^*(892)^0\overline{K}^0$ + c.c.	(1.0 ±0.4)	$\times10^{-3}$		1602
$K^*(892)^+K^-$ + c.c.	(1.5 ±0.7)	$\times10^{-3}$		1602
$K^*_J(1430)^0\overline{K}^0$ + c.c. $\to$ $K^0_SK^+\pi^-$ + c.c.	< 8	$\times10^{-4}$	CL=90%	–
$K^*_J(1430)^+K^-$ + c.c. $\to$ $K^0_SK^+\pi^-$ + c.c.	< 2.2	$\times10^{-3}$	CL=90%	–
$K^+K^-\pi^0$	(1.85±0.25)	$\times10^{-3}$		1662
$\eta\pi^+\pi^-$	(4.9 ±0.5)	$\times10^{-3}$		1701
$a_0(980)^+\pi^-$ + c.c. $\to$ $\eta\pi^+\pi^-$	(1.8 ±0.6)	$\times10^{-3}$		–
$f_2(1270)\eta$	(2.7 ±0.8)	$\times10^{-3}$		1468
$\pi^+\pi^-\eta'$	(2.3 ±0.5)	$\times10^{-3}$		1612
$\pi^0f_0(980) \to \pi^0\pi^+\pi^-$	< 6	$\times10^{-6}$	CL=90%	–
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(3.2 ±2.1)	$\times10^{-3}$		1577
$K^*(892)^0\overline{K}^*(892)^0$	(1.5 ±0.4)	$\times10^{-3}$		1512
$K^+K^-K^0_SK^0_S$	< 4	$\times10^{-4}$	CL=90%	1390
$K^+K^-K^+K^-$	(5.5 ±1.1)	$\times10^{-4}$		1393
$K^+K^-\phi$	(4.2 ±1.6)	$\times10^{-4}$		1440
$\omega\omega$	(5.8 ±0.7)	$\times10^{-4}$		1571
$\omega\phi$	(2.1 ±0.6)	$\times10^{-5}$		1503
$\phi\phi$	(4.2 ±0.5)	$\times10^{-4}$		1429
$p\overline{p}$	(7.72±0.35)	$\times10^{-5}$		1484
$p\overline{p}\pi^0$	(1.59±0.19)	$\times10^{-4}$		1438
$p\overline{p}\eta$	(1.48±0.25)	$\times10^{-4}$		1254
$p\overline{p}\omega$	(2.16±0.31)	$\times10^{-4}$		1117
$p\overline{p}\phi$	< 1.8	$\times10^{-5}$	CL=90%	962
$p\overline{p}\pi^+\pi^-$	(5.0 ±1.9)	$\times10^{-4}$		1381
$p\overline{p}K^+K^-$ (non-resonant)	(1.30±0.23)	$\times10^{-4}$		974
$p\overline{p}K^0_SK^0_S$	< 4.5	$\times10^{-4}$	CL=90%	968
$p\overline{n}\pi^-$	(3.9 ±0.5)	$\times10^{-4}$		1435
$\overline{p}n\pi^+$	(4.0 ±0.5)	$\times10^{-4}$		1435
$p\overline{n}\pi^-\pi^0$	(1.05±0.12)	$\times10^{-3}$		1383
$\overline{p}n\pi^+\pi^0$	(1.03±0.12)	$\times10^{-3}$		1383
$\Lambda\overline{\Lambda}$	(1.16±0.12)	$\times10^{-4}$		1355
$\Lambda\overline{\Lambda}\pi^+\pi^-$	(3.0 ±0.5)	$\times10^{-4}$		1223
$\Lambda\overline{\Lambda}\pi^+\pi^-$ (non-resonant)	(2.5 ±0.6)	$\times10^{-4}$		1223
$\Sigma(1385)^+\overline{\Lambda}\pi^-$ + c.c.	< 1.3	$\times10^{-4}$	CL=90%	1157
$\Sigma(1385)^-\overline{\Lambda}\pi^+$ + c.c.	< 1.3	$\times10^{-4}$	CL=90%	1157
$K^+\overline{p}\Lambda$	(4.2 ±0.4)	$\times10^{-4}$	S=1.1	1203
$K^+\overline{p}\Lambda(1520)$ + c.c.	(1.7 ±0.5)	$\times10^{-4}$		950
$\Lambda(1520)\overline{\Lambda}(1520)$	< 1.0	$\times10^{-4}$	CL=90%	879
$\Sigma^0\overline{\Sigma}^0$	< 4	$\times10^{-5}$	CL=90%	1288
$\Sigma^+\overline{\Sigma}^-$	< 6	$\times10^{-5}$	CL=90%	1291
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	< 1.0	$\times10^{-4}$	CL=90%	1081
$\Sigma(1385)^-\overline{\Sigma}(1385)^+$	< 5	$\times10^{-5}$	CL=90%	1081
$\Xi^0\overline{\Xi}^0$	< 6	$\times10^{-5}$	CL=90%	1163

$\Xi^-\overline{\Xi}^+$	(8.2 ±2.2) $\times 10^{-5}$		1155
$\pi^+\pi^- + K^+K^-$	< 2.1 $\times 10^{-3}$		–
$K^0_S K^0_S$	< 6 $\times 10^{-5}$	CL=90%	1683
Radiative decays			
$\gamma J/\psi(1S)$	(33.9 ±1.2) %		389
$\gamma\rho^0$	(2.20±0.18) $\times 10^{-4}$		1670
$\gamma\omega$	(6.9 ±0.8) $\times 10^{-5}$		1668
$\gamma\phi$	(2.5 ±0.5) $\times 10^{-5}$		1607

$h_c(1P)$

$I^G(J^{PC}) = ?^?(1^{+-})$

Mass m = 3525.38 ± 0.11 MeV
Full width Γ = 0.7 ± 0.4 MeV

$h_c(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$J/\psi(1S)\pi\pi$	not seen		312
$p\overline{p}$	< 1.5 $\times 10^{-4}$	90%	1492
$\eta_c(1S)\gamma$	(51 ±6) %		500
$\pi^+\pi^-\pi^0$	< 2.2 $\times 10^{-3}$		1749
$2\pi^+2\pi^-\pi^0$	($2.2^{+0.8}_{-0.7}$) %		1716
$3\pi^+3\pi^-\pi^0$	< 2.9 %		1661

$\chi_{c2}(1P)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass m = 3556.20 ± 0.09 MeV
Full width Γ = 1.93 ± 0.11 MeV

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(1.07±0.10) %		1751
$\pi^+\pi^-\pi^0\pi^0$	(1.92±0.25) %		1752
$\rho^+\pi^-\pi^0$ + c.c.	(2.3 ±0.4) %		1682
$4\pi^0$	(1.16±0.16) $\times 10^{-3}$		1752
$K^+K^-\pi^0\pi^0$	(2.2 ±0.4) $\times 10^{-3}$		1658
$K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(1.44±0.21) %		1657
$\rho^- K^+\overline{K}^0$ + c.c.	(4.3 ±1.3) $\times 10^{-3}$		1540
$K^*(892)^0 K^-\pi^+ \to K^-\pi^+ K^0\pi^0$ + c.c.	(3.1 ±0.8) $\times 10^{-3}$		–
$K^*(892)^0\overline{K}^0\pi^0 \to K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(4.0 ±0.9) $\times 10^{-3}$		–
$K^*(892)^- K^+\pi^0 \to K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(3.9 ±0.9) $\times 10^{-3}$		–
$K^*(892)^+\overline{K}^0\pi^- \to K^+\pi^-\overline{K}^0\pi^0$ + c.c.	(3.1 ±0.8) $\times 10^{-3}$		–
$K^+K^-\eta\pi^0$	(1.3 ±0.5) $\times 10^{-3}$		1549
$K^+K^-\pi^+\pi^-$	(8.8 ±1.0) $\times 10^{-3}$		1656
$K^+K^-\pi^+\pi^-\pi^0$	(1.23±0.34) %		1623
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(2.2 ±1.1) $\times 10^{-3}$		1602
$K^*(892)^0\overline{K}^*(892)^0$	(2.4 ±0.5) $\times 10^{-3}$		1538
$3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$		1707
$\phi\phi$	(1.12±0.10) $\times 10^{-3}$		1457
$\omega\omega$	(8.8 ±1.1) $\times 10^{-4}$		1597

$\pi\pi$	$(\ 2.33\pm0.12)\times10^{-3}$			1773
$\rho^0\pi^+\pi^-$	$(\ 3.8\ \pm1.6\ )\times10^{-3}$			1682
$\pi^+\pi^-\eta$	$(\ 5.0\ \pm1.3\ )\times10^{-4}$			1724
$\pi^+\pi^-\eta'$	$(\ 5.2\ \pm1.9\ )\times10^{-4}$			1636
$\eta\eta$	$(\ 5.7\ \pm0.5\ )\times10^{-4}$			1692
K^+K^-	$(\ 1.05\pm0.07)\times10^{-3}$			1708
$K^0_S K^0_S$	$(\ 5.5\ \pm0.4\ )\times10^{-4}$			1707
$\overline{K}^0 K^+\pi^-$ + c.c.	$(\ 1.34\pm0.19)\times10^{-3}$			1685
$K^+K^-\pi^0$	$(\ 3.2\ \pm0.8\ )\times10^{-4}$			1686
$K^+K^-\eta$	$<\ 3.4\ \times10^{-4}$		90%	1592
$\eta\eta'$	$<\ 6\ \times10^{-5}$		90%	1600
$\eta'\eta'$	$<\ 1.0\ \times10^{-4}$		90%	1498
$\pi^+\pi^- K^0_S K^0_S$	$(\ 2.3\ \pm0.6\ )\times10^{-3}$			1655
$K^+K^- K^0_S K^0_S$	$<\ 4\ \times10^{-4}$		90%	1418
$K^+K^-K^+K^-$	$(\ 1.73\pm0.21)\times10^{-3}$			1421
$K^+K^-\phi$	$(\ 1.48\pm0.31)\times10^{-3}$			1468
$p\overline{p}$	$(\ 7.5\ \pm0.4\ )\times10^{-5}$			1510
$p\overline{p}\pi^0$	$(\ 4.9\ \pm0.4\ )\times10^{-4}$			1465
$p\overline{p}\eta$	$(\ 1.82\pm0.26)\times10^{-4}$			1285
$p\overline{p}\omega$	$(\ 3.8\ \pm0.5\ )\times10^{-4}$			1152
$p\overline{p}\phi$	$(\ 2.9\ \pm0.9\ )\times10^{-5}$			1002
$p\overline{p}\pi^+\pi^-$	$(\ 1.32\pm0.34)\times10^{-3}$			1410
$p\overline{p}\pi^0\pi^0$	$(\ 8.2\ \pm2.5\ )\times10^{-4}$			1414
$p\overline{p}K^+K^-$ (non-resonant)	$(\ 2.00\pm0.34)\times10^{-4}$			1013
$p\overline{p}K^0_S K^0_S$	$<\ 7.9\ \times10^{-4}$		90%	1007
$p\overline{n}\pi^-$	$(\ 8.9\ \pm1.0\ )\times10^{-4}$			1463
$\overline{p}n\pi^+$	$(\ 9.3\ \pm0.9\ )\times10^{-4}$			1463
$p\overline{n}\pi^-\pi^0$	$(\ 2.27\pm0.19)\times10^{-3}$			1411
$\overline{p}n\pi^+\pi^0$	$(\ 2.21\pm0.20)\times10^{-3}$			1411
$\Lambda\overline{\Lambda}$	$(\ 1.92\pm0.16)\times10^{-4}$			1385
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$(\ 1.31\pm0.17)\times10^{-3}$			1255
$\Lambda\overline{\Lambda}\pi^+\pi^-$ (non-resonant)	$(\ 6.9\ \pm1.6\ )\times10^{-4}$			1255
$\Sigma(1385)^+\overline{\Lambda}\pi^-$ + c.c.	$<\ 4\ \times10^{-4}$		90%	1192
$\Sigma(1385)^-\overline{\Lambda}\pi^+$ + c.c.	$<\ 6\ \times10^{-4}$		90%	1192
$K^+\overline{p}\Lambda$ + c.c.	$(\ 8.1\ \pm0.6\ )\times10^{-4}$			1236
$K^+\overline{p}\Lambda(1520)$ + c.c.	$(\ 2.9\ \pm0.7\ )\times10^{-4}$			992
$\Lambda(1520)\overline{\Lambda}(1520)$	$(\ 4.8\ \pm1.5\ )\times10^{-4}$			923
$\Sigma^0\overline{\Sigma}^0$	$<\ 6\ \times10^{-5}$		90%	1319
$\Sigma^+\overline{\Sigma}^-$	$<\ 7\ \times10^{-5}$		90%	1322
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	$<\ 1.6\ \times10^{-4}$		90%	1118
$\Sigma(1385)^-\overline{\Sigma}(1385)^+$	$<\ 8\ \times10^{-5}$		90%	1118
$\Xi^0\overline{\Xi}^0$	$<\ 1.1\ \times10^{-4}$		90%	1197
$\Xi^-\overline{\Xi}^+$	$(\ 1.48\pm0.33)\times10^{-4}$			1189
$J/\psi(1S)\pi^+\pi^-\pi^0$	$<\ 1.5$	%	90%	185
$\eta_c(1S)\pi^+\pi^-$	$<\ 2.2$	%	90%	459
Radiative decays				
$\gamma J/\psi(1S)$	$(19.2\ \pm0.7\ )$	%		430
$\gamma\rho^0$	$<\ 2.0\ \times10^{-5}$		90%	1694
$\gamma\omega$	$<\ 6\ \times10^{-6}$		90%	1692
$\gamma\phi$	$<\ 8\ \times10^{-6}$		90%	1632
$\gamma\gamma$	$(\ 2.74\pm0.14)\times10^{-4}$			1778

$\eta_c(2S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Quantum numbers are quark model predictions.

Mass $m = 3639.4 \pm 1.3$ MeV (S = 1.2)
Full width $\Gamma = 11.3^{+3.2}_{-2.9}$ MeV

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	not seen		–
$K\overline{K}\pi$	(1.9±1.2) %		1730
$2\pi^+2\pi^-$	not seen		1793
$\rho^0\rho^0$	not seen		1646
$3\pi^+3\pi^-$	not seen		1750
$K^+K^-\pi^+\pi^-$	not seen		1701
$K^{*0}\overline{K}^{*0}$	not seen		1586
$K^+K^-\pi^+\pi^-\pi^0$	(1.4±1.0) %		1668
$K^+K^-2\pi^+2\pi^-$	not seen		1628
$K^0_S K^-2\pi^+\pi^-$ + c.c.	seen		1667
$2K^+2K^-$	not seen		1471
$\phi\phi$	not seen		1507
$p\overline{p}$	$< 2.0 \times 10^{-3}$	90%	1559
$\gamma\gamma$	$(1.9\pm1.3)\times10^{-4}$		1820
$\pi^+\pi^-\eta$	not seen		1767
$\pi^+\pi^-\eta'$	not seen		1681
$K^+K^-\eta$	not seen		1638
$\pi^+\pi^-\eta_c(1S)$	< 25 %	90%	539

$\psi(2S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 3686.109^{+0.012}_{-0.014}$ MeV
Full width $\Gamma = 299 \pm 8$ keV
$\Gamma_{ee} = 2.36 \pm 0.04$ keV

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85 ±0.13) %		–
virtual $\gamma \to$ hadrons	(1.73 ±0.14) %	S=1.5	–
ggg	(10.6 ±1.6) %		–
γgg	(1.03 ±0.29) %		–
light hadrons	(15.4 ±1.5) %		–
e^+e^-	$(7.89 \pm0.17)\times10^{-3}$		1843
$\mu^+\mu^-$	$(7.9 \pm0.9)\times10^{-3}$		1840
$\tau^+\tau^-$	$(3.1 \pm0.4)\times10^{-3}$		490
Decays into $J/\psi(1S)$ and anything			
$J/\psi(1S)$ anything	(60.9 ±0.6) %		–
$J/\psi(1S)$ neutrals	(25.10 ±0.33) %		–
$J/\psi(1S)\pi^+\pi^-$	(34.45 ±0.30) %		477
$J/\psi(1S)\pi^0\pi^0$	(18.13 ±0.31) %		481
$J/\psi(1S)\eta$	(3.36 ±0.05) %		199
$J/\psi(1S)\pi^0$	$(1.268\pm0.032)\times10^{-3}$		528

Hadronic decays

$\pi^0 h_c(1P)$	(8.6	± 1.3	) $\times 10^{-4}$		85
$3(\pi^+\pi^-)\pi^0$	(3.5	± 1.6	) $\times 10^{-3}$		1746
$2(\pi^+\pi^-)\pi^0$	(2.9	± 1.0	) $\times 10^{-3}$	S=4.7	1799
$\rho a_2(1320)$	(2.6	± 0.9	) $\times 10^{-4}$		1500
$p\overline{p}$	(2.80	± 0.11	) $\times 10^{-4}$		1586
$\Delta^{++}\overline{\Delta}^{--}$	(1.28	± 0.35	) $\times 10^{-4}$		1371
$\Lambda\overline{\Lambda}\pi^0$	< 2.9		$\times 10^{-6}$	CL=90%	1412
$\Lambda\overline{\Lambda}\eta$	(2.5	± 0.4	) $\times 10^{-5}$		1197
$\Lambda\overline{p}K^+$	(1.00	± 0.14	) $\times 10^{-4}$		1327
$\Lambda\overline{p}K^+\pi^+\pi^-$	(1.8	± 0.4	) $\times 10^{-4}$		1167
$\Lambda\overline{\Lambda}\pi^+\pi^-$	(2.8	± 0.6	) $\times 10^{-4}$		1346
$\Lambda\overline{\Lambda}$	(2.8	± 0.5	) $\times 10^{-4}$	S=2.6	1467
$\Lambda\overline{\Sigma}^+\pi^-$ + c.c.	(1.40	± 0.13	) $\times 10^{-4}$		1376
$\Lambda\overline{\Sigma}^-\pi^+$ + c.c.	(1.54	± 0.14	) $\times 10^{-4}$		1379
$\Sigma^0\overline{p}K^+$ + c.c.	(1.67	± 0.18	) $\times 10^{-5}$		1291
$\Sigma^+\overline{\Sigma}^-$	(2.6	± 0.8	) $\times 10^{-4}$		1408
$\Sigma^0\overline{\Sigma}^0$	(2.2	± 0.4	) $\times 10^{-4}$	S=1.5	1405
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	(1.1	± 0.4	) $\times 10^{-4}$		1218
$\Xi^-\overline{\Xi}^+$	(1.8	± 0.6	) $\times 10^{-4}$	S=2.8	1284
$\Xi^0\overline{\Xi}^0$	(2.8	± 0.9	) $\times 10^{-4}$		1292
$\Xi(1530)^0\overline{\Xi}(1530)^0$	(5.2	$^{+3.2}_{-1.2}$	) $\times 10^{-5}$		1025
$\Omega^-\overline{\Omega}^+$	< 7.3		$\times 10^{-5}$	CL=90%	774
$\pi^0 p\overline{p}$	(1.53	± 0.07	) $\times 10^{-4}$		1543
$N(940)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(6.4	$^{+1.8}_{-1.3}$	) $\times 10^{-5}$		–
$N(1440)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(7.3	$^{+1.7}_{-1.5}$	) $\times 10^{-5}$	S=2.5	–
$N(1520)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(6.4	$^{+2.3}_{-1.8}$	) $\times 10^{-6}$		–
$N(1535)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(2.5	± 1.0	) $\times 10^{-5}$		–
$N(1650)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(3.8	$^{+1.4}_{-1.7}$	) $\times 10^{-5}$		–
$N(1720)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(1.79	$^{+0.26}_{-0.70}$	) $\times 10^{-5}$		–
$N(2300)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(2.6	$^{+1.2}_{-0.7}$	) $\times 10^{-5}$		–
$N(2570)\overline{p}+$ c.c. $\rightarrow \pi^0 p\overline{p}$	(2.13	$^{+0.40}_{-0.31}$	) $\times 10^{-5}$		–
$\pi^0 f_0(2100) \rightarrow \pi^0 p\overline{p}$	(1.1	± 0.4	) $\times 10^{-5}$		–
$\eta p\overline{p}$	(6.0	± 0.4	) $\times 10^{-5}$		1373
$\eta f_0(2100) \rightarrow \eta p\overline{p}$	(1.2	± 0.4	) $\times 10^{-5}$		–
$N(1535)\overline{p} \rightarrow \eta p\overline{p}$	(4.4	± 0.7	) $\times 10^{-5}$		–
$\omega p\overline{p}$	(6.9	± 2.1	) $\times 10^{-5}$		1247
$\phi p\overline{p}$	< 2.4		$\times 10^{-5}$	CL=90%	1109
$\pi^+\pi^- p\overline{p}$	(6.0	± 0.4	) $\times 10^{-4}$		1491
$p\overline{n}\pi^-$ or c.c.	(2.48	± 0.17	) $\times 10^{-4}$		–
$p\overline{n}\pi^-\pi^0$	(3.2	± 0.7	) $\times 10^{-4}$		1492
$2(\pi^+\pi^-\pi^0)$	(4.7	± 1.5	) $\times 10^{-3}$		1776
$\eta\pi^+\pi^-$	< 1.6		$\times 10^{-4}$	CL=90%	1791
$\eta\pi^+\pi^-\pi^0$	(9.5	± 1.7	) $\times 10^{-4}$		1778
$2(\pi^+\pi^-)\eta$	(1.2	± 0.6	) $\times 10^{-3}$		1758
$\eta'\pi^+\pi^-\pi^0$	(4.5	± 2.1	) $\times 10^{-4}$		1692
$\omega\pi^+\pi^-$	(7.3	± 1.2	) $\times 10^{-4}$	S=2.1	1748
$b_1^{\pm}\pi^{\mp}$	(4.0	± 0.6	) $\times 10^{-4}$	S=1.1	1635
$b_1^0\pi^0$	(2.4	± 0.6	) $\times 10^{-4}$		–
$\omega f_2(1270)$	(2.2	± 0.4	) $\times 10^{-4}$		1515

$\pi^+\pi^-K^+K^-$	$(\ 7.5\ \pm0.9\ )\times10^{-4}$	S=1.9	1726
$\rho^0K^+K^-$	$(\ 2.2\ \pm0.4\ )\times10^{-4}$		1616
$K^*(892)^0\overline{K}{}^*_2(1430)^0$	$(\ 1.9\ \pm0.5\ )\times10^{-4}$		1418
$K^+K^-\pi^+\pi^-\eta$	$(\ 1.3\ \pm0.7\ )\times10^{-3}$		1574
$K^+K^-2(\pi^+\pi^-)\pi^0$	$(\ 1.00\ \pm0.31\ )\times10^{-3}$		1611
$K^+K^-2(\pi^+\pi^-)$	$(\ 1.9\ \pm0.9\ )\times10^{-3}$		1654
$K_1(1270)^\pm K^\mp$	$(\ 1.00\ \pm0.28\ )\times10^{-3}$		1581
$K^0_SK^0_S\pi^+\pi^-$	$(\ 2.2\ \pm0.4\ )\times10^{-4}$		1724
$\rho^0p\overline{p}$	$(\ 5.0\ \pm2.2\ )\times10^{-5}$		1252
$K^+\overline{K}{}^*(892)^0\pi^-$ + c.c.	$(\ 6.7\ \pm2.5\ )\times10^{-4}$		1674
$2(\pi^+\pi^-)$	$(\ 2.4\ \pm0.6\ )\times10^{-4}$	S=2.2	1817
$\rho^0\pi^+\pi^-$	$(\ 2.2\ \pm0.6\ )\times10^{-4}$	S=1.4	1750
$K^+K^-\pi^+\pi^-\pi^0$	$(\ 1.26\ \pm0.09\ )\times10^{-3}$		1694
$\omega f_0(1710)\rightarrow\ \omega K^+K^-$	$(\ 5.9\ \pm2.2\ )\times10^{-5}$		–
$K^*(892)^0K^-\pi^+\pi^0$ + c.c.	$(\ 8.6\ \pm2.2\ )\times10^{-4}$		–
$K^*(892)^+K^-\pi^+\pi^-$ + c.c.	$(\ 9.6\ \pm2.8\ )\times10^{-4}$		–
$K^*(892)^+K^-\rho^0$ + c.c.	$(\ 7.3\ \pm2.6\ )\times10^{-4}$		–
$K^*(892)^0K^-\rho^+$ + c.c.	$(\ 6.1\ \pm1.8\ )\times10^{-4}$		–
ηK^+K^-, no $\eta\phi$	$(\ 3.1\ \pm0.4\ )\times10^{-5}$		1664
ωK^+K^-	$(\ 1.85\ \pm0.25\ )\times10^{-4}$	S=1.1	1614
$\omega K^*(892)^+K^-$ + c.c.	$(\ 2.07\ \pm0.26\ )\times10^{-4}$		1482
$\omega K^*_2(1430)^+K^-$ + c.c.	$(\ 6.1\ \pm1.2\ )\times10^{-5}$		1253
$\omega\overline{K}{}^*(892)^0K^0$	$(\ 1.68\ \pm0.30\ )\times10^{-4}$		1481
$\omega\overline{K}{}^*_2(1430)^0K^0$	$(\ 5.8\ \pm2.2\ )\times10^{-5}$		1251
$\omega X(1440)\rightarrow\ \omega K^0_SK^-\pi^+$ + c.c.	$(\ 1.6\ \pm0.4\ )\times10^{-5}$		–
$\omega X(1440)\rightarrow\ \omega K^+K^-\pi^0$	$(\ 1.09\ \pm0.26\ )\times10^{-5}$		–
$\omega f_1(1285)\rightarrow\ \omega K^0_SK^-\pi^+$ + c.c.	$(\ 3.0\ \pm1.0\ )\times10^{-6}$		–
$\omega f_1(1285)\rightarrow\ \omega K^+K^-\pi^0$	$(\ 1.2\ \pm0.7\ )\times10^{-6}$		–
$3(\pi^+\pi^-)$	$(\ 3.5\ \pm2.0\ )\times10^{-4}$	S=2.8	1774
$p\overline{p}\pi^+\pi^-\pi^0$	$(\ 7.3\ \pm0.7\ )\times10^{-4}$		1435
K^+K^-	$(\ 7.1\ \pm0.5\ )\times10^{-5}$	S=1.5	1776
$K^0_SK^0_L$	$(\ 5.34\ \pm0.33\ )\times10^{-5}$		1775
$\pi^+\pi^-\pi^0$	$(\ 2.01\ \pm0.17\ )\times10^{-4}$	S=1.7	1830
$\rho(2150)\pi\rightarrow\ \pi^+\pi^-\pi^0$	$(\ 1.9\ {}^{+1.2}_{-0.4}\ )\times10^{-4}$		–
$\rho(770)\pi\rightarrow\ \pi^+\pi^-\pi^0$	$(\ 3.2\ \pm1.2\ )\times10^{-5}$	S=1.8	–
$\pi^+\pi^-$	$(\ 7.8\ \pm2.6\ )\times10^{-6}$		1838
$K_1(1400)^\pm K^\mp$	$<\ 3.1\ \times10^{-4}$	CL=90%	1532
$K^*_2(1430)^\pm K^\mp$	$(\ 7.1\ {}^{+1.3}_{-0.9}\ )\times10^{-5}$		–
$K^+K^-\pi^0$	$(\ 4.07\ \pm0.31\ )\times10^{-5}$		1754
$K^+K^*(892)^-$ + c.c.	$(\ 2.9\ \pm0.4\ )\times10^{-5}$	S=1.2	1698
$K^*(892)^0\overline{K}{}^0$ + c.c.	$(\ 1.09\ \pm0.20\ )\times10^{-4}$		1697
$\phi\pi^+\pi^-$	$(\ 1.17\ \pm0.29\ )\times10^{-4}$	S=1.7	1690
$\phi f_0(980)\rightarrow\ \pi^+\pi^-$	$(\ 6.8\ \pm2.4\ )\times10^{-5}$	S=1.1	–
$2(K^+K^-)$	$(\ 6.0\ \pm1.4\ )\times10^{-5}$		1499
ϕK^+K^-	$(\ 7.0\ \pm1.6\ )\times10^{-5}$		1546
$2(K^+K^-)\pi^0$	$(\ 1.10\ \pm0.28\ )\times10^{-4}$		1440
$\phi\eta$	$(\ 3.10\ \pm0.31\ )\times10^{-5}$		1654
$\phi\eta'$	$(\ 3.1\ \pm1.6\ )\times10^{-5}$		1555
$\omega\eta'$	$(\ 3.2\ {}^{+2.5}_{-2.1}\ )\times10^{-5}$		1623
$\omega\pi^0$	$(\ 2.1\ \pm0.6\ )\times10^{-5}$		1757
$\rho\eta'$	$(\ 1.9\ {}^{+1.7}_{-1.2}\ )\times10^{-5}$		1625
$\rho\eta$	$(\ 2.2\ \pm0.6\ )\times10^{-5}$	S=1.1	1717

$\omega\eta$	$<$ 1.1		$\times 10^{-5}$	CL=90%	1715
$\phi\pi^0$	$<$ 4		$\times 10^{-7}$	CL=90%	1699
$\eta_c\pi^+\pi^-\pi^0$	$<$ 1.0		$\times 10^{-3}$	CL=90%	–
$p\overline{p}K^+K^-$	(2.7	± 0.7)	$\times 10^{-5}$		1118
$\overline{\Lambda}nK^0_S$ + c.c.	(8.1	± 1.8)	$\times 10^{-5}$		1324
$\phi f'_2(1525)$	(4.4	± 1.6)	$\times 10^{-5}$		1321
$\Theta(1540)\overline{\Theta}(1540) \rightarrow$ $K^0_S pK^-\overline{n}$ + c.c.	$<$ 8.8		$\times 10^{-6}$	CL=90%	–
$\Theta(1540)K^-\overline{n} \rightarrow K^0_S pK^-\overline{n}$	$<$ 1.0		$\times 10^{-5}$	CL=90%	–
$\Theta(1540)K^0_S\overline{p} \rightarrow K^0_S\overline{p}K^+n$	$<$ 7.0		$\times 10^{-6}$	CL=90%	–
$\overline{\Theta}(1540)K^+n \rightarrow K^0_S\overline{p}K^+n$	$<$ 2.6		$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540)K^0_S p \rightarrow K^0_S pK^-\overline{n}$	$<$ 6.0		$\times 10^{-6}$	CL=90%	–
$K^0_S K^0_S$	$<$ 4.6		$\times 10^{-6}$		1775

Radiative decays

$\gamma\chi_{c0}(1P)$	(9.99	± 0.27) %			261
$\gamma\chi_{c1}(1P)$	(9.55	± 0.31) %			171
$\gamma\chi_{c2}(1P)$	(9.11	± 0.31) %			128
$\gamma\eta_c(1S)$	(3.4	± 0.5)	$\times 10^{-3}$	S=1.3	636
$\gamma\eta_c(2S)$	(7	± 5)	$\times 10^{-4}$		46
$\gamma\pi^0$	(1.6	± 0.4)	$\times 10^{-6}$		1841
$\gamma\eta'(958)$	(1.23	± 0.06)	$\times 10^{-4}$		1719
$\gamma f_2(1270)$	(2.1	± 0.4)	$\times 10^{-4}$		1623
$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	(3.0	± 1.3)	$\times 10^{-5}$		–
$\gamma f_0(1710) \rightarrow \gamma K\overline{K}$	(6.0	± 1.6)	$\times 10^{-5}$		–
$\gamma\gamma$	$<$ 1.4		$\times 10^{-4}$	CL=90%	1843
$\gamma\eta$	(1.4	± 0.5)	$\times 10^{-6}$		1802
$\gamma\eta\pi^+\pi^-$	(8.7	± 2.1)	$\times 10^{-4}$		1791
$\gamma\eta(1405) \rightarrow \gamma K\overline{K}\pi$	$<$ 9		$\times 10^{-5}$	CL=90%	1569
$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	(3.6	± 2.5)	$\times 10^{-5}$		–
$\gamma\eta(1475) \rightarrow K\overline{K}\pi$	$<$ 1.4		$\times 10^{-4}$	CL=90%	–
$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	$<$ 8.8		$\times 10^{-5}$	CL=90%	–
$\gamma 2(\pi^+\pi^-)$	(4.0	± 0.6)	$\times 10^{-4}$		1817
$\gamma K^{*0}K^+\pi^-$ + c.c.	(3.7	± 0.9)	$\times 10^{-4}$		1674
$\gamma K^{*0}\overline{K}^{*0}$	(2.4	± 0.7)	$\times 10^{-4}$		1613
$\gamma K^0_S K^+\pi^-$ + c.c.	(2.6	± 0.5)	$\times 10^{-4}$		1753
$\gamma K^+K^-\pi^+\pi^-$	(1.9	± 0.5)	$\times 10^{-4}$		1726
$\gamma p\overline{p}$	(3.9	± 0.5)	$\times 10^{-5}$	S=2.0	1586
$\gamma f_2(1950) \rightarrow \gamma p\overline{p}$	(1.20	± 0.22)	$\times 10^{-5}$		–
$\gamma f_2(2150) \rightarrow \gamma p\overline{p}$	(7.2	± 1.8)	$\times 10^{-6}$		–
$\gamma X(1835) \rightarrow \gamma p\overline{p}$	(4.6	$^{+1.8}_{-4.0}$)	$\times 10^{-6}$		–
$\gamma X \rightarrow \gamma p\overline{p}$	[vvaa] $<$ 2		$\times 10^{-6}$	CL=90%	–
$\gamma\pi^+\pi^-p\overline{p}$	(2.8	± 1.4)	$\times 10^{-5}$		1491
$\gamma 2(\pi^+\pi^-)K^+K^-$	$<$ 2.2		$\times 10^{-4}$	CL=90%	1654
$\gamma 3(\pi^+\pi^-)$	$<$ 1.7		$\times 10^{-4}$	CL=90%	1774
$\gamma K^+K^-K^+K^-$	$<$ 4		$\times 10^{-5}$	CL=90%	1499
$\gamma\gamma J/\psi$	(3.1	$^{+1.0}_{-1.2}$)	$\times 10^{-4}$		542

Other decays

invisible	$<$ 1.6		%	CL=90%	–

$\psi(3770)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 3773.15 \pm 0.33$ MeV
Full width $\Gamma = 27.2 \pm 1.0$ MeV
$\Gamma_{ee} = 0.262 \pm 0.018$ keV (S = 1.4)

In addition to the dominant decay mode to $D\overline{D}$, $\psi(3770)$ was found to decay into the final states containing the J/ψ (BAI 05, ADAM 06). ADAMS 06 and HUANG 06A searched for various decay modes with light hadrons and found a statistically significant signal for the decay to $\phi\eta$ only (ADAMS 06).

$\psi(3770)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\overline{D}$	$(93\ ^{+8}_{-9})$ %	S=2.0	286
$D^0\overline{D}^0$	(52 ± 5) %	S=2.0	286
D^+D^-	(41 ± 4) %	S=2.0	252
$J/\psi\pi^+\pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		560
$J/\psi\pi^0\pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		564
$J/\psi\eta$	$(9 \pm 4) \times 10^{-4}$		360
$J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	603
e^+e^-	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	1887
Decays to light hadrons			
$b_1(1235)\pi$	$< 1.4 \times 10^{-5}$	CL=90%	1683
$\phi\eta'$	$< 7 \times 10^{-4}$	CL=90%	1607
$\omega\eta'$	$< 4 \times 10^{-4}$	CL=90%	1672
$\rho^0\eta'$	$< 6 \times 10^{-4}$	CL=90%	1674
$\phi\eta$	$(3.1 \pm 0.7) \times 10^{-4}$		1703
$\omega\eta$	$< 1.4 \times 10^{-5}$	CL=90%	1762
$\rho^0\eta$	$< 5 \times 10^{-4}$	CL=90%	1764
$\phi\pi^0$	$< 3 \times 10^{-5}$	CL=90%	1746
$\omega\pi^0$	$< 6 \times 10^{-4}$	CL=90%	1803
$\pi^+\pi^-\pi^0$	$< 5 \times 10^{-6}$	CL=90%	1874
$\rho\pi$	$< 5 \times 10^{-6}$	CL=90%	1804
$K^*(892)^+K^-$ + c.c.	$< 1.4 \times 10^{-5}$	CL=90%	1745
$K^*(892)^0\overline{K}^0$ + c.c.	$< 1.2 \times 10^{-3}$	CL=90%	1744
$K^0_S K^0_L$	$< 1.2 \times 10^{-5}$	CL=90%	1820
$2(\pi^+\pi^-)$	$< 1.12 \times 10^{-3}$	CL=90%	1861
$2(\pi^+\pi^-)\pi^0$	$< 1.06 \times 10^{-3}$	CL=90%	1843
$2(\pi^+\pi^-\pi^0)$	< 5.85 %	CL=90%	1821
$\omega\pi^+\pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	1794
$3(\pi^+\pi^-)$	$< 9.1 \times 10^{-3}$		1819
$3(\pi^+\pi^-)\pi^0$	< 1.37 %		1792
$3(\pi^+\pi^-)2\pi^0$	< 11.74 %	CL=90%	1760
$\eta\pi^+\pi^-$	$< 1.24 \times 10^{-3}$	CL=90%	1836
$\pi^+\pi^-2\pi^0$	$< 8.9 \times 10^{-3}$	CL=90%	1862
$\rho^0\pi^+\pi^-$	$< 6.9 \times 10^{-3}$	CL=90%	1796
$\eta 3\pi$	$< 1.34 \times 10^{-3}$	CL=90%	1824
$\eta 2(\pi^+\pi^-)$	< 2.43 %		1804
$\eta\rho^0\pi^+\pi^-$	< 1.45 %	CL=90%	1708
$\eta' 3\pi$	$< 2.44 \times 10^{-3}$	CL=90%	1740
$K^+K^-\pi^+\pi^-$	$< 9.0 \times 10^{-4}$	CL=90%	1772
$\phi\pi^+\pi^-$	$< 4.1 \times 10^{-4}$	CL=90%	1737
$K^+K^-2\pi^0$	$< 4.2 \times 10^{-3}$	CL=90%	1774
$4(\pi^+\pi^-)$	< 1.67 %	CL=90%	1757
$4(\pi^+\pi^-)\pi^0$	< 3.06 %	CL=90%	1720

$\phi f_0(980)$	$<$	4.5	$\times 10^{-4}$	CL=90%	1597
$K^+ K^- \pi^+ \pi^- \pi^0$	$<$	2.36	$\times 10^{-3}$	CL=90%	1741
$K^+ K^- \rho^0 \pi^0$	$<$	8	$\times 10^{-4}$	CL=90%	1624
$K^+ K^- \rho^+ \pi^-$	$<$	1.46	%	CL=90%	1622
$\omega K^+ K^-$	$<$	3.4	$\times 10^{-4}$	CL=90%	1664
$\phi \pi^+ \pi^- \pi^0$	$<$	3.8	$\times 10^{-3}$	CL=90%	1722
$K^{*0} K^- \pi^+ \pi^0 +$ c.c.	$<$	1.62	%	CL=90%	1693
$K^{*+} K^- \pi^+ \pi^- +$ c.c.	$<$	3.23	%	CL=90%	1692
$K^+ K^- \pi^+ \pi^- 2\pi^0$	$<$	2.67	%	CL=90%	1705
$K^+ K^- 2(\pi^+ \pi^-)$	$<$	1.03	%	CL=90%	1702
$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$<$	3.60	%	CL=90%	1660
$\eta K^+ K^-$	$<$	4.1	$\times 10^{-4}$	CL=90%	1712
$\eta K^+ K^- \pi^+ \pi^-$	$<$	1.24	%	CL=90%	1624
$\rho^0 K^+ K^-$	$<$	5.0	$\times 10^{-3}$	CL=90%	1665
$2(K^+ K^-)$	$<$	6.0	$\times 10^{-4}$	CL=90%	1552
$\phi K^+ K^-$	$<$	7.5	$\times 10^{-4}$	CL=90%	1598
$2(K^+ K^-) \pi^0$	$<$	2.9	$\times 10^{-4}$	CL=90%	1493
$2(K^+ K^-) \pi^+ \pi^-$	$<$	3.2	$\times 10^{-3}$	CL=90%	1425
$K^0_S K^- \pi^+$	$<$	3.2	$\times 10^{-3}$	CL=90%	1799
$K^0_S K^- \pi^+ \pi^0$	$<$	1.33	%	CL=90%	1773
$K^0_S K^- \rho^+$	$<$	6.6	$\times 10^{-3}$	CL=90%	1664
$K^0_S K^- 2\pi^+ \pi^-$	$<$	8.7	$\times 10^{-3}$	CL=90%	1739
$K^0_S K^- \pi^+ \rho^0$	$<$	1.6	%	CL=90%	1621
$K^0_S K^- \pi^+ \eta$	$<$	1.3	%	CL=90%	1669
$K^0_S K^- 2\pi^+ \pi^- \pi^0$	$<$	4.18	%	CL=90%	1703
$K^0_S K^- 2\pi^+ \pi^- \eta$	$<$	4.8	%	CL=90%	1570
$K^0_S K^- \pi^+ 2(\pi^+ \pi^-)$	$<$	1.22	%	CL=90%	1658
$K^0_S K^- \pi^+ 2\pi^0$	$<$	2.65	%	CL=90%	1742
$K^0_S K^- K^+ K^- \pi^+$	$<$	4.9	$\times 10^{-3}$	CL=90%	1490
$K^0_S K^- K^+ K^- \pi^+ \pi^0$	$<$	3.0	%	CL=90%	1427
$K^0_S K^- K^+ K^- \pi^+ \eta$	$<$	2.2	%	CL=90%	1214
$K^{*0} K^- \pi^+ +$ c.c.	$<$	9.7	$\times 10^{-3}$	CL=90%	1722
$p \overline{p} \pi^0$	$<$	1.2	$\times 10^{-3}$		1595
$p \overline{p} \pi^+ \pi^-$	$<$	5.8	$\times 10^{-4}$	CL=90%	1544
$\Lambda \overline{\Lambda}$	$<$	1.2	$\times 10^{-4}$	CL=90%	1521
$p \overline{p} \pi^+ \pi^- \pi^0$	$<$	1.85	$\times 10^{-3}$	CL=90%	1490
$\omega p \overline{p}$	$<$	2.9	$\times 10^{-4}$	CL=90%	1309
$\Lambda \overline{\Lambda} \pi^0$	$<$	7	$\times 10^{-5}$	CL=90%	1469
$p \overline{p} 2(\pi^+ \pi^-)$	$<$	2.6	$\times 10^{-3}$	CL=90%	1425
$\eta p \overline{p}$	$<$	5.4	$\times 10^{-4}$	CL=90%	1430
$\eta p \overline{p} \pi^+ \pi^-$	$<$	3.3	$\times 10^{-3}$	CL=90%	1284
$\rho^0 p \overline{p}$	$<$	1.7	$\times 10^{-3}$	CL=90%	1313
$p \overline{p} K^+ K^-$	$<$	3.2	$\times 10^{-4}$	CL=90%	1185
$\eta p \overline{p} K^+ K^-$	$<$	6.9	$\times 10^{-3}$	CL=90%	736
$\pi^0 p \overline{p} K^+ K^-$	$<$	1.2	$\times 10^{-3}$	CL=90%	1093
$\phi p \overline{p}$	$<$	1.3	$\times 10^{-4}$	CL=90%	1178
$\Lambda \overline{\Lambda} \pi^+ \pi^-$	$<$	2.5	$\times 10^{-4}$	CL=90%	1405
$\Lambda \overline{p} K^+$	$<$	2.8	$\times 10^{-4}$	CL=90%	1387
$\Lambda \overline{p} K^+ \pi^+ \pi^-$	$<$	6.3	$\times 10^{-4}$	CL=90%	1234
$\Lambda \overline{\Lambda} \eta$	$<$	1.9	$\times 10^{-4}$	CL=90%	1262
$\Sigma^+ \overline{\Sigma}^-$	$<$	1.0	$\times 10^{-4}$	CL=90%	1464
$\Sigma^0 \overline{\Sigma}^0$	$<$	4	$\times 10^{-5}$	CL=90%	1462
$\Xi^+ \overline{\Xi}^-$	$<$	1.5	$\times 10^{-4}$	CL=90%	–
$\Xi^0 \overline{\Xi}^0$	$<$	1.4	$\times 10^{-4}$	CL=90%	1353

Radiative decays

$\gamma\chi_{c2}$	< 9	$\times 10^{-4}$	CL=90%	211
$\gamma\chi_{c1}$	$(2.9 \pm 0.6) \times 10^{-3}$			253
$\gamma\chi_{c0}$	$(7.3 \pm 0.9) \times 10^{-3}$			341
$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	1765
$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	1847
$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%	1884

X(3872)

$I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 3871.69 \pm 0.17$ MeV
$m_{X(3872)} - m_{J/\psi} = 775 \pm 4$ MeV
$m_{X(3872)} - m_{\psi(2S)}$
Full width $\Gamma < 1.2$ MeV, CL = 90%

X(3872) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^- J/\psi(1S)$	> 2.6 %	650
$\omega J/\psi(1S)$	> 1.9 %	†
$D^0\overline{D}{}^0\pi^0$	>32 %	117
$\overline{D}{}^{*0}D^0$	>24 %	†
$\gamma J/\psi$	$> 6 \times 10^{-3}$	697
$\gamma\psi(2S)$	[xxaa] > 3.0 %	181
$\pi^+\pi^-\eta_c(1S)$	not seen	746
$p\overline{p}$	not seen	1693

X(3900)±

$I(J^P) = ?(1^+)$

Mass $m = 3888.7 \pm 3.4$ MeV (S = 1.3)
Full width $\Gamma = 35 \pm 7$ MeV

X(3900)± DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\pi^\pm$	seen	700
$h_c\pi^\pm$	not seen	–
$(D\overline{D}{}^*)^\pm$	seen	–

$\chi_{c0}(2P)$ was X(3915)

$I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 3918.4 \pm 1.9$ MeV
Full width $\Gamma = 20 \pm 5$ MeV (S = 1.1)

$\chi_{c0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega J/\psi$	seen	222
$\pi^+\pi^-\eta_c(1S)$	not seen	785
$K\overline{K}$	not seen	–
$\gamma\gamma$	seen	1959

$\chi_{c2}(2P)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 3927.2 \pm 2.6$ MeV
Full width $\Gamma = 24 \pm 6$ MeV

$\chi_{c2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma$	seen	1964
$D\overline{D}$	seen	615
D^+D^-	seen	600
$D^0\overline{D}^0$	seen	615
$\pi^+\pi^-\eta_c(1S)$	not seen	792
$K\overline{K}$	not seen	1901

$\psi(4040)$ [yyaa]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4039 \pm 1$ MeV
Full width $\Gamma = 80 \pm 10$ MeV
$\Gamma_{ee} = 0.86 \pm 0.07$ keV

Due to the complexity of the $c\overline{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

$\psi(4040)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	$(1.07\pm0.16)\times10^{-5}$		2019
$D\overline{D}$	seen		775
$D^0\overline{D}^0$	seen		775
D^+D^-	seen		764
$D^*\overline{D}$ + c.c.	seen		569
$D^*(2007)^0\overline{D}^0$ + c.c.	seen		575
$D^*(2010)^+D^-$ + c.c.	seen		561
$D^*\overline{D}^*$	seen		193
$D^*(2007)^0\overline{D}^*(2007)^0$	seen		225
$D^*(2010)^+D^*(2010)^-$	seen		193
$D^0D^-\pi^+$ +c.c. (excl. $D^*(2007)^0\overline{D}^0$ +c.c., $D^*(2010)^+D^-$ +c.c.)	not seen		–
$D\overline{D}^*\pi$ (excl. $D^*\overline{D}^*$)	not seen		–
$D^0\overline{D}^{*-}\pi^+$ +c.c. (excl. $D^*(2010)^+D^*(2010)^-$)	seen		–
$D_s^+D_s^-$	seen		452
$J/\psi\pi^+\pi^-$	$< 4 \times10^{-3}$	90%	794
$J/\psi\pi^0\pi^0$	$< 2 \times10^{-3}$	90%	797
$J/\psi\eta$	$(5.2 \pm0.7) \times10^{-3}$		675
$J/\psi\pi^0$	$< 2.8 \times10^{-4}$	90%	823
$J/\psi\pi^+\pi^-\pi^0$	$< 2 \times10^{-3}$	90%	746
$\chi_{c1}\gamma$	< 1.1 %	90%	494
$\chi_{c2}\gamma$	< 1.7 %	90%	454
$\chi_{c1}\pi^+\pi^-\pi^0$	< 1.1 %	90%	306
$\chi_{c2}\pi^+\pi^-\pi^0$	< 3.2 %	90%	233
$h_c(1P)\pi^+\pi^-$	$< 3 \times10^{-3}$	90%	403
$\phi\pi^+\pi^-$	$< 3 \times10^{-3}$	90%	1880

$\Lambda\overline{\Lambda}\pi^+\pi^-$	< 2.9	$\times 10^{-4}$	90%	1578
$\Lambda\overline{\Lambda}\pi^0$	< 9	$\times 10^{-5}$	90%	1636
$\Lambda\overline{\Lambda}\eta$	< 3.0	$\times 10^{-4}$	90%	1452
$\Sigma^+\overline{\Sigma}^-$	< 1.3	$\times 10^{-4}$	90%	1632
$\Sigma^0\overline{\Sigma}^0$	< 7	$\times 10^{-5}$	90%	1630
$\Xi^+\overline{\Xi}^-$	< 1.6	$\times 10^{-4}$	90%	–
$\Xi^0\overline{\Xi}^0$	< 1.8	$\times 10^{-4}$	90%	1533

$\psi(4160)$ [yyaa]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4191 \pm 5$ MeV
Full width $\Gamma = 70 \pm 10$ MeV
$\Gamma_{ee} = 0.48 \pm 0.22$ keV

Due to the complexity of the $c\overline{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

$\psi(4160)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	$(6.9\pm3.3)\times10^{-6}$		2096
$\mu^+\mu^-$	seen		2093
$D\overline{D}$	seen		956
$D^0\overline{D}^0$	seen		956
D^+D^-	seen		947
$D^*\overline{D}+$ c.c.	seen		798
$D^*(2007)^0\overline{D}^0+$ c.c.	seen		802
$D^*(2010)^+D^-+$ c.c.	seen		792
$D^*\overline{D}^*$	seen		592
$D^*(2007)^0\overline{D}^*(2007)^0$	seen		603
$D^*(2010)^+D^*(2010)^-$	seen		592
$D^0D^-\pi^+$+c.c. (excl. $D^*(2007)^0\overline{D}^0$ +c.c., $D^*(2010)^+D^-$ +c.c.)	not seen		–
$D\overline{D}^*\pi$+c.c. (excl. $D^*\overline{D}^*$)	seen		–
$D^0D^{*-}\pi^+$+c.c. (excl. $D^*(2010)^+D^*(2010)^-$)	not seen		–
$D_s^+D_s^-$	not seen		720
$D_s^{*+}D_s^-$+c.c.	seen		385
$J/\psi\pi^+\pi^-$	< 3 $\times 10^{-3}$	90%	919
$J/\psi\pi^0\pi^0$	< 3 $\times 10^{-3}$	90%	922
$J/\psi K^+K^-$	< 2 $\times 10^{-3}$	90%	407
$J/\psi\eta$	< 8 $\times 10^{-3}$	90%	821
$J/\psi\pi^0$	< 1 $\times 10^{-3}$	90%	944
$J/\psi\eta'$	< 5 $\times 10^{-3}$	90%	457
$J/\psi\pi^+\pi^-\pi^0$	< 1 $\times 10^{-3}$	90%	879
$\psi(2S)\pi^+\pi^-$	< 4 $\times 10^{-3}$	90%	396
$\chi_{c1}\gamma$	< 7 $\times 10^{-3}$	90%	625
$\chi_{c2}\gamma$	< 1.3 %	90%	587
$\chi_{c1}\pi^+\pi^-\pi^0$	< 2 $\times 10^{-3}$	90%	496
$\chi_{c2}\pi^+\pi^-\pi^0$	< 8 $\times 10^{-3}$	90%	445
$h_c(1P)\pi^+\pi^-$	< 5 $\times 10^{-3}$	90%	556
$h_c(1P)\pi^0\pi^0$	< 2 $\times 10^{-3}$	90%	560

$h_c(1P)\eta$	< 2	$\times 10^{-3}$	90%	348
$h_c(1P)\pi^0$	< 4	$\times 10^{-4}$	90%	600
$\phi\pi^+\pi^-$	< 2	$\times 10^{-3}$	90%	1961

$X(4260)$

$I^G(J^{PC}) = ?^?(1^{--})$

Mass $m = 4251 \pm 9$ MeV (S = 1.6)
Full width $\Gamma = 120 \pm 12$ MeV (S = 1.1)

$X(4260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\pi^+\pi^-$	seen	967
$J/\psi f_0(980)$, $f_0(980) \to \pi^+\pi^-$	seen	–
$X(3900)^\pm\pi^\mp$, $X^\pm \to J/\psi\pi^\pm$	seen	–
$J/\psi\pi^0\pi^0$	seen	969
$J/\psi K^+K^-$	seen	512
$X(3872)\gamma$	seen	363
$J/\psi\eta$	not seen	876
$J/\psi\pi^0$	not seen	991
$J/\psi\eta'$	not seen	552
$J/\psi\pi^+\pi^-\pi^0$	not seen	930
$J/\psi\eta\eta$	not seen	311
$\psi(2S)\pi^+\pi^-$	not seen	459
$\psi(2S)\eta$	not seen	129
$\chi_{c0}\omega$	not seen	265
$\chi_{c1}\gamma$	not seen	676
$\chi_{c2}\gamma$	not seen	638
$\chi_{c1}\pi^+\pi^-\pi^0$	not seen	560
$\chi_{c2}\pi^+\pi^-\pi^0$	not seen	512
$h_c(1P)\pi^+\pi^-$	not seen	613
$\phi\pi^+\pi^-$	not seen	1993
$\phi f_0(980) \to \phi\pi^+\pi^-$	not seen	–
$D\overline{D}$	not seen	1020
$D^0\overline{D}^0$	not seen	1020
D^+D^-	not seen	1011
$D^*\overline{D}$ + c.c.	not seen	887
$D^*(2007)^0\overline{D}^0$ + c.c.	not seen	–
$D^*(2010)^+D^-$ + c.c.	not seen	–
$D^*\overline{D}^*$	not seen	691
$D^*(2007)^0\overline{D}^*(2007)^0$	not seen	700
$D^*(2010)^+D^*(2010)^-$	not seen	691
$D^0D^-\pi^+$ + c.c. (excl. $D^*(2007)^0\overline{D}^{*0}$ + c.c., $D^*(2010)^+D^-$ + c.c.)	not seen	–
$D\overline{D}^*\pi$ + c.c. (excl. $D^*\overline{D}^*$)	not seen	723
$D^0D^{*-}\pi^+$ + c.c. (excl. $D^*(2010)^+D^*(2010)^-$)	not seen	–
$D^0D^*(2010)^-\pi^+$ + c.c.	not seen	716
$D^*\overline{D}^*\pi$	not seen	449
$D_s^+D_s^-$	not seen	803
$D_s^{*+}D_s^-$ + c.c.	not seen	615
$D_s^{*+}D_s^{*-}$	not seen	239

$p\overline{p}$	not seen	1907
$K^0_S K^\pm \pi^\mp$	not seen	2048
$K^+ K^- \pi^0$	not seen	2049

$X(4360)$

$I^G(J^{PC}) = ?^?(1^{--})$

$X(4360)$ MASS $= 4361 \pm 13$ MeV
$X(4360)$ WIDTH $= 74 \pm 18$ MeV

$X(4360)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\psi(2S)\pi^+\pi^-$	seen	567

$\psi(4415)$ [yyaa]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4421 \pm 4$ MeV
Full width $\Gamma = 62 \pm 20$ MeV
$\Gamma_{ee} = 0.58 \pm 0.07$ keV

Due to the complexity of the $c\overline{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

$\psi(4415)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$D\overline{D}$	not seen		1187
$D^0\overline{D}^0$	seen		1187
D^+D^-	seen		1179
$D^*\overline{D}$ + c.c.	not seen		1063
$D^*(2007)^0\overline{D}^0$ + c.c.	seen		1066
$D^*(2010)^+D^-$ + c.c.	seen		1059
$D^*\overline{D}^*$	not seen		919
$D^*(2007)^0\overline{D}^*(2007)^0$ + c.c.	seen		927
$D^*(2010)^+D^*(2010)^-$ + c.c.	seen		919
$D^0D^-\pi^+$ (excl. $D^*(2007)^0\overline{D}^0$ +c.c., $D^*(2010)^+D^-$ +c.c.	< 2.3 %	90%	–
$D\overline{D}_2^*(2460) \rightarrow D^0D^-\pi^+$ +c.c.	(10 ± 4) %		–
$D^0D^{*-}\pi^+$ +c.c.	< 11 %	90%	926
$D_s^+D_s^-$	not seen		1006
$D_s^{*+}D_s^-$ +c.c.	seen		–
$D_s^{*+}D_s^{*-}$	not seen		652
$J/\psi\eta$	$< 6 \times 10^{-3}$	90%	1022
e^+e^-	$(9.4 \pm 3.2) \times 10^{-6}$		2210

$X(4660)$

$I^G(J^{PC}) = ?^?(1^{--})$

$X(4660)$ MASS $= 4664 \pm 12$ MeV
$X(4660)$ WIDTH $= 48 \pm 15$ MeV

$X(4660)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\psi(2S)\pi^+\pi^-$	seen	838

$b\overline{b}$ MESONS

$\Upsilon(1S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 9460.30 \pm 0.26$ MeV (S = 3.3)
Full width $\Gamma = 54.02 \pm 1.25$ keV
$\Gamma_{ee} = 1.340 \pm 0.018$ keV

$\Upsilon(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\tau^+\tau^-$	(2.60 ±0.10) %		4384
e^+e^-	(2.38 ±0.11) %		4730
$\mu^+\mu^-$	(2.48 ±0.05) %		4729
Hadronic decays			
ggg	(81.7 ±0.7) %		–
γgg	(2.2 ±0.6) %		–
$\eta'(958)$ anything	(2.94 ±0.24) %		–
$J/\psi(1S)$ anything	(6.5 ±0.7) $\times 10^{-4}$		4223
χ_{c0} anything	< 5 $\times 10^{-3}$	90%	–
χ_{c1} anything	(2.3 ±0.7) $\times 10^{-4}$		–
χ_{c2} anything	(3.4 ±1.0) $\times 10^{-4}$		–
$\psi(2S)$ anything	(2.7 ±0.9) $\times 10^{-4}$		–
$\rho\pi$	< 3.68 $\times 10^{-6}$	90%	4697
$\omega\pi^0$	< 3.90 $\times 10^{-6}$	90%	4697
$\pi^+\pi^-$	< 5 $\times 10^{-4}$	90%	4728
K^+K^-	< 5 $\times 10^{-4}$	90%	4704
$p\overline{p}$	< 5 $\times 10^{-4}$	90%	4636
$\pi^+\pi^-\pi^0$	(2.1 ±0.8) $\times 10^{-6}$		4725
ϕK^+K^-	(2.4 ±0.5) $\times 10^{-6}$		4622
$\omega\pi^+\pi^-$	(4.5 ±1.0) $\times 10^{-6}$		4694
$K^*(892)^0K^-\pi^+$ + c.c.	(4.4 ±0.8) $\times 10^{-6}$		4667
$\phi f_2'(1525)$	< 1.63 $\times 10^{-6}$	90%	4549
$\omega f_2(1270)$	< 1.79 $\times 10^{-6}$	90%	4611
$\rho(770)a_2(1320)$	< 2.24 $\times 10^{-6}$	90%	4605
$K^*(892)^0\overline{K}_2^*(1430)^0$ + c.c.	(3.0 ±0.8) $\times 10^{-6}$		4579
$K_1(1270)^\pm K^\mp$	< 2.41 $\times 10^{-6}$	90%	4631
$K_1(1400)^\pm K^\mp$	(1.0 ±0.4) $\times 10^{-6}$		4613
$b_1(1235)^\pm\pi^\mp$	< 1.25 $\times 10^{-6}$	90%	4649
$\pi^+\pi^-\pi^0\pi^0$	(1.28 ±0.30) $\times 10^{-5}$		4720
$K_S^0K^+\pi^-$ + c.c.	(1.6 ±0.4) $\times 10^{-6}$		4696
$K^*(892)^0\overline{K}^0$ + c.c.	(2.9 ±0.9) $\times 10^{-6}$		4675
$K^*(892)^-K^+$ + c.c.	< 1.11 $\times 10^{-6}$	90%	4675
$D^*(2010)^\pm$ anything	(2.52 ±0.20) %		–
$\overline{d}$ anything	(2.86 ±0.28) $\times 10^{-5}$		–
Sum of 100 exclusive modes	(1.200±0.017) %		–
Radiative decays			
$\gamma\pi^+\pi^-$	(6.3 ±1.8) $\times 10^{-5}$		4728
$\gamma\pi^0\pi^0$	(1.7 ±0.7) $\times 10^{-5}$		4728
$\gamma\pi^0\eta$	< 2.4 $\times 10^{-6}$	90%	4713
γK^+K^-	[zzaa] (1.14 ±0.13) $\times 10^{-5}$		4704
$\gamma p\overline{p}$	[aabb] < 6 $\times 10^{-6}$	90%	4636
$\gamma 2h^+2h^-$	(7.0 ±1.5) $\times 10^{-4}$		4720

$\gamma 3h^+ 3h^-$		(5.4	±2.0	) $\times 10^{-4}$		4703
$\gamma 4h^+ 4h^-$		(7.4	±3.5	) $\times 10^{-4}$		4679
$\gamma \pi^+ \pi^- K^+ K^-$		(2.9	±0.9	) $\times 10^{-4}$		4686
$\gamma 2\pi^+ 2\pi^-$		(2.5	±0.9	) $\times 10^{-4}$		4720
$\gamma 3\pi^+ 3\pi^-$		(2.5	±1.2	) $\times 10^{-4}$		4703
$\gamma 2\pi^+ 2\pi^- K^+ K^-$		(2.4	±1.2	) $\times 10^{-4}$		4658
$\gamma \pi^+ \pi^- p\overline{p}$		(1.5	±0.6	) $\times 10^{-4}$		4604
$\gamma 2\pi^+ 2\pi^- p\overline{p}$		(4	±6	) $\times 10^{-5}$		4563
$\gamma 2K^+ 2K^-$		(2.0	±2.0	) $\times 10^{-5}$		4601
$\gamma \eta'(958)$		< 1.9		$\times 10^{-6}$	90%	4682
$\gamma \eta$		< 1.0		$\times 10^{-6}$	90%	4714
$\gamma f_0(980)$		< 3		$\times 10^{-5}$	90%	4678
$\gamma f_2'(1525)$		(3.8	±0.9	) $\times 10^{-5}$		4607
$\gamma f_2(1270)$		(1.01	±0.09	) $\times 10^{-4}$		4644
$\gamma \eta(1405)$		< 8.2		$\times 10^{-5}$	90%	4625
$\gamma f_0(1500)$		< 1.5		$\times 10^{-5}$	90%	4610
$\gamma f_0(1710)$		< 2.6		$\times 10^{-4}$	90%	4573
$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$		< 7		$\times 10^{-6}$	90%	–
$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$		< 1.4		$\times 10^{-6}$	90%	–
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$		< 1.8		$\times 10^{-6}$	90%	–
$\gamma f_4(2050)$		< 5.3		$\times 10^{-5}$	90%	4515
$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$		< 2		$\times 10^{-4}$	90%	4475
$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$		< 8		$\times 10^{-7}$	90%	4469
$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$		< 6		$\times 10^{-7}$	90%	–
$\gamma f_J(2220) \rightarrow \gamma p\overline{p}$		< 1.1		$\times 10^{-6}$	90%	–
$\gamma \eta(2225) \rightarrow \gamma \phi \phi$		< 3		$\times 10^{-3}$	90%	4469
$\gamma \eta_c(1S)$		< 5.7		$\times 10^{-5}$	90%	4260
$\gamma \chi_{c0}$		< 6.5		$\times 10^{-4}$	90%	4114
$\gamma \chi_{c1}$		< 2.3		$\times 10^{-5}$	90%	4079
$\gamma \chi_{c2}$		< 7.6		$\times 10^{-6}$	90%	4062
$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$		< 1.6		$\times 10^{-6}$	90%	–
$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$		< 2.8		$\times 10^{-6}$	90%	–
$\gamma \chi_{c0}(2P) \rightarrow \omega J/\psi$		< 3.0		$\times 10^{-6}$	90%	–
$\gamma X(4140) \rightarrow \phi J/\psi$		< 2.2		$\times 10^{-6}$	90%	–
γX	[*bbbb*]	< 4.5		$\times 10^{-6}$	90%	–
$\gamma X \overline{X}(m_X < 3.1$ GeV)	[*ccbb*]	< 1		$\times 10^{-3}$	90%	–
$\gamma X \overline{X}(m_X < 4.5$ GeV)	[*ddbb*]	< 2.4		$\times 10^{-4}$	90%	–
$\gamma X \rightarrow \gamma +$ ≥ 4 prongs	[*eebb*]	< 1.78		$\times 10^{-4}$	95%	–
$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	[*ffbb*]	< 9		$\times 10^{-6}$	90%	–
$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	[*zzaa*]	< 1.30		$\times 10^{-4}$	90%	–
$\gamma a_1^0 \rightarrow \gamma g g$	[*ggbb*]	< 1		%	90%	–
$\gamma a_1^0 \rightarrow \gamma s\overline{s}$	[*ggbb*]	< 1		$\times 10^{-3}$	90%	–

Lepton Family number (*LF*) violating modes

$\mu^\pm \tau^\mp$	*LF*	< 6.0		$\times 10^{-6}$	95%	4563

Other decays

invisible		< 3.0		$\times 10^{-4}$	90%	–

$\chi_{b0}(1P)$ [hhbb]

$I^G(J^{PC}) = 0^+(0^{++})$
J needs confirmation.

Mass $m = 9859.44 \pm 0.42 \pm 0.31$ MeV

$\chi_{b0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(1.76 ± 0.35) %		391
$D^0\,X$	< 10.4 %	90%	–
$\pi^+\pi^-\,K^+\,K^-\,\pi^0$	$< 1.6 \times 10^{-4}$	90%	4875
$2\pi^+\pi^-\,K^-\,K^0_S$	$< 5 \times 10^{-5}$	90%	4875
$2\pi^+\pi^-\,K^-\,K^0_S\,2\pi^0$	$< 5 \times 10^{-4}$	90%	4846
$2\pi^+2\pi^-2\pi^0$	$< 2.1 \times 10^{-4}$	90%	4905
$2\pi^+2\pi^-\,K^+\,K^-$	$(1.1 \pm0.6) \times 10^{-4}$		4861
$2\pi^+2\pi^-\,K^+\,K^-\,\pi^0$	$< 2.7 \times 10^{-4}$	90%	4846
$2\pi^+2\pi^-\,K^+\,K^-\,2\pi^0$	$< 5 \times 10^{-4}$	90%	4828
$3\pi^+2\pi^-\,K^-\,K^0_S\,\pi^0$	$< 1.6 \times 10^{-4}$	90%	4827
$3\pi^+3\pi^-$	$< 8 \times 10^{-5}$	90%	4904
$3\pi^+3\pi^-2\pi^0$	$< 6 \times 10^{-4}$	90%	4881
$3\pi^+3\pi^-\,K^+\,K^-$	$(2.4 \pm1.2) \times 10^{-4}$		4827
$3\pi^+3\pi^-\,K^+\,K^-\,\pi^0$	$< 1.0 \times 10^{-3}$	90%	4808
$4\pi^+4\pi^-$	$< 8 \times 10^{-5}$	90%	4880
$4\pi^+4\pi^-2\pi^0$	$< 2.1 \times 10^{-3}$	90%	4850
$J/\psi\,J/\psi$	$< 7 \times 10^{-5}$	90%	3836
$J/\psi\,\psi(2S)$	$< 1.2 \times 10^{-4}$	90%	3571
$\psi(2S)\psi(2S)$	$< 3.1 \times 10^{-5}$	90%	3273

$\chi_{b1}(1P)$ [hhbb]

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Mass $m = 9892.78 \pm 0.26 \pm 0.31$ MeV

$\chi_{b1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(33.9 ± 2.2) %		423
$D^0\,X$	(12.6 ± 2.2) %		–
$\pi^+\pi^-\,K^+\,K^-\,\pi^0$	$(2.0\pm0.6) \times 10^{-4}$		4892
$2\pi^+\pi^-\,K^-\,K^0_S$	$(1.3\pm0.5) \times 10^{-4}$		4892
$2\pi^+\pi^-\,K^-\,K^0_S\,2\pi^0$	$< 6 \times 10^{-4}$	90%	4863
$2\pi^+2\pi^-2\pi^0$	$(8.0\pm2.5) \times 10^{-4}$		4921
$2\pi^+2\pi^-\,K^+\,K^-$	$(1.5\pm0.5) \times 10^{-4}$		4878
$2\pi^+2\pi^-\,K^+\,K^-\,\pi^0$	$(3.5\pm1.2) \times 10^{-4}$		4863
$2\pi^+2\pi^-\,K^+\,K^-\,2\pi^0$	$(8.6\pm3.2) \times 10^{-4}$		4845
$3\pi^+2\pi^-\,K^-\,K^0_S\,\pi^0$	$(9.3\pm3.3) \times 10^{-4}$		4844
$3\pi^+3\pi^-$	$(1.9\pm0.6) \times 10^{-4}$		4921
$3\pi^+3\pi^-2\pi^0$	$(1.7\pm0.5) \times 10^{-3}$		4898
$3\pi^+3\pi^-\,K^+\,K^-$	$(2.6\pm0.8) \times 10^{-4}$		4844
$3\pi^+3\pi^-\,K^+\,K^-\,\pi^0$	$(7.5\pm2.6) \times 10^{-4}$		4825
$4\pi^+4\pi^-$	$(2.6\pm0.9) \times 10^{-4}$		4897
$4\pi^+4\pi^-2\pi^0$	$(1.4\pm0.6) \times 10^{-3}$		4867
$J/\psi\,J/\psi$	$< 2.7 \times 10^{-5}$	90%	3857
$J/\psi\,\psi(2S)$	$< 1.7 \times 10^{-5}$	90%	3594
$\psi(2S)\psi(2S)$	$< 6 \times 10^{-5}$	90%	3298

$h_b(1P)$

$I^G(J^{PC}) = ?^?(1^{+-})$

Mass $m = 9899.3 \pm 1.0$ MeV

$h_b(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta_b(1S)\gamma$	(49^{+8}_{-7}) %	489

$\chi_{b2}(1P)$ [hhbb]

$I^G(J^{PC}) = 0^+(2^{++})$
J needs confirmation.

Mass $m = 9912.21 \pm 0.26 \pm 0.31$ MeV

$\chi_{b2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\Upsilon(1S)$	(19.1±1.2) %		442
D^0X	< 7.9 %	90%	–
$\pi^+\pi^-K^+K^-\pi^0$	(8 ±5) $\times 10^{-5}$		4902
$2\pi^+\pi^-K^-K^0_S$	< 1.0 $\times 10^{-4}$	90%	4901
$2\pi^+\pi^-K^-K^0_S2\pi^0$	(5.3±2.4) $\times 10^{-4}$		4873
$2\pi^+2\pi^-2\pi^0$	(3.5±1.4) $\times 10^{-4}$		4931
$2\pi^+2\pi^-K^+K^-$	(1.1±0.4) $\times 10^{-4}$		4888
$2\pi^+2\pi^-K^+K^-\pi^0$	(2.1±0.9) $\times 10^{-4}$		4872
$2\pi^+2\pi^-K^+K^-2\pi^0$	(3.9±1.8) $\times 10^{-4}$		4855
$3\pi^+2\pi^-K^-K^0_S\pi^0$	< 5 $\times 10^{-4}$	90%	4854
$3\pi^+3\pi^-$	(7.0±3.1) $\times 10^{-5}$		4931
$3\pi^+3\pi^-2\pi^0$	(1.0±0.4) $\times 10^{-3}$		4908
$3\pi^+3\pi^-K^+K^-$	< 8 $\times 10^{-5}$	90%	4854
$3\pi^+3\pi^-K^+K^-\pi^0$	(3.6±1.5) $\times 10^{-4}$		4835
$4\pi^+4\pi^-$	(8 ±4) $\times 10^{-5}$		4907
$4\pi^+4\pi^-2\pi^0$	(1.8±0.7) $\times 10^{-3}$		4877
$J/\psi J/\psi$	< 4 $\times 10^{-5}$	90%	3869
$J/\psi\psi(2S)$	< 5 $\times 10^{-5}$	90%	3608
$\psi(2S)\psi(2S)$	< 1.6 $\times 10^{-5}$	90%	3313

$\Upsilon(2S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10023.26 \pm 0.31$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV
Full width $\Gamma = 31.98 \pm 2.63$ keV
$\Gamma_{ee} = 0.612 \pm 0.011$ keV

$\Upsilon(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(1S)\pi^+\pi^-$	(17.85± 0.26) %		475
$\Upsilon(1S)\pi^0\pi^0$	(8.6 ± 0.4) %		480
$\tau^+\tau^-$	(2.00± 0.21) %		4686
$\mu^+\mu^-$	(1.93± 0.17) %	S=2.2	5011
e^+e^-	(1.91± 0.16) %		5012
$\Upsilon(1S)\pi^0$	< 4 $\times 10^{-5}$	CL=90%	531
$\Upsilon(1S)\eta$	(2.9 ± 0.4) $\times 10^{-4}$	S=2.0	126
$J/\psi(1S)$ anything	< 6 $\times 10^{-3}$	CL=90%	4533
$\overline{d}$ anything	(3.4 ± 0.6) $\times 10^{-5}$		–
hadrons	(94 ±11) %		–

$g\,g\,g$		(58.8 ± 1.2) %			–
$\gamma\,g\,g$		(8.8 ± 1.1) %			–
$\phi K^+ K^-$		$(1.6 \pm 0.4) \times 10^{-6}$			4910
$\omega\pi^+\pi^-$		$< 2.58 \times 10^{-6}$		CL=90%	4977
$K^*(892)^0 K^-\pi^+ +$ c.c.		$(2.3 \pm 0.7) \times 10^{-6}$			4952
$\phi f_2'(1525)$		$< 1.33 \times 10^{-6}$		CL=90%	4841
$\omega f_2(1270)$		$< 5.7 \times 10^{-7}$		CL=90%	4899
$\rho(770) a_2(1320)$		$< 8.8 \times 10^{-7}$		CL=90%	4894
$K^*(892)^0 \overline{K}_2^*(1430)^0 +$ c.c.		$(1.5 \pm 0.6) \times 10^{-6}$			4869
$K_1(1270)^\pm K^\mp$		$< 3.22 \times 10^{-6}$		CL=90%	4918
$K_1(1400)^\pm K^\mp$		$< 8.3 \times 10^{-7}$		CL=90%	4901
$b_1(1235)^\pm \pi^\mp$		$< 4.0 \times 10^{-7}$		CL=90%	4935
$\rho\pi$		$< 1.16 \times 10^{-6}$		CL=90%	4981
$\pi^+\pi^-\pi^0$		$< 8.0 \times 10^{-7}$		CL=90%	5007
$\omega\pi^0$		$< 1.63 \times 10^{-6}$		CL=90%	4980
$\pi^+\pi^-\pi^0\pi^0$		$(1.30 \pm 0.28) \times 10^{-5}$			5002
$K_S^0 K^+\pi^- +$ c.c.		$(1.14 \pm 0.33) \times 10^{-6}$			4979
$K^*(892)^0 \overline{K}^0 +$ c.c.		$< 4.22 \times 10^{-6}$		CL=90%	4959
$K^*(892)^- K^+ +$ c.c.		$< 1.45 \times 10^{-6}$		CL=90%	4960
Sum of 100 exclusive modes		$(2.90 \pm 0.30) \times 10^{-3}$			–

Radiative decays

$\gamma\chi_{b1}(1P)$		(6.9 ± 0.4) %			130
$\gamma\chi_{b2}(1P)$		(7.15 ± 0.35) %			110
$\gamma\chi_{b0}(1P)$		(3.8 ± 0.4) %			162
$\gamma f_0(1710)$		$< 5.9 \times 10^{-4}$		CL=90%	4864
$\gamma f_2'(1525)$		$< 5.3 \times 10^{-4}$		CL=90%	4896
$\gamma f_2(1270)$		$< 2.41 \times 10^{-4}$		CL=90%	4931
$\gamma\eta_c(1S)$		$< 2.7 \times 10^{-5}$		CL=90%	4568
$\gamma\chi_{c0}$		$< 1.0 \times 10^{-4}$		CL=90%	4430
$\gamma\chi_{c1}$		$< 3.6 \times 10^{-6}$		CL=90%	4397
$\gamma\chi_{c2}$		$< 1.5 \times 10^{-5}$		CL=90%	4381
$\gamma X(3872) \to \pi^+\pi^- J/\psi$		$< 8 \times 10^{-7}$		CL=90%	–
$\gamma X(3872) \to \pi^+\pi^-\pi^0 J/\psi$		$< 2.4 \times 10^{-6}$		CL=90%	–
$\gamma\chi_{c0}(2P) \to \omega J/\psi$		$< 2.8 \times 10^{-6}$		CL=90%	–
$\gamma X(4140) \to \phi J/\psi$		$< 1.2 \times 10^{-6}$		CL=90%	–
$\gamma X(4350) \to \phi J/\psi$		$< 1.3 \times 10^{-6}$		CL=90%	–
$\gamma\eta_b(1S)$		$(3.9 \pm 1.5) \times 10^{-4}$			606
$\gamma\eta_b(1S) \to \gamma$Sum of 26 exclusive modes		$< 3.7 \times 10^{-6}$		CL=90%	–
$\gamma X_{b\overline{b}} \to \gamma$Sum of 26 exclusive modes		$< 4.9 \times 10^{-6}$		CL=90%	–
$\gamma X \to \gamma +\geq 4$ prongs	[*iibb*]	$< 1.95 \times 10^{-4}$		CL=95%	–
$\gamma A^0 \to \gamma$hadrons		$< 8 \times 10^{-5}$		CL=90%	–
$\gamma a_1^0 \to \gamma\mu^+\mu^-$		$< 8.3 \times 10^{-6}$		CL=90%	–

Lepton Family number (*LF*) violating modes

$e^\pm\tau^\mp$	*LF*	$< 3.2 \times 10^{-6}$		CL=90%	4854
$\mu^\pm\tau^\mp$	*LF*	$< 3.3 \times 10^{-6}$		CL=90%	4854

$\Upsilon(1D)$

$I^G(J^{PC}) = 0^-(2^{--})$

Mass $m = 10163.7 \pm 1.4$ MeV (S = 1.7)

$\Upsilon(1D)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma\,\Upsilon(1S)$	seen	679
$\gamma\chi_{bJ}(1P)$	seen	300
$\eta\,\Upsilon(1S)$	not seen	426
$\pi^+\pi^-\,\Upsilon(1S)$	$(6.6\pm1.6)\times10^{-3}$	623

$\chi_{b0}(2P)$ [hhbb]

$I^G(J^{PC}) = 0^+(0^{++})$
J needs confirmation.

Mass $m = 10232.5 \pm 0.4 \pm 0.5$ MeV

$\chi_{b0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(2S)$	(4.6 ± 2.1) %		207
$\gamma\,\Upsilon(1S)$	$(9\ \pm6\ )\times10^{-3}$		743
D^0X	< 8.2 %	90%	–
$\pi^+\pi^-K^+K^-\pi^0$	$< 3.4 \times10^{-5}$	90%	5064
$2\pi^+\pi^-K^-K^0_S$	$< 5 \times10^{-5}$	90%	5063
$2\pi^+\pi^-K^-K^0_S2\pi^0$	$< 2.2 \times10^{-4}$	90%	5036
$2\pi^+2\pi^-2\pi^0$	$< 2.4 \times10^{-4}$	90%	5092
$2\pi^+2\pi^-K^+K^-$	$< 1.5 \times10^{-4}$	90%	5050
$2\pi^+2\pi^-K^+K^-\pi^0$	$< 2.2 \times10^{-4}$	90%	5035
$2\pi^+2\pi^-K^+K^-2\pi^0$	$< 1.1 \times10^{-3}$	90%	5019
$3\pi^+2\pi^-K^-K^0_S\pi^0$	$< 7 \times10^{-4}$	90%	5018
$3\pi^+3\pi^-$	$< 7 \times10^{-5}$	90%	5091
$3\pi^+3\pi^-2\pi^0$	$< 1.2 \times10^{-3}$	90%	5070
$3\pi^+3\pi^-K^+K^-$	$< 1.5 \times10^{-4}$	90%	5017
$3\pi^+3\pi^-K^+K^-\pi^0$	$< 7 \times10^{-4}$	90%	4999
$4\pi^+4\pi^-$	$< 1.7 \times10^{-4}$	90%	5069
$4\pi^+4\pi^-2\pi^0$	$< 6 \times10^{-4}$	90%	5039

$\chi_{b1}(2P)$ [hhbb]

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Mass $m = 10255.46 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$ MeV

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(\ 1.63^{+0.40}_{-0.34}\ )$ %		135
$\gamma\,\Upsilon(2S)$	$(19.9\ \pm1.9\ )$ %		230
$\gamma\,\Upsilon(1S)$	$(\ 9.2\ \pm0.8\ )$ %	1.1	764
$\pi\pi\,\chi_{b1}(1P)$	$(\ 9.1\ \pm1.3\ )\times10^{-3}$		238
D^0X	$(\ 8.8\ \pm1.7\ )$ %		–
$\pi^+\pi^-K^+K^-\pi^0$	$(\ 3.1\ \pm1.0\ )\times10^{-4}$		5075
$2\pi^+\pi^-K^-K^0_S$	$(\ 1.1\ \pm0.5\ )\times10^{-4}$		5075
$2\pi^+\pi^-K^-K^0_S2\pi^0$	$(\ 7.7\ \pm3.2\ )\times10^{-4}$		5047
$2\pi^+2\pi^-2\pi^0$	$(\ 5.9\ \pm2.0\ )\times10^{-4}$		5104

$2\pi^+ 2\pi^- K^+ K^-$	$(10 \pm 4) \times 10^{-5}$	5062
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	5047
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(10 \pm 4) \times 10^{-4}$	5030
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	5029
$3\pi^+ 3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	5103
$3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	5081
$3\pi^+ 3\pi^- K^+ K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	5029
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	5011
$4\pi^+ 4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	5080
$4\pi^+ 4\pi^- 2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	5051

$\chi_{b2}(2P)$ [hhbb]

$I^G(J^{PC}) = 0^+(2^{++})$
J needs confirmation.

Mass $m = 10268.65 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.5 \pm 0.6$ MeV

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30})$ %		194
$\gamma \Upsilon(2S)$	(10.6 ± 2.6) %	S=2.0	242
$\gamma \Upsilon(1S)$	(7.0 ± 0.7) %		777
$\pi\pi\chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$		229
$D^0 X$	< 2.4 %	CL=90%	–
$\pi^+\pi^- K^+ K^- \pi^0$	$< 1.1 \times 10^{-4}$	CL=90%	5082
$2\pi^+\pi^- K^- K^0_S$	$< 9 \times 10^{-5}$	CL=90%	5082
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$< 7 \times 10^{-4}$	CL=90%	5054
$2\pi^+ 2\pi^- 2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$		5110
$2\pi^+ 2\pi^- K^+ K^-$	$(9 \pm 4) \times 10^{-5}$		5068
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$		5054
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$		5037
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$< 4 \times 10^{-4}$	CL=90%	5036
$3\pi^+ 3\pi^-$	$(9 \pm 4) \times 10^{-5}$		5110
$3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		5088
$3\pi^+ 3\pi^- K^+ K^-$	$(1.4 \pm 0.7) \times 10^{-4}$		5036
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$		5017
$4\pi^+ 4\pi^-$	$(9 \pm 5) \times 10^{-5}$		5087
$4\pi^+ 4\pi^- 2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$		5058

$\Upsilon(3S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10355.2 \pm 0.5$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV
Full width $\Gamma = 20.32 \pm 1.85$ keV
$\Gamma_{ee} = 0.443 \pm 0.008$ keV

$\Upsilon(3S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(2S)$ anything	(10.6 ± 0.8) %		296
$\Upsilon(2S)\pi^+\pi^-$	(2.82 ± 0.18) %	S=1.6	177
$\Upsilon(2S)\pi^0\pi^0$	(1.85 ± 0.14) %		190
$\Upsilon(2S)\gamma\gamma$	(5.0 ± 0.7) %		327
$\Upsilon(2S)\pi^0$	$< 5.1 \times 10^{-4}$	CL=90%	298
$\Upsilon(1S)\pi^+\pi^-$	(4.37 ± 0.08) %		813

$\Upsilon(1S)\pi^0\pi^0$	(2.20±0.13) %			816
$\Upsilon(1S)\eta$	< 1	$\times 10^{-4}$	CL=90%	677
$\Upsilon(1S)\pi^0$	< 7	$\times 10^{-5}$	CL=90%	846
$h_b(1P)\pi^0$	< 1.2	$\times 10^{-3}$	CL=90%	426
$h_b(1P)\pi^0 \to \gamma\eta_b(1S)\pi^0$	(4.3 ±1.4)	$\times 10^{-4}$		–
$h_b(1P)\pi^+\pi^-$	< 1.2	$\times 10^{-4}$	CL=90%	353
$\tau^+\tau^-$	(2.29±0.30) %			4863
$\mu^+\mu^-$	(2.18±0.21) %		S=2.1	5177
e^+e^-	seen			5178
ggg	(35.7 ±2.6) %			–
γgg	(9.7 ±1.8)	$\times 10^{-3}$		–
Radiative decays				
$\gamma\chi_{b2}(2P)$	(13.1 ±1.6) %		S=3.4	86
$\gamma\chi_{b1}(2P)$	(12.6 ±1.2) %		S=2.4	99
$\gamma\chi_{b0}(2P)$	(5.9 ±0.6) %		S=1.4	122
$\gamma\chi_{b2}(1P)$	(9.9 ±1.3)	$\times 10^{-3}$	S=2.0	434
$\gamma A^0 \to \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%	–
$\gamma\chi_{b1}(1P)$	(9 ±5)	$\times 10^{-4}$	S=1.9	452
$\gamma\chi_{b0}(1P)$	(2.7 ±0.4)	$\times 10^{-3}$		484
$\gamma\eta_b(2S)$	< 6.2	$\times 10^{-4}$	CL=90%	350
$\gamma\eta_b(1S)$	(5.1 ±0.7)	$\times 10^{-4}$		913
$\gamma X \to \gamma +\geq 4$ prongs	[*jjbb*] < 2.2	$\times 10^{-4}$	CL=95%	–
$\gamma a_1^0 \to \gamma\mu^+\mu^-$	< 5.5	$\times 10^{-6}$	CL=90%	–
$\gamma a_1^0 \to \gamma\tau^+\tau^-$	[*kkbb*] < 1.6	$\times 10^{-4}$	CL=90%	–
Lepton Family number (*LF*) violating modes				
$e^\pm\tau^\mp$	*LF* < 4.2	$\times 10^{-6}$	CL=90%	5025
$\mu^\pm\tau^\mp$	*LF* < 3.1	$\times 10^{-6}$	CL=90%	5025

$\chi_b(3P)$

$I^G(J^{PC}) = ?^?(?^{?+})$

Mass $m = 10534 \pm 9$ MeV

$\chi_b(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\gamma$	seen	1019
$\Upsilon(2S)\gamma$	seen	498

$\Upsilon(4S)$ or $\Upsilon(10580)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10579.4 \pm 1.2$ MeV
Full width $\Gamma = 20.5 \pm 2.5$ MeV
$\Gamma_{ee} = 0.272 \pm 0.029$ keV (S = 1.5)

$\Upsilon(4S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}$	> 96 %	95%	327
B^+B^-	(51.4 ±0.6) %		332
D_s^+ anything + c.c.	(17.8 ±2.6) %		–
$B^0\overline{B}^0$	(48.6 ±0.6) %		327
$J/\psi K_S^0(J/\psi,\ \eta_c)K_S^0$	< 4	$\times 10^{-7}$ 90%	–
non-$B\overline{B}$	< 4 %	95%	–
e^+e^-	(1.57±0.08)	$\times 10^{-5}$	5290

$\rho^+\rho^-$	< 5.7	$\times 10^{-6}$	90%	5233
$K^*(892)^0\overline{K}^0$	< 2.0	$\times 10^{-6}$	90%	5240
$J/\psi(1S)$ anything	< 1.9	$\times 10^{-4}$	95%	–
D^{*+} anything + c.c.	< 7.4	%	90%	5099
ϕ anything	(7.1 ± 0.6) %			5240
$\phi\eta$	< 1.8	$\times 10^{-6}$	90%	5226
$\phi\eta'$	< 4.3	$\times 10^{-6}$	90%	5196
$\rho\eta$	< 1.3	$\times 10^{-6}$	90%	5247
$\rho\eta'$	< 2.5	$\times 10^{-6}$	90%	5217
$\Upsilon(1S)$ anything	< 4	$\times 10^{-3}$	90%	1053
$\Upsilon(1S)\pi^+\pi^-$	$(8.1 \pm 0.6) \times 10^{-5}$			1026
$\Upsilon(1S)\eta$	$(1.96 \pm 0.28) \times 10^{-4}$			924
$\Upsilon(2S)\pi^+\pi^-$	$(8.6 \pm 1.3) \times 10^{-5}$			468
$h_b(1P)\pi^+\pi^-$	not seen			600
$\overline{d}$ anything	< 1.3	$\times 10^{-5}$	90%	–

$\Upsilon(10860)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10876 \pm 11$ MeV
Full width $\Gamma = 55 \pm 28$ MeV
$\Gamma_{ee} = 0.31 \pm 0.07$ keV (S = 1.3)

$\Upsilon(10860)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}X$	$(76.2 \, ^{+2.7}_{-4.0})$ %		–
$B\overline{B}$	(5.5 ± 1.0) %		1303
$B\overline{B}^* +$ c.c.	(13.7 ± 1.6) %		–
$B^*\overline{B}^*$	(38.1 ± 3.4) %		1102
$B\overline{B}^{(*)}\pi$	< 19.7 %	90%	990
$B\overline{B}\pi$	(0.0 ± 1.2) %		990
$B^*\overline{B}\pi + B\overline{B}^*\pi$	(7.3 ± 2.3) %		–
$B^*\overline{B}^*\pi$	(1.0 ± 1.4) %		701
$B\overline{B}\pi\pi$	< 8.9 %	90%	504
$B_s^{(*)}\overline{B}_s^{(*)}$	(20.1 ± 3.1) %		877
$B_s\overline{B}_s$	$(5 \pm 5) \times 10^{-3}$		877
$B_s\overline{B}_s^* +$ c.c.	(1.35 ± 0.32) %		–
$B_s^*\overline{B}_s^*$	(17.6 ± 2.7) %		495
no open-bottom	$(3.8 \, ^{+5.0}_{-0.5})$ %		–
e^+e^-	$(5.6 \pm 3.1) \times 10^{-6}$		5438
$K^*(892)^0\overline{K}^0$	$< 1.0 \times 10^{-5}$	90%	5390
$\Upsilon(1S)\pi^+\pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$		1297
$\Upsilon(2S)\pi^+\pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$		774
$\Upsilon(3S)\pi^+\pi^-$	$(4.8 \, ^{+1.9}_{-1.7}) \times 10^{-3}$		429
$\Upsilon(1S)K^+K^-$	$(6.1 \pm 1.8) \times 10^{-4}$		947
$h_b(1P)\pi^+\pi^-$	$(3.5 \, ^{+1.0}_{-1.3}) \times 10^{-3}$		894
$h_b(2P)\pi^+\pi^-$	$(6.0 \, ^{+2.1}_{-1.8}) \times 10^{-3}$		534

Inclusive Decays.

These decay modes are submodes of one or more of the decay modes above.

ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %	–
D^0 anything + c.c.	(108 ±8) %	–
D_s anything + c.c.	(46 ±6) %	–
J/ψ anything	(2.06±0.21) %	–
B^0 anything + c.c.	(77 ±8) %	–
B^+ anything + c.c.	(72 ±6) %	–

$\Upsilon(11020)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 11019 \pm 8$ MeV
Full width $\Gamma = 79 \pm 16$ MeV
$\Gamma_{ee} = 0.130 \pm 0.030$ keV

$\Upsilon(11020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$e^+ e^-$	$(1.6\pm0.5)\times10^{-6}$	5510

NOTES

In this Summary Table:

When a quantity has "(S = ...)" to its right, the error on the quantity has been enlarged by the "scale factor" S, defined as $S = \sqrt{\chi^2/(N-1)}$, where N is the number of measurements used in calculating the quantity. We do this when $S > 1$, which often indicates that the measurements are inconsistent. When $S > 1.25$, we also show in the Particle Listings an ideogram of the measurements. For more about S, see the Introduction.

A decay momentum p is given for each decay mode. For a 2-body decay, p is the momentum of each decay product in the rest frame of the decaying particle. For a 3-or-more-body decay, p is the largest momentum any of the products can have in this frame.

[*a*] See the "Note on $\pi^\pm \to \ell^\pm \nu\gamma$ and $K^\pm \to \ell^\pm \nu\gamma$ Form Factors" in the $\pi^\pm$ Particle Listings in the Full *Review of Particle Physics* for definitions and details.

[*b*] Measurements of $\Gamma(e^+\nu_e)/\Gamma(\mu^+\nu_\mu)$ always include decays with γ's, and measurements of $\Gamma(e^+\nu_e\gamma)$ and $\Gamma(\mu^+\nu_\mu\gamma)$ never include low-energy γ's. Therefore, since no clean separation is possible, we consider the modes with γ's to be subreactions of the modes without them, and let $[\Gamma(e^+\nu_e) + \Gamma(\mu^+\nu_\mu)]/\Gamma_{\text{total}} = 100\%$.

[*c*] See the $\pi^\pm$ Particle Listings in the Full *Review of Particle Physics* for the energy limits used in this measurement; low-energy γ's are not included.

[*d*] Derived from an analysis of neutrino-oscillation experiments.

[*e*] Astrophysical and cosmological arguments give limits of order 10^{-13}; see the π^0 Particle Listings in the Full *Review of Particle Physics*.

[*f*] C parity forbids this to occur as a single-photon process.

[*g*] See the "Note on scalar mesons" in the $f_0(500)$ Particle Listings in the Full *Review of Particle Physics*. The interpretation of this entry as a particle is controversial.

[*h*] See the "Note on $\rho(770)$" in the $\rho(770)$ Particle Listings in the Full *Review of Particle Physics*.

[*i*] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \to \mu^+\mu^-) = \Gamma(\rho^0 \to e^+e^-) \times 0.99785$.

[*j*] See the "Note on scalar mesons" in the $f_0(500)$ Particle Listings in the Full *Review of Particle Physics*.

[*k*] See the "Note on $a_1(1260)$" in the $a_1(1260)$ Particle Listings in PDG 06, Journal of Physics (generic for all A,B,E,G) **G33** 1 (2006).

[*l*] This is only an educated guess; the error given is larger than the error on the average of the published values. See the Particle Listings in the Full *Review of Particle Physics* for details.

[*n*] See the "Note on non-$q\overline{q}$ mesons" in the Particle Listings in PDG 06, Journal of Physics (generic for all A,B,E,G) **G33** 1 (2006).

[*o*] See the "Note on the $\eta(1405)$" in the $\eta(1405)$ Particle Listings in the Full *Review of Particle Physics*.

[*p*] See the "Note on the $f_1(1420)$" in the $\eta(1405)$ Particle Listings in the Full *Review of Particle Physics*.

[*q*] See also the $\omega(1650)$ Particle Listings.

[*r*] See the "Note on the $\rho(1450)$ and the $\rho(1700)$" in the $\rho(1700)$ Particle Listings in the Full *Review of Particle Physics*.

[*s*] See also the $\omega(1420)$ Particle Listings.

[*t*] See the "Note on $f_0(1710)$" in the $f_0(1710)$ Particle Listings in 2004 edition of *Review of Particle Physics*.

[*u*] See the note in the $K^{\pm}$ Particle Listings in the Full *Review of Particle Physics*.

[*v*] The definition of the slope parameter g of the $K \to 3\pi$ Dalitz plot is as follows (see also "Note on Dalitz Plot Parameters for $K \to 3\pi$ Decays" in the $K^{\pm}$ Particle Listings in the Full *Review of Particle Physics*):

$$|M|^2 = 1 + g(s_3 - s_0)/m^2_{\pi^+} + \cdots .$$

[*x*] For more details and definitions of parameters see Particle Listings in the Full *Review of Particle Physics*.

[*y*] See the $K^{\pm}$ Particle Listings in the Full *Review of Particle Physics* for the energy limits used in this measurement.

[*z*] Most of this radiative mode, the low-momentum γ part, is also included in the parent mode listed without γ's.

[*aa*] Structure-dependent part.

[*bb*] Direct-emission branching fraction.

[*cc*] Violates angular-momentum conservation.

[*dd*] Derived from measured values of ϕ_{+-}, ϕ_{00}, $|\eta|$, $|m_{K^0_L} - m_{K^0_S}|$, and $\tau_{K^0_S}$, as described in the introduction to "Tests of Conservation Laws."

[*ee*] The *CP*-violation parameters are defined as follows (see also "Note on *CP* Violation in $K_S \to 3\pi$" and "Note on *CP* Violation in K^0_L Decay" in the Particle Listings in the Full *Review of Particle Physics*):

$$\eta_{+-} = |\eta_{+-}|e^{i\phi_{+-}} = \frac{A(K^0_L \to \pi^+\pi^-)}{A(K^0_S \to \pi^+\pi^-)} = \epsilon + \epsilon'$$

$$\eta_{00} = |\eta_{00}|e^{i\phi_{00}} = \frac{A(K^0_L \to \pi^0\pi^0)}{A(K^0_S \to \pi^0\pi^0)} = \epsilon - 2\epsilon'$$

$$\delta = \frac{\Gamma(K^0_L \to \pi^-\ell^+\nu) - \Gamma(K^0_L \to \pi^+\ell^-\nu)}{\Gamma(K^0_L \to \pi^-\ell^+\nu) + \Gamma(K^0_L \to \pi^+\ell^-\nu)} ,$$

$$\mathrm{Im}(\eta_{+-0})^2 = \frac{\Gamma(K^0_S \to \pi^+\pi^-\pi^0)^{CP \text{ viol.}}}{\Gamma(K^0_L \to \pi^+\pi^-\pi^0)} ,$$

$$\mathrm{Im}(\eta_{000})^2 = \frac{\Gamma(K^0_S \to \pi^0\pi^0\pi^0)}{\Gamma(K^0_L \to \pi^0\pi^0\pi^0)} .$$

where for the last two relations *CPT* is assumed valid, *i.e.*, $\mathrm{Re}(\eta_{+-0}) \simeq 0$ and $\mathrm{Re}(\eta_{000}) \simeq 0$.

[*ff*] See the K^0_S Particle Listings in the Full *Review of Particle Physics* for the energy limits used in this measurement.

[*gg*] The value is for the sum of the charge states or particle/antiparticle states indicated.

[*hh*] $\mathrm{Re}(\epsilon'/\epsilon) = \epsilon'/\epsilon$ to a very good approximation provided the phases satisfy *CPT* invariance.

[*ii*] This mode includes gammas from inner bremsstrahlung but not the direct emission mode $K^0_L \to \pi^+\pi^-\gamma$(DE).

[*jj*] See the K^0_L Particle Listings in the Full *Review of Particle Physics* for the energy limits used in this measurement.

[*kk*] Allowed by higher-order electroweak interactions.

[*ll*] Violates *CP* in leading order. Test of direct *CP* violation since the indirect *CP*-violating and *CP*-conserving contributions are expected to be suppressed.

[*nn*] See the "Note on $f_0(1370)$" in the $f_0(1370)$ Particle Listings in the Full *Review of Particle Physics* and in the 1994 edition.

[*oo*] See the note in the $L(1770)$ Particle Listings in Reviews of Modern Physics **56** S1 (1984), p. S200. See also the "Note on $K_2(1770)$ and the $K_2(1820)$" in the $K_2(1770)$ Particle Listings in the Full *Review of Particle Physics*.

[*pp*] See the "Note on $K_2(1770)$ and the $K_2(1820)$" in the $K_2(1770)$ Particle Listings in the Full *Review of Particle Physics*.

[*qq*] This result applies to $Z^0 \to c\overline{c}$ decays only. Here ℓ^+ is an average (not a sum) of e^+ and μ^+ decays.

[*rr*] See the Particle Listings for the (complicated) definition of this quantity.

[*ss*] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers in the Particle Listings in the Full *Review of Particle Physics*.

[*tt*] These subfractions of the $K^-2\pi^+$ mode are uncertain: see the Particle Listings.

[*uu*] Submodes of the $D^+ \to K^-2\pi^+\pi^0$ and $K^0_S2\pi^+\pi^-$ modes were studied by ANJOS 92C and COFFMAN 92B, but with at most 142 events for the first mode and 229 for the second – not enough for precise results. With nothing new for 18 years, we refer to our 2008 edition, Physics Letters **B667** 1 (2008), for those results.

[*vv*] The unseen decay modes of the resonances are included.

[*xx*] This is *not* a test for the ΔC=1 weak neutral current, but leads to the $\pi^+\ell^+\ell^-$ final state.

[*yy*] This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

[*zz*] In the 2010 *Review*, the values for these quantities were given using a measure of the asymmetry that was inconsistent with the usual definition.

[*aaa*] This value is obtained by subtracting the branching fractions for 2-, 4- and 6-prongs from unity.

[*bbb*] This is the sum of our $K^-2\pi^+\pi^-$, $K^-2\pi^+\pi^-\pi^0$, $\overline{K}^02\pi^+2\pi^-$, $K^+2K^-\pi^+$, $2\pi^+2\pi^-$, $2\pi^+2\pi^-\pi^0$, $K^+K^-\pi^+\pi^-$, and $K^+K^-\pi^+\pi^-\pi^0$, branching fractions.

[*ccc*] This is the sum of our $K^-3\pi^+2\pi^-$ and $3\pi^+3\pi^-$ branching fractions.

[*ddd*] The branching fractions for the $K^-e^+\nu_e$, $K^*(892)^-e^+\nu_e$, $\pi^-e^+\nu_e$, and $\rho^-e^+\nu_e$ modes add up to 6.19 ± 0.17 %.

[*eee*] This is a doubly Cabibbo-suppressed mode.

[*fff*] The two experiments measuring this fraction are in serious disagreement. See the Particle Listings in the Full *Review of Particle Physics*.

[*ggg*] Submodes of the $D^0 \to K^0_S\pi^+\pi^-\pi^0$ mode with a K^* and/or ρ were studied by COFFMAN 92B, but with only 140 events. With nothing new for 18 years, we refer to our 2008 edition, Physics Letters **B667** 1 (2008), for those results.

[*hhh*] This branching fraction includes all the decay modes of the resonance in the final state.

[*iii*] This limit is for either D^0 or $\overline{D}^0$ to pe^-.

[*jjj*] This limit is for either D^0 or $\overline{D}^0$ to $\overline{p}e^+$.

[*kkk*] This is the purely e^+ semileptonic branching fraction: the e^+ fraction from τ^+ decays has been subtracted off. The sum of our (non-τ) e^+ exclusive fractions — an $e^+\nu_e$ with an η, η', ϕ, K^0, K^{*0}, or $f_0(980)$ — is 7.0 ± 0.4 %

[*lll*] This fraction includes η from η' decays.

[*nnn*] Two times (to include μ decays) the $\eta' e^+\nu_e$ branching fraction, plus the $\eta'\pi^+$, $\eta'\rho^+$, and $\eta' K^+$ fractions, is (18.6 ± 2.3)%, which considerably exceeds the inclusive η' fraction of (11.7 ± 1.8)%. Our best guess is that the $\eta'\rho^+$ fraction, (12.5 ± 2.2)%, is too large.

[*ooo*] This branching fraction includes all the decay modes of the final-state resonance.

[*ppp*] A test for $u\overline{u}$ or $d\overline{d}$ content in the D_s^+. Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and ω–ϕ mixing is an unlikely explanation for any fraction above about 2×10^{-4}.

[*qqq*] We decouple the $D_s^+ \to \phi\pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \to \phi\pi^+$, $\phi \to K^+K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \to K^+K^-\pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \to K^+K^-$ branching fraction 0.491.

[*rrr*] This is the average of a model-independent and a *K*-matrix parametrization of the $\pi^+\pi^-$ *S*-wave and is a sum over several f_0 mesons.

[*sss*] An ℓ indicates an e or a μ mode, not a sum over these modes.

[*ttt*] An *CP*(±1) indicates the *CP*=+1 and *CP*=−1 eigenstates of the D^0-$\overline{D}^0$ system.

[*uuu*] D denotes D^0 or $\overline{D}^0$.

[*vvv*] D^{*0}_{CP+} decays into $D^0\pi^0$ with the D^0 reconstructed in *CP*-even eigenstates K^+K^- and $\pi^+\pi^-$.

[*xxx*] $\overline{D}^{**}$ represents an excited state with mass $2.2 < M < 2.8$ GeV/c^2.

[*yyy*] $X(3872)^+$ is a hypothetical charged partner of the $X(3872)$.

[*zzz*] $\Theta(1710)^{++}$ is a possible narrow pentaquark state and $G(2220)$ is a possible glueball resonance.

[*aaaa*] $(\overline{\Lambda}_c^- p)_s$ denotes a low-mass enhancement near 3.35 GeV/c^2.

[*bbaa*] Stands for the possible candidates of $K^*(1410)$, $K_0^*(1430)$ and $K_2^*(1430)$.

[*ccaa*] B^0 and B_s^0 contributions not separated. Limit is on weighted average of the two decay rates.

[*ddaa*] This decay refers to the coherent sum of resonant and nonresonant $J^P = 0^+$ $K\pi$ components with $1.60 < m_{K\pi} < 2.15$ GeV/c^2.

[*eeaa*] $X(214)$ is a hypothetical particle of mass 214 MeV/c^2 reported by the HyperCP experiment, Physical Review Letters **94** 021801 (2005)

[*ffaa*] $\Theta(1540)^+$ denotes a possible narrow pentaquark state.

[*ggaa*] Here *S* and *P* are the hypothetical scalar and pseudoscalar particles with masses of 2.5 GeV/c^2 and 214.3 MeV/c^2, respectively.

[*hhaa*] These values are model dependent.

[*iiaa*] Here "anything" means at least one particle observed.

[*jjaa*] This is a B($B^0 \to D^{*-}\ell^+\nu_\ell$) value.

[*kkaa*] D^{**} stands for the sum of the $D(1\,^1P_1)$, $D(1\,^3P_0)$, $D(1\,^3P_1)$, $D(1\,^3P_2)$, $D(2\,^1S_0)$, and $D(2\,^1S_1)$ resonances.

[*llaa*] $D^{(*)}\overline{D}^{(*)}$ stands for the sum of $D^*\overline{D}^*$, $D^*\overline{D}$, $D\overline{D}^*$, and $D\overline{D}$.

[*nnaa*] $X(3915)$ denotes a near-threshold enhancement in the $\omega J/\psi$ mass spectrum.

[*ooaa*] Inclusive branching fractions have a multiplicity definition and can be greater than 100%.

[*ppaa*] D_J represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states.

[*qqaa*] Not a pure measurement. See note at head of B_s^0 Decay Modes.

[*rraa*] For $E_\gamma > 100$ MeV.

[*ssaa*] Includes $p\overline{p}\pi^+\pi^-\gamma$ and excludes $p\overline{p}\eta$, $p\overline{p}\omega$, $p\overline{p}\eta'$.

[*ttaa*] For a narrow state A with mass less than 960 MeV.

[*uuaa*] For a narrow scalar or pseudoscalar A^0 with mass 0.21–3.0 GeV.

[*vvaa*] For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

[*xxaa*] BHARDWAJ 11 does not observe this decay and presents a stronger 90% CL limit than this value. See measurements listings for details.

[*yyaa*] J^{PC} known by production in e^+e^- via single photon annihilation. I^G is not known; interpretation of this state as a single resonance is unclear because of the expectation of substantial threshold effects in this energy region.

[*zzaa*] $2m_\tau < \mathrm{M}(\tau^+\tau^-) < 9.2$ GeV

[*aabb*] 2 GeV $< m_{K^+K^-} < 3$ GeV

[*bbbb*] X = scalar with $m < 8.0$ GeV

[*ccbb*] $X\overline{X}$ = vectors with $m < 3.1$ GeV

[*ddbb*] X and $\overline{X}$ = zero spin with $m < 4.5$ GeV

[*eebb*] 1.5 GeV $< m_X < 5.0$ GeV

[*ffbb*] 201 MeV $< \mathrm{M}(\mu^+\mu^-) < 3565$ MeV

[*ggbb*] 0.5 GeV $< m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

[*hhbb*] Spectroscopic labeling for these states is theoretical, pending experimental information.

[*iibb*] 1.5 GeV $< m_X < 5.0$ GeV

[*jjbb*] 1.5 GeV $< m_X < 5.0$ GeV

[*kkbb*] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

N BARYONS ($S = 0$, $I = 1/2$)

p, $N^+ = uud$; n, $N^0 = udd$

p

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

Mass $m = 1.00727646681 \pm 0.00000000009$ u
Mass $m = 938.272046 \pm 0.000021$ MeV [a]
$|m_p - m_{\overline{p}}|/m_p < 7 \times 10^{-10}$, CL = 90% [b]
$|\frac{q_{\overline{p}}}{m_{\overline{p}}}|/(\frac{q_p}{m_p}) = 0.99999999991 \pm 0.00000000009$
$|q_p + q_{\overline{p}}|/e < 7 \times 10^{-10}$, CL = 90% [b]
$|q_p + q_e|/e < 1 \times 10^{-21}$ [c]
Magnetic moment $\mu = 2.792847356 \pm 0.000000023\ \mu_N$
$(\mu_p + \mu_{\overline{p}}) / \mu_p = (0 \pm 5) \times 10^{-6}$
Electric dipole moment $d < 0.54 \times 10^{-23}\ e$ cm
Electric polarizability $\alpha = (11.2 \pm 0.4) \times 10^{-4}$ fm^3
Magnetic polarizability $\beta = (2.5 \pm 0.4) \times 10^{-4}$ fm^3 (S = 1.2)
Charge radius, μp Lamb shift = 0.84087 ± 0.00039 fm [d]
Charge radius, $e p$ CODATA value = 0.8775 ± 0.0051 fm [d]
Magnetic radius = 0.777 ± 0.016 fm
Mean life $\tau > 2.1 \times 10^{29}$ years, CL = 90% [e] ($p \rightarrow$ invisible mode)
Mean life $\tau > 10^{31}$ to 10^{33} years [e] (mode dependent)

See the "Note on Nucleon Decay" in our 1994 edition (Phys. Rev. **D50**, 1173) for a short review.

The "partial mean life" limits tabulated here are the limits on τ/B_i, where τ is the total mean life and B_i is the branching fraction for the mode in question. For N decays, p and n indicate proton and neutron partial lifetimes.

p DECAY MODES	Partial mean life (10^{30} years)	Confidence level	p (MeV/c)
Antilepton + meson			
$N \rightarrow e^+\pi$	$> 2000\ (n)$, $> 8200\ (p)$	90%	459
$N \rightarrow \mu^+\pi$	$> 1000\ (n)$, $> 6600\ (p)$	90%	453
$N \rightarrow \nu\pi$	$> 112\ (n)$, $> 16\ (p)$	90%	459
$p \rightarrow e^+\eta$	> 4200	90%	309
$p \rightarrow \mu^+\eta$	> 1300	90%	297
$n \rightarrow \nu\eta$	> 158	90%	310
$N \rightarrow e^+\rho$	$> 217\ (n)$, $> 710\ (p)$	90%	149
$N \rightarrow \mu^+\rho$	$> 228\ (n)$, $> 160\ (p)$	90%	113
$N \rightarrow \nu\rho$	$> 19\ (n)$, $> 162\ (p)$	90%	149
$p \rightarrow e^+\omega$	> 320	90%	143
$p \rightarrow \mu^+\omega$	> 780	90%	105
$n \rightarrow \nu\omega$	> 108	90%	144
$N \rightarrow e^+K$	$> 17\ (n)$, $> 1000\ (p)$	90%	339
$N \rightarrow \mu^+K$	$> 26\ (n)$, $> 1600\ (p)$	90%	329
$N \rightarrow \nu K$	$> 86\ (n)$, $> 2300\ (p)$	90%	339
$n \rightarrow \nu K^0_S$	> 260	90%	338
$p \rightarrow e^+K^*(892)^0$	> 84	90%	45
$N \rightarrow \nu K^*(892)$	$> 78\ (n)$, $> 51\ (p)$	90%	45

Antilepton + mesons

$p \to e^+\pi^+\pi^-$	> 82	90%	448
$p \to e^+\pi^0\pi^0$	> 147	90%	449
$n \to e^+\pi^-\pi^0$	> 52	90%	449
$p \to \mu^+\pi^+\pi^-$	> 133	90%	425
$p \to \mu^+\pi^0\pi^0$	> 101	90%	427
$n \to \mu^+\pi^-\pi^0$	> 74	90%	427
$n \to e^+K^0\pi^-$	> 18	90%	319

Lepton + meson

$n \to e^-\pi^+$	> 65	90%	459
$n \to \mu^-\pi^+$	> 49	90%	453
$n \to e^-\rho^+$	> 62	90%	150
$n \to \mu^-\rho^+$	> 7	90%	115
$n \to e^-K^+$	> 32	90%	340
$n \to \mu^-K^+$	> 57	90%	330

Lepton + mesons

$p \to e^-\pi^+\pi^+$	> 30	90%	448
$n \to e^-\pi^+\pi^0$	> 29	90%	449
$p \to \mu^-\pi^+\pi^+$	> 17	90%	425
$n \to \mu^-\pi^+\pi^0$	> 34	90%	427
$p \to e^-\pi^+K^+$	> 75	90%	320
$p \to \mu^-\pi^+K^+$	> 245	90%	279

Antilepton + photon(s)

$p \to e^+\gamma$	> 670	90%	469
$p \to \mu^+\gamma$	> 478	90%	463
$n \to \nu\gamma$	> 28	90%	470
$p \to e^+\gamma\gamma$	> 100	90%	469
$n \to \nu\gamma\gamma$	> 219	90%	470

Three (or more) leptons

$p \to e^+e^+e^-$	> 793	90%	469
$p \to e^+\mu^+\mu^-$	> 359	90%	457
$p \to e^+\nu\nu$	> 17	90%	469
$n \to e^+e^-\nu$	> 257	90%	470
$n \to \mu^+e^-\nu$	> 83	90%	464
$n \to \mu^+\mu^-\nu$	> 79	90%	458
$p \to \mu^+e^+e^-$	> 529	90%	463
$p \to \mu^+\mu^+\mu^-$	> 675	90%	439
$p \to \mu^+\nu\nu$	> 21	90%	463
$p \to e^-\mu^+\mu^+$	> 6	90%	457
$n \to 3\nu$	> 0.0005	90%	470

Inclusive modes

$N \to e^+$ anything	> 0.6 (n, p)	90%	–
$N \to \mu^+$ anything	> 12 (n, p)	90%	–
$N \to e^+\pi^0$ anything	> 0.6 (n, p)	90%	–

$\Delta B = 2$ dinucleon modes

The following are lifetime limits per iron nucleus.

$pp \to \pi^+\pi^+$	> 0.7	90%	–
$pn \to \pi^+\pi^0$	> 2	90%	–
$nn \to \pi^+\pi^-$	> 0.7	90%	–
$nn \to \pi^0\pi^0$	> 3.4	90%	–
$pp \to e^+e^+$	> 5.8	90%	–

$p p \to e^+ \mu^+$	> 3.6	90%	–
$p p \to \mu^+ \mu^+$	> 1.7	90%	–
$p n \to e^+ \overline{\nu}$	> 2.8	90%	–
$p n \to \mu^+ \overline{\nu}$	> 1.6	90%	–
$n n \to \nu_e \overline{\nu}_e$	> 1.4	90%	–
$n n \to \nu_\mu \overline{\nu}_\mu$	> 1.4	90%	–
$p n \to$ invisible	> 0.000021	90%	–
$p p \to$ invisible	> 0.00005	90%	–

$\overline{p}$ DECAY MODES

Mode	Partial mean life (years)	Confidence level	p (MeV/c)
$\overline{p} \to e^- \gamma$	$> 7 \times 10^5$	90%	469
$\overline{p} \to \mu^- \gamma$	$> 5 \times 10^4$	90%	463
$\overline{p} \to e^- \pi^0$	$> 4 \times 10^5$	90%	459
$\overline{p} \to \mu^- \pi^0$	$> 5 \times 10^4$	90%	453
$\overline{p} \to e^- \eta$	$> 2 \times 10^4$	90%	309
$\overline{p} \to \mu^- \eta$	$> 8 \times 10^3$	90%	297
$\overline{p} \to e^- K^0_S$	> 900	90%	337
$\overline{p} \to \mu^- K^0_S$	$> 4 \times 10^3$	90%	326
$\overline{p} \to e^- K^0_L$	$> 9 \times 10^3$	90%	337
$\overline{p} \to \mu^- K^0_L$	$> 7 \times 10^3$	90%	326
$\overline{p} \to e^- \gamma\gamma$	$> 2 \times 10^4$	90%	469
$\overline{p} \to \mu^- \gamma\gamma$	$> 2 \times 10^4$	90%	463
$\overline{p} \to e^- \omega$	> 200	90%	143

n

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

Mass $m = 1.0086649160 \pm 0.0000000004$ u
Mass $m = 939.565379 \pm 0.000021$ MeV [a]
$(m_n - m_{\overline{n}})/\ m_n = (9 \pm 6) \times 10^{-5}$
$m_n - m_p = 1.2933322 \pm 0.0000004$ MeV
$= 0.00138844919(45)$ u
Mean life $\tau = 880.3 \pm 1.1$ s (S = 1.9)
$c\tau = 2.6391 \times 10^8$ km
Magnetic moment $\mu = -1.9130427 \pm 0.0000005\ \mu_N$
Electric dipole moment $d < 0.29 \times 10^{-25}\ e$ cm, CL = 90%
Mean-square charge radius $\langle r_n^2 \rangle = -0.1161 \pm 0.0022$ fm^2 (S = 1.3)
Magnetic radius $\sqrt{\langle r_M^2 \rangle} = 0.862^{+0.009}_{-0.008}$ fm
Electric polarizability $\alpha = (11.6 \pm 1.5) \times 10^{-4}$ fm^3
Magnetic polarizability $\beta = (3.7 \pm 2.0) \times 10^{-4}$ fm^3
Charge $q = (-0.2 \pm 0.8) \times 10^{-21}\ e$
Mean $n\overline{n}$-oscillation time $> 8.6 \times 10^7$ s, CL = 90% (free n)
Mean $n\overline{n}$-oscillation time $> 1.3 \times 10^8$ s, CL = 90% [f] (bound n)
Mean nn'-oscillation time > 414 s, CL = 90% [g]

$pe^-\nu_e$ decay parameters [h]

$\lambda \equiv g_A / g_V = -1.2723 \pm 0.0023$ (S = 2.2)
$A = -0.1184 \pm 0.0010$ (S = 2.4)
$B = 0.9807 \pm 0.0030$
$C = -0.2377 \pm 0.0026$
$a = -0.103 \pm 0.004$
$\phi_{AV} = (180.017 \pm 0.026)^\circ$ [i]
$D = (-1.2 \pm 2.0) \times 10^{-4}$ [j]
$R = 0.004 \pm 0.013$ [j]

n DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$pe^-\overline{\nu}_e$	100 %		1
$pe^-\overline{\nu}_e\gamma$	[k] (3.09±0.32) $\times 10^{-3}$		1
Charge conservation (Q) violating mode			
$p\nu_e\overline{\nu}_e$	Q < 8 $\times 10^{-27}$	68%	1

$N(1440)$ 1/2$^+$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

Breit-Wigner mass = 1410 to 1450 (≈ 1430) MeV
Breit-Wigner full width = 250 to 450 (≈ 350) MeV
Re(pole position) = 1350 to 1380 (≈ 1365) MeV
−2Im(pole position) = 160 to 220 (≈ 190) MeV

The following branching fractions are our estimates, not fits or averages.

$N(1440)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	55–75 %	391
$N\eta$	(0.0±1.0) %	†
$N\pi\pi$	30–40 %	338
$\Delta\pi$	20–30 %	135
$\Delta(1232)\pi$, P-wave	15–30 %	135
$N\rho$	<8 %	†
$N\rho$, S=1/2, P-wave	(0.0±1.0) %	†
$N(\pi\pi)^{I=0}_{S\text{-wave}}$	10–20 %	–
$p\gamma$	0.035–0.048 %	407
$p\gamma$, helicity=1/2	0.035–0.048 %	407
$n\gamma$	0.02–0.04 %	406
$n\gamma$, helicity=1/2	0.02–0.04 %	406

$N(1520)$ 3/2$^-$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$

Breit-Wigner mass = 1510 to 1520 (≈ 1515) MeV
Breit-Wigner full width = 100 to 125 (≈ 115) MeV
Re(pole position) = 1505 to 1515 (≈ 1510) MeV
−2Im(pole position) = 105 to 120 (≈ 110) MeV

The following branching fractions are our estimates, not fits or averages.

$N(1520)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	55–65 %	453
$N\eta$	(2.3±0.4) $\times 10^{-3}$	142

$N\pi\pi$	20–30 %	410
$\Delta\pi$	15–25 %	225
$\Delta(1232)\pi$, S-wave	10–20 %	225
$\Delta(1232)\pi$, D-wave	10–15 %	225
$N\rho$	15–25 %	†
$N\rho$, S=3/2, S-wave	(9.0±1.0) %	†
$N(\pi\pi)^{I=0}_{S\text{-wave}}$	<8 %	–
$p\gamma$	0.31–0.52 %	467
$p\gamma$, helicity=1/2	0.01–0.02 %	467
$p\gamma$, helicity=3/2	0.30–0.50 %	467
$n\gamma$	0.30–0.53 %	466
$n\gamma$, helicity=1/2	0.04–0.10 %	466
$n\gamma$, helicity=3/2	0.25–0.45 %	466

$N(1535)\ 1/2^-$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$

Breit-Wigner mass = 1525 to 1545 (≈ 1535) MeV
Breit-Wigner full width = 125 to 175 (≈ 150) MeV
Re(pole position) = 1490 to 1530 (≈ 1510) MeV
−2Im(pole position) = 90 to 250 (≈ 170) MeV

The following branching fractions are our estimates, not fits or averages.

$N(1535)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	35–55 %	468
$N\eta$	(42 ±10) %	186
$N\pi\pi$	1–10 %	426
$\Delta\pi$	<1 %	244
$\Delta(1232)\pi$, D-wave	0–4 %	244
$N\rho$	<4 %	†
$N\rho$, S=1/2, S-wave	(2.0± 1.0) %	†
$N\rho$, S=3/2, D-wave	(0.0± 1.0) %	†
$N(\pi\pi)^{I=0}_{S\text{-wave}}$	(2 ± 1) %	–
$N(1440)\pi$	(8 ± 3) %	†
$p\gamma$	0.15–0.30 %	481
$p\gamma$, helicity=1/2	0.15–0.30 %	481
$n\gamma$	0.01–0.25 %	480
$n\gamma$, helicity=1/2	0.01–0.25 %	480

$N(1650)\ 1/2^-$, $N(1675)\ 5/2^-$, $N(1680)\ 5/2^+$, $N(1700)\ 3/2^-$, $N(1710)\ 1/2^+$, $N(1720)\ 3/2^+$, $N(2190)\ 7/2^-$, $N(2220)\ 9/2^+$, $N(2250)\ 9/2^-$, $N(2600)\ 11/2^-$

The N resonances listed above are omitted from this Booklet but not from the Summary Table in the full *Review*.

$N(1875)\ 3/2^-$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$

Breit-Wigner mass = 1820 to 1920 ($\approx$ 1875) MeV
Breit-Wigner full width
Re(pole position) = 1800 to 1950 MeV
-2Im(pole position) = 150 to 250 MeV

$N(1875)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$N\pi$	(7 ± 6) %		695
$N\eta$	(1.2± 1.8) %	2.3	559
$N\omega$	(20 ± 4) %		371
ΣK	(7 ± 4) $\times 10^{-3}$		384
$\Delta(1232)\pi$, S-wave	(40 ±10) %		520
$\Delta(1232)\pi$, D-wave	(17 ±10) %		520
$N\rho$, S=3/2, S-wave	(6 ± 6) %		379
$N(\pi\pi)^{I=0}_{S\text{-wave}}$	(24 ±24) %		–
$p\gamma$	0.008–0.016 %		703
$p\gamma$, helicity=1/2	0.006–0.010 %		703
$p\gamma$, helicity=3/2	0.002–0.006 %		703

$N(1900)\ 3/2^+$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$

Breit-Wigner mass $\approx$ 1900 MeV
Breit-Wigner full width $\sim$ 250 MeV
Re(pole position) = 1900 ± 30 MeV
-2Im(pole position) = 200^{+100}_{-60} MeV

$N(1900)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$N\pi$	$\sim$ 5 %		710
$N\eta$	$\sim$ 12 %		579
$N\omega$	(13 ±9) %	3.1	401
ΛK	0–10 %		477
ΣK	(5.0±2.0) %		410

Δ BARYONS
($S = 0$, $I = 3/2$)

$\Delta^{++} = uuu$, $\Delta^+ = uud$, $\Delta^0 = udd$, $\Delta^- = ddd$

$\Delta(1232)\ 3/2^+$

$I(J^P) = \frac{3}{2}(\frac{3}{2}^+)$

Breit-Wigner mass (mixed charges) = 1230 to 1234 ($\approx$ 1232) MeV
Breit-Wigner full width (mixed charges) = 114 to 120 ($\approx$ 117) MeV
Re(pole position) = 1209 to 1211 ($\approx$ 1210) MeV
-2Im(pole position) = 98 to 102 ($\approx$ 100) MeV

The following branching fractions are our estimates, not fits or averages.

$\Delta(1232)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	100 %	229
$N\gamma$	0.55–0.65 %	259
$N\gamma$, helicity=1/2	0.11–0.13 %	259
$N\gamma$, helicity=3/2	0.44–0.52 %	259

$\Delta(1600)\ 3/2^+$

$I(J^P) = \frac{3}{2}(\frac{3}{2}^+)$

Breit-Wigner mass = 1500 to 1700 ($\approx$ 1600) MeV
Breit-Wigner full width = 220 to 420 ($\approx$ 320) MeV
Re(pole position) = 1460 to 1560 ($\approx$ 1510) MeV
-2Im(pole position) = 200 to 350 ($\approx$ 275) MeV

The following branching fractions are our estimates, not fits or averages.

$\Delta(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	10–25 %	513
$N\pi\pi$	75–90 %	477
$\Delta\pi$	40–70 %	303
$N\rho$	<25 %	†
$N(1440)\pi$	10–35 %	98
$N\gamma$	0.001–0.035 %	525
$N\gamma$, helicity=1/2	0.0–0.02 %	525
$N\gamma$, helicity=3/2	0.001–0.015 %	525

$\Delta(1620)\ 1/2^-$

$I(J^P) = \frac{3}{2}(\frac{1}{2}^-)$

Breit-Wigner mass = 1600 to 1660 ($\approx$ 1630) MeV
Breit-Wigner full width = 130 to 150 ($\approx$ 140) MeV
Re(pole position) = 1590 to 1610 ($\approx$ 1600) MeV
-2Im(pole position) = 120 to 140 ($\approx$ 130) MeV

The following branching fractions are our estimates, not fits or averages.

$\Delta(1620)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	20–30 %	534
$N\pi\pi$	70–80 %	499
$\Delta\pi$	30–60 %	328
$N\rho$	7–25 %	†
$N\gamma$	0.03–0.10 %	545
$N\gamma$, helicity=1/2	0.03–0.10 %	545

$\Delta(1700)\ 3/2^-$, $\Delta(1905)\ 5/2^+$, $\Delta(1910)\ 1/2^+$, $\Delta(1920)\ 3/2^+$, $\Delta(1930)\ 5/2^-$, $\Delta(1950)\ 7/2^+$, $\Delta(2420)\ 11/2^+$

The Δ resonances listed above are omitted from this Booklet but not from the Summary Table in the full *Review*.

Λ BARYONS ($S = -1$, $I = 0$)

$\Lambda^0 = uds$

Λ

$I(J^P) = 0(\frac{1}{2}^+)$

Mass $m = 1115.683 \pm 0.006$ MeV
$(m_\Lambda - m_{\overline{\Lambda}}) / m_\Lambda = (-0.1 \pm 1.1) \times 10^{-5}$ (S = 1.6)
Mean life $\tau = (2.632 \pm 0.020) \times 10^{-10}$ s (S = 1.6)
$(\tau_\Lambda - \tau_{\overline{\Lambda}}) / \tau_\Lambda = -0.001 \pm 0.009$
$c\tau = 7.89$ cm
Magnetic moment $\mu = -0.613 \pm 0.004\ \mu_N$
Electric dipole moment $d < 1.5 \times 10^{-16}$ $e$cm, CL = 95%

Decay parameters

$p\pi^-$	$\alpha_- = 0.642 \pm 0.013$
$\overline{p}\pi^+$	$\alpha_+ = -0.71 \pm 0.08$
$p\pi^-$	$\phi_- = (-6.5 \pm 3.5)^\circ$
"	$\gamma_- = 0.76$ [l]
"	$\Delta_- = (8 \pm 4)^\circ$ [l]
$n\pi^0$	$\alpha_0 = 0.65 \pm 0.04$
$pe^-\overline{\nu}_e$	$g_A/g_V = -0.718 \pm 0.015$ [h]

Λ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$p\pi^-$	(63.9 ±0.5) %	101
$n\pi^0$	(35.8 ±0.5) %	104
$n\gamma$	(1.75±0.15) $\times 10^{-3}$	162
$p\pi^-\gamma$	[n] (8.4 ±1.4) $\times 10^{-4}$	101
$pe^-\overline{\nu}_e$	(8.32±0.14) $\times 10^{-4}$	163
$p\mu^-\overline{\nu}_\mu$	(1.57±0.35) $\times 10^{-4}$	131

Λ(1405) 1/2⁻

$I(J^P) = 0(\frac{1}{2}^-)$

Mass $m = 1405.1^{+1.3}_{-1.0}$ MeV
Full width $\Gamma = 50.5 \pm 2.0$ MeV
Below $\overline{K}N$ threshold

Λ(1405) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Sigma\pi$	100 %	155

Λ(1520) 3/2⁻

$I(J^P) = 0(\frac{3}{2}^-)$

Mass $m = 1519.5 \pm 1.0$ MeV [o]
Full width $\Gamma = 15.6 \pm 1.0$ MeV [o]

Λ(1520) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	45 ± 1%	243
$\Sigma\pi$	42 ± 1%	268

$\Lambda\pi\pi$	$10 \pm 1\%$	259
$\Sigma\pi\pi$	$0.9 \pm 0.1\%$	169
$\Lambda\gamma$	$0.85 \pm 0.15\%$	350

$\Lambda(1600)$ $1/2^+$, $\Lambda(1670)$ $1/2^-$, $\Lambda(1690)$ $3/2^-$, $\Lambda(1800)$ $1/2^-$, $\Lambda(1810)$ $1/2^+$, $\Lambda(1820)$ $5/2^+$, $\Lambda(1830)$ $5/2^-$, $\Lambda(1890)$ $3/2^+$, $\Lambda(2100)$ $7/2^-$, $\Lambda(2110)$ $5/2^+$, $\Lambda(2350)$ $9/2^+$

The Λ resonances listed above are omitted from this Booklet but not from the Summary Table in the full *Review*.

Σ BARYONS ($S = -1$, $I = 1$)

$\Sigma^+ = uus$, $\Sigma^0 = uds$, $\Sigma^- = dds$

Σ^+

$I(J^P) = 1(\frac{1}{2}^+)$

Mass $m = 1189.37 \pm 0.07$ MeV (S = 2.2)
Mean life $\tau = (0.8018 \pm 0.0026) \times 10^{-10}$ s
$c\tau = 2.404$ cm
$(\tau_{\Sigma^+} - \tau_{\overline{\Sigma}^-}) / \tau_{\Sigma^+} = (-0.6 \pm 1.2) \times 10^{-3}$
Magnetic moment $\mu = 2.458 \pm 0.010\ \mu_N$ (S = 2.1)
$(\mu_{\Sigma^+} + \mu_{\overline{\Sigma}^-}) / \mu_{\Sigma^+} = 0.014 \pm 0.015$
$\Gamma(\Sigma^+ \to n\ell^+\nu)/\Gamma(\Sigma^- \to n\ell^-\overline{\nu}) < 0.043$

Decay parameters

$p\pi^0$	$\alpha_0 = -0.980^{+0.017}_{-0.015}$
"	$\phi_0 = (36 \pm 34)^\circ$
"	$\gamma_0 = 0.16$ [*l*]
"	$\Delta_0 = (187 \pm 6)^\circ$ [*l*]
$n\pi^+$	$\alpha_+ = 0.068 \pm 0.013$
"	$\phi_+ = (167 \pm 20)^\circ$ (S = 1.1)
"	$\gamma_+ = -0.97$ [*l*]
"	$\Delta_+ = (-73^{+133}_{-10})^\circ$ [*l*]
$p\gamma$	$\alpha_\gamma = -0.76 \pm 0.08$

Σ^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$p\pi^0$		(51.57±0.30) %		189
$n\pi^+$		(48.31±0.30) %		185
$p\gamma$		(1.23±0.05) $\times 10^{-3}$		225
$n\pi^+\gamma$	[*n*]	(4.5 ±0.5) $\times 10^{-4}$		185
$\Lambda e^+\nu_e$		(2.0 ±0.5) $\times 10^{-5}$		71
$\Delta S = \Delta Q$ (*SQ*) violating modes or $\Delta S = 1$ weak neutral current (*S1*) modes				
$ne^+\nu_e$	*SQ*	$< 5 \times 10^{-6}$	90%	224
$n\mu^+\nu_\mu$	*SQ*	$< 3.0 \times 10^{-5}$	90%	202
pe^+e^-	*S1*	$< 7 \times 10^{-6}$		225
$p\mu^+\mu^-$	*S1*	(9 $^{+9}_{-8}$) $\times 10^{-8}$		121

Σ^0

$I(J^P) = 1(\frac{1}{2}^+)$

Mass $m = 1192.642 \pm 0.024$ MeV
$m_{\Sigma^-} - m_{\Sigma^0} = 4.807 \pm 0.035$ MeV (S = 1.1)
$m_{\Sigma^0} - m_{\Lambda} = 76.959 \pm 0.023$ MeV
Mean life $\tau = (7.4 \pm 0.7) \times 10^{-20}$ s
$c\tau = 2.22 \times 10^{-11}$ m
Transition magnetic moment $|\mu_{\Sigma\Lambda}| = 1.61 \pm 0.08\ \mu_N$

Σ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\gamma$	100 %		74
$\Lambda\gamma\gamma$	$<$ 3 %	90%	74
$\Lambda e^+ e^-$	[p] 5×10^{-3}		74

Σ^-

$I(J^P) = 1(\frac{1}{2}^+)$

Mass $m = 1197.449 \pm 0.030$ MeV (S = 1.2)
$m_{\Sigma^-} - m_{\Sigma^+} = 8.08 \pm 0.08$ MeV (S = 1.9)
$m_{\Sigma^-} - m_{\Lambda} = 81.766 \pm 0.030$ MeV (S = 1.2)
Mean life $\tau = (1.479 \pm 0.011) \times 10^{-10}$ s (S = 1.3)
$c\tau = 4.434$ cm
Magnetic moment $\mu = -1.160 \pm 0.025\ \mu_N$ (S = 1.7)
Σ^- charge radius = 0.78 ± 0.10 fm

Decay parameters

$n\pi^-$	$\alpha_- = -0.068 \pm 0.008$
"	$\phi_- = (10 \pm 15)^\circ$
"	$\gamma_- = 0.98$ [l]
"	$\Delta_- = (249^{+\ 12}_{-120})^\circ$ [l]
$n e^- \overline{\nu}_e$	$g_A/g_V = 0.340 \pm 0.017$ [h]
"	$f_2(0)/f_1(0) = 0.97 \pm 0.14$
"	$D = 0.11 \pm 0.10$
$\Lambda e^- \overline{\nu}_e$	$g_V/g_A = 0.01 \pm 0.10$ [h] (S = 1.5)
"	$g_{WM}/g_A = 2.4 \pm 1.7$ [h]

Σ^- DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$n\pi^-$	(99.848$\pm$0.005) %	193
$n\pi^-\gamma$	[n] (4.6 $\pm$0.6) $\times 10^{-4}$	193
$n e^- \overline{\nu}_e$	(1.017$\pm$0.034) $\times 10^{-3}$	230
$n\mu^- \overline{\nu}_\mu$	(4.5 $\pm$0.4) $\times 10^{-4}$	210
$\Lambda e^- \overline{\nu}_e$	(5.73 $\pm$0.27) $\times 10^{-5}$	79

$\Sigma(1385)\ 3/2^+$

$I(J^P) = 1(\frac{3}{2}^+)$

$\Sigma(1385)^+$ mass $m = 1382.80 \pm 0.35$ MeV (S = 1.9)
$\Sigma(1385)^0$ mass $m = 1383.7 \pm 1.0$ MeV (S = 1.4)
$\Sigma(1385)^-$ mass $m = 1387.2 \pm 0.5$ MeV (S = 2.2)
$\Sigma(1385)^+$ full width $\Gamma = 36.0 \pm 0.7$ MeV
$\Sigma(1385)^0$ full width $\Gamma = 36 \pm 5$ MeV
$\Sigma(1385)^-$ full width $\Gamma = 39.4 \pm 2.1$ MeV (S = 1.7)
Below $\overline{K}N$ threshold

$\Sigma(1385)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi$	(87.0 ±1.5) %		208
$\Sigma\pi$	(11.7 ±1.5) %		129
$\Lambda\gamma$	($1.25^{+0.13}_{-0.12}$) %		241
$\Sigma^+\gamma$	(7.0 ±1.7) $\times 10^{-3}$		180
$\Sigma^-\gamma$	< 2.4 $\times 10^{-4}$	90%	173

$\Sigma(1660)\ 1/2^+$

$I(J^P) = 1(\frac{1}{2}^+)$

Mass m = 1630 to 1690 ($\approx$ 1660) MeV
Full width Γ = 40 to 200 ($\approx$ 100) MeV

$\Sigma(1660)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	10–30 %	405
$\Lambda\pi$	seen	440
$\Sigma\pi$	seen	387

$\Sigma(1670)\ 3/2^-$, $\Sigma(1750)\ 1/2^-$, $\Sigma(1775)\ 5/2^-$, $\Sigma(1915)\ 5/2^+$, $\Sigma(1940)\ 3/2^-$, $\Sigma(2030)\ 7/2^+$, $\Sigma(2250)$

The Σ resonances listed above are omitted from this Booklet but not from the Summary Table in the full *Review*.

Ξ BARYONS
$(S = -2, I = 1/2)$

$\Xi^0 = uss$, $\Xi^- = dss$

Ξ^0

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

P is not yet measured; + is the quark model prediction.

Mass $m = 1314.86 \pm 0.20$ MeV
$m_{\Xi^-} - m_{\Xi^0} = 6.85 \pm 0.21$ MeV
Mean life $\tau = (2.90 \pm 0.09) \times 10^{-10}$ s
$c\tau = 8.71$ cm
Magnetic moment $\mu = -1.250 \pm 0.014\ \mu_N$

Decay parameters

$\Lambda\pi^0$	$\alpha = -0.406 \pm 0.013$
"	$\phi = (21 \pm 12)^\circ$
"	$\gamma = 0.85$ [l]
"	$\Delta = (218^{+12}_{-19})^\circ$ [l]
$\Lambda\gamma$	$\alpha = -0.70 \pm 0.07$
$\Lambda e^+ e^-$	$\alpha = -0.8 \pm 0.2$
$\Sigma^0\gamma$	$\alpha = -0.69 \pm 0.06$
$\Sigma^+ e^- \overline{\nu}_e$	$g_1(0)/f_1(0) = 1.22 \pm 0.05$
$\Sigma^+ e^- \overline{\nu}_e$	$f_2(0)/f_1(0) = 2.0 \pm 0.9$

Ξ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi^0$	(99.524±0.012) %		135
$\Lambda\gamma$	(1.17 ±0.07) $\times 10^{-3}$		184
$\Lambda e^+ e^-$	(7.6 ±0.6) $\times 10^{-6}$		184
$\Sigma^0\gamma$	(3.33 ±0.10) $\times 10^{-3}$		117
$\Sigma^+ e^- \overline{\nu}_e$	(2.52 ±0.08) $\times 10^{-4}$		120
$\Sigma^+ \mu^- \overline{\nu}_\mu$	(2.33 ±0.35) $\times 10^{-6}$		64
$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 2$ forbidden ($S2$) modes			
$\Sigma^- e^+ \nu_e$	SQ < 9 $\times 10^{-4}$	90%	112
$\Sigma^- \mu^+ \nu_\mu$	SQ < 9 $\times 10^{-4}$	90%	49
$p\pi^-$	$S2$ < 8 $\times 10^{-6}$	90%	299
$p e^- \overline{\nu}_e$	$S2$ < 1.3 $\times 10^{-3}$		323
$p\mu^- \overline{\nu}_\mu$	$S2$ < 1.3 $\times 10^{-3}$		309

Ξ^-

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

P is not yet measured; + is the quark model prediction.

Mass $m = 1321.71 \pm 0.07$ MeV
$(m_{\Xi^-} - m_{\overline{\Xi}^+}) / m_{\Xi^-} = (-3 \pm 9) \times 10^{-5}$
Mean life $\tau = (1.639 \pm 0.015) \times 10^{-10}$ s
$c\tau = 4.91$ cm
$(\tau_{\Xi^-} - \tau_{\overline{\Xi}^+}) / \tau_{\Xi^-} = -0.01 \pm 0.07$
Magnetic moment $\mu = -0.6507 \pm 0.0025\ \mu_N$
$(\mu_{\Xi^-} + \mu_{\overline{\Xi}^+}) / |\mu_{\Xi^-}| = +0.01 \pm 0.05$

Decay parameters

$\Lambda\pi^-$	$\alpha = -0.458 \pm 0.012$ (S = 1.8)
$[\alpha(\Xi^-)\alpha_-(\Lambda) - \alpha(\overline{\Xi}^+)\alpha_+(\overline{\Lambda})] / [\text{ sum }] = (0 \pm 7) \times 10^{-4}$	
"	$\phi = (-2.1 \pm 0.8)^\circ$
"	$\gamma = 0.89$ [l]
"	$\Delta = (175.9 \pm 1.5)^\circ$ [l]
$\Lambda e^- \overline{\nu}_e$	$g_A/g_V = -0.25 \pm 0.05$ [h]

Ξ^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi^-$	(99.887±0.035) %		140
$\Sigma^-\gamma$	(1.27 ±0.23) $\times 10^{-4}$		118
$\Lambda e^- \overline{\nu}_e$	(5.63 ±0.31) $\times 10^{-4}$		190

$\Lambda\mu^-\overline{\nu}_\mu$		$(\ 3.5\ ^{+3.5}_{-2.2}\ )\times10^{-4}$			163
$\Sigma^0 e^-\overline{\nu}_e$		$(\ 8.7\ \pm1.7\ )\times10^{-5}$			123
$\Sigma^0\mu^-\overline{\nu}_\mu$		$<\ 8$	$\times10^{-4}$	90%	70
$\Xi^0 e^-\overline{\nu}_e$		$<\ 2.3$	$\times10^{-3}$	90%	7
$\Delta S = 2$ forbidden ($S2$) modes					
$n\pi^-$	$S2$	$<\ 1.9$	$\times10^{-5}$	90%	304
$ne^-\overline{\nu}_e$	$S2$	$<\ 3.2$	$\times10^{-3}$	90%	327
$n\mu^-\overline{\nu}_\mu$	$S2$	$<\ 1.5$	%	90%	314
$p\pi^-\pi^-$	$S2$	$<\ 4$	$\times10^{-4}$	90%	223
$p\pi^- e^-\overline{\nu}_e$	$S2$	$<\ 4$	$\times10^{-4}$	90%	305
$p\pi^-\mu^-\overline{\nu}_\mu$	$S2$	$<\ 4$	$\times10^{-4}$	90%	251
$p\mu^-\mu^-$	L	$<\ 4$	$\times10^{-8}$	90%	272

$\Xi(1530)\ 3/2^+$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$

$\Xi(1530)^0$ mass $m = 1531.80 \pm 0.32$ MeV (S = 1.3)
$\Xi(1530)^-$ mass $m = 1535.0 \pm 0.6$ MeV
$\Xi(1530)^0$ full width $\Gamma = 9.1 \pm 0.5$ MeV
$\Xi(1530)^-$ full width $\Gamma = 9.9^{+1.7}_{-1.9}$ MeV

$\Xi(1530)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Xi\pi$	100 %		158
$\Xi\gamma$	<4 %	90%	202

$\Xi(1690)$, $\Xi(1820)\ 3/2^-$, $\Xi(1950)$, $\Xi(2030)$

The Ξ resonances listed above are omitted from this Booklet but not from the Summary Table in the full *Review*.

Ω BARYONS ($S = -3, I = 0$)

$\Omega^- = sss$

Ω^-

$I(J^P) = 0(\frac{3}{2}^+)$

$J^P = \frac{3}{2}^+$ is the quark-model prediction; and $J = 3/2$ is fairly well established.

Mass $m = 1672.45 \pm 0.29$ MeV
$(m_{\Omega^-} - m_{\overline{\Omega}^+}) / m_{\Omega^-} = (-1 \pm 8)\times10^{-5}$
Mean life $\tau = (0.821 \pm 0.011)\times10^{-10}$ s
$c\tau = 2.461$ cm
$(\tau_{\Omega^-} - \tau_{\overline{\Omega}^+}) / \tau_{\Omega^-} = 0.00 \pm 0.05$
Magnetic moment $\mu = -2.02 \pm 0.05\ \mu_N$

Decay parameters

ΛK^- $\alpha = 0.0180 \pm 0.0024$
$\Lambda K^-, \overline{\Lambda} K^+$ $(\alpha + \overline{\alpha})/(\alpha - \overline{\alpha}) = -0.02 \pm 0.13$
$\Xi^0 \pi^-$ $\alpha = 0.09 \pm 0.14$
$\Xi^- \pi^0$ $\alpha = 0.05 \pm 0.21$

Ω^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
ΛK^-	(67.8±0.7) %		211
$\Xi^0 \pi^-$	(23.6±0.7) %		294
$\Xi^- \pi^0$	(8.6±0.4) %		289
$\Xi^- \pi^+ \pi^-$	$(3.7^{+0.7}_{-0.6}) \times 10^{-4}$		189
$\Xi(1530)^0 \pi^-$	$< 7 \times 10^{-5}$	90%	17
$\Xi^0 e^- \overline{\nu}_e$	$(5.6 \pm 2.8) \times 10^{-3}$		319
$\Xi^- \gamma$	$< 4.6 \times 10^{-4}$	90%	314
$\Delta S = 2$ forbidden ($S2$) modes			
$\Lambda \pi^-$ $S2$	$< 2.9 \times 10^{-6}$	90%	449

$\Omega(2250)^-$

$I(J^P) = 0(?^?)$

Mass $m = 2252 \pm 9$ MeV
Full width $\Gamma = 55 \pm 18$ MeV

$\Omega(2250)^-$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi^- \pi^+ K^-$	seen	532
$\Xi(1530)^0 K^-$	seen	437

CHARMED BARYONS ($C = +1$)

$\Lambda_c^+ = udc$, $\Sigma_c^{++} = uuc$, $\Sigma_c^+ = udc$, $\Sigma_c^0 = ddc$,
$\Xi_c^+ = usc$, $\Xi_c^0 = dsc$, $\Omega_c^0 = ssc$

Λ_c^+

$I(J^P) = 0(\frac{1}{2}^+)$

J is not well measured; $\frac{1}{2}$ is the quark-model prediction.

Mass $m = 2286.46 \pm 0.14$ MeV
Mean life $\tau = (200 \pm 6) \times 10^{-15}$ s (S = 1.6)
$c\tau = 59.9\ \mu$m

Decay asymmetry parameters

$\Lambda \pi^+$ $\alpha = -0.91 \pm 0.15$
$\Sigma^+ \pi^0$ $\alpha = -0.45 \pm 0.32$
$\Lambda \ell^+ \nu_\ell$ $\alpha = -0.86 \pm 0.04$
$(\alpha + \overline{\alpha})/(\alpha - \overline{\alpha})$ in $\Lambda_c^+ \to \Lambda \pi^+, \overline{\Lambda}_c^- \to \overline{\Lambda} \pi^- = -0.07 \pm 0.31$
$(\alpha + \overline{\alpha})/(\alpha - \overline{\alpha})$ in $\Lambda_c^+ \to \Lambda e^+ \nu_e, \overline{\Lambda}_c^- \to \overline{\Lambda} e^- \overline{\nu}_e = 0.00 \pm 0.04$

Nearly all branching fractions of the Λ_c^+ are measured relative to the $pK^-\pi^+$ mode, but there are no model-independent measurements of this branching fraction. We explain how we arrive at our value of $B(\Lambda_c^+ \to pK^-\pi^+)$ in a Note at the beginning of the branching-ratio measurements in the Listings. When this branching fraction is eventually well determined, all the other branching fractions will slide up or down proportionally as the true value differs from the value we use here.

Λ_c^+ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic modes with a p: $S = -1$ final states				
$p\overline{K}^0$		(2.3 ± 0.6) %		873
$pK^-\pi^+$	[q]	(5.0 ± 1.3) %		823
$p\overline{K}^*(892)^0$	[r]	(1.6 ± 0.5) %		685
$\Delta(1232)^{++}K^-$		(8.6 ± 3.0) $\times 10^{-3}$		710
$\Lambda(1520)\pi^+$	[r]	(1.8 ± 0.6) %		627
$pK^-\pi^+$ nonresonant		(2.8 ± 0.8) %		823
$p\overline{K}^0\pi^0$		(3.3 ± 1.0) %		823
$p\overline{K}^0\eta$		(1.2 ± 0.4) %		568
$p\overline{K}^0\pi^+\pi^-$		(2.6 ± 0.7) %		754
$pK^-\pi^+\pi^0$		(3.4 ± 1.0) %		759
$pK^*(892)^-\pi^+$	[r]	(1.1 ± 0.5) %		580
$p(K^-\pi^+)_{\text{nonresonant}}\pi^0$		(3.6 ± 1.2) %		759
$\Delta(1232)\overline{K}^*(892)$		seen		419
$pK^-\pi^+\pi^+\pi^-$		(1.1 ± 0.8) $\times 10^{-3}$		671
$pK^-\pi^+\pi^0\pi^0$		(8 ± 4) $\times 10^{-3}$		678
Hadronic modes with a p: $S = 0$ final states				
$p\pi^+\pi^-$		(3.5 ± 2.0) $\times 10^{-3}$		927
$pf_0(980)$	[r]	(2.8 ± 1.9) $\times 10^{-3}$		614
$p\pi^+\pi^+\pi^-\pi^-$		(1.8 ± 1.2) $\times 10^{-3}$		852
pK^+K^-		(7.7 ± 3.5) $\times 10^{-4}$		616
$p\phi$	[r]	(8.2 ± 2.7) $\times 10^{-4}$		590
pK^+K^- non-ϕ		(3.5 ± 1.7) $\times 10^{-4}$		616
Hadronic modes with a hyperon: $S = -1$ final states				
$\Lambda\pi^+$		(1.07± 0.28) %		864
$\Lambda\pi^+\pi^0$		(3.6 ± 1.3) %		844
$\Lambda\rho^+$		< 5 %	CL=95%	636
$\Lambda\pi^+\pi^+\pi^-$		(2.6 ± 0.7) %		807
$\Sigma(1385)^+\pi^+\pi^-$, $\Sigma^{*+} \to \Lambda\pi^+$		(7 ± 4) $\times 10^{-3}$		688
$\Sigma(1385)^-\pi^+\pi^+$, $\Sigma^{*-} \to \Lambda\pi^-$		(5.5 ± 1.7) $\times 10^{-3}$		688
$\Lambda\pi^+\rho^0$		(1.1 ± 0.5) %		524
$\Sigma(1385)^+\rho^0$, $\Sigma^{*+} \to \Lambda\pi^+$		(3.7 ± 3.1) $\times 10^{-3}$		363
$\Lambda\pi^+\pi^+\pi^-$ nonresonant		< 8 $\times 10^{-3}$	CL=90%	807
$\Lambda\pi^+\pi^+\pi^-\pi^0$ total		(1.8 ± 0.8) %		757
$\Lambda\pi^+\eta$	[r]	(1.8 ± 0.6) %		691
$\Sigma(1385)^+\eta$	[r]	(8.5 ± 3.3) $\times 10^{-3}$		570
$\Lambda\pi^+\omega$	[r]	(1.2 ± 0.5) %		517
$\Lambda\pi^+\pi^+\pi^-\pi^0$, no η or ω		< 7 $\times 10^{-3}$	CL=90%	757
$\Lambda K^+\overline{K}^0$		(4.7 ± 1.5) $\times 10^{-3}$	S=1.2	443
$\Xi(1690)^0K^+$, $\Xi^{*0} \to \Lambda\overline{K}^0$		(1.3 ± 0.5) $\times 10^{-3}$		286
$\Sigma^0\pi^+$		(1.05± 0.28) %		825
$\Sigma^+\pi^0$		(1.00± 0.34) %		827

$\Sigma^+\eta$		$(5.5 \pm 2.3) \times 10^{-3}$			713
$\Sigma^+\pi^+\pi^-$		(3.6 ± 1.0) %			804
$\Sigma^+\rho^0$		< 1.4	%	CL=95%	575
$\Sigma^-\pi^+\pi^+$		(1.7 ± 0.5) %			799
$\Sigma^0\pi^+\pi^0$		(1.8 ± 0.8) %			803
$\Sigma^0\pi^+\pi^+\pi^-$		$(8.3 \pm 3.1) \times 10^{-3}$			763
$\Sigma^+\pi^+\pi^-\pi^0$		—			767
$\Sigma^+\omega$	[r]	(2.7 ± 1.0) %			569
$\Sigma^+K^+K^-$		$(2.8 \pm 0.8) \times 10^{-3}$			349
$\Sigma^+\phi$	[r]	$(3.1 \pm 0.9) \times 10^{-3}$			295
$\Xi(1690)^0K^+$, $\Xi^{*0} \to \Sigma^+K^-$		$(8.1 \pm 3.0) \times 10^{-4}$			286
$\Sigma^+K^+K^-$ nonresonant		< 6	$\times 10^{-4}$	CL=90%	349
Ξ^0K^+		$(3.9 \pm 1.4) \times 10^{-3}$			653
$\Xi^-K^+\pi^+$		$(5.1 \pm 1.4) \times 10^{-3}$			565
$\Xi(1530)^0K^+$	[r]	$(2.6 \pm 1.0) \times 10^{-3}$			473
Hadronic modes with a hyperon: $S = 0$ final states					
ΛK^+		$(5.0 \pm 1.6) \times 10^{-4}$			781
$\Lambda K^+\pi^+\pi^-$		< 4	$\times 10^{-4}$	CL=90%	637
Σ^0K^+		$(4.2 \pm 1.3) \times 10^{-4}$			735
$\Sigma^0K^+\pi^+\pi^-$		< 2.1	$\times 10^{-4}$	CL=90%	574
$\Sigma^+K^+\pi^-$		$(1.7 \pm 0.7) \times 10^{-3}$			670
$\Sigma^+K^*(892)^0$	[r]	$(2.8 \pm 1.1) \times 10^{-3}$			470
$\Sigma^-K^+\pi^+$		< 1.0	$\times 10^{-3}$	CL=90%	664
Doubly Cabibbo-suppressed modes					
$pK^+\pi^-$		< 2.3	$\times 10^{-4}$	CL=90%	823
Semileptonic modes					
$\Lambda\ell^+\nu_\ell$	[s]	(2.0 ± 0.6) %			871
$\Lambda e^+\nu_e$		(2.1 ± 0.6) %			871
$\Lambda\mu^+\nu_\mu$		(2.0 ± 0.7) %			867
Inclusive modes					
e^+ anything		(4.5 ± 1.7) %			–
pe^+ anything		(1.8 ± 0.9) %			–
p anything		(50 ± 16) %			–
p anything (no Λ)		(12 ± 19) %			–
n anything		(50 ± 16) %			–
n anything (no Λ)		(29 ± 17) %			–
Λ anything		(35 ± 11) %		S=1.4	–
$\Sigma^\pm$ anything	[t]	(10 ± 5) %			–
3prongs		(24 ± 8) %			–
$\Delta C = 1$ weak neutral current ($C1$) modes, or Lepton Family number (LF), or Lepton number (L), or Baryon number (B) violating modes					
pe^+e^-	$C1$	< 5.5	$\times 10^{-6}$	CL=90%	951
$p\mu^+\mu^-$	$C1$	< 4.4	$\times 10^{-5}$	CL=90%	937
$pe^+\mu^-$	LF	< 9.9	$\times 10^{-6}$	CL=90%	947
$pe^-\mu^+$	LF	< 1.9	$\times 10^{-5}$	CL=90%	947
$\overline{p}2e^+$	L,B	< 2.7	$\times 10^{-6}$	CL=90%	951
$\overline{p}2\mu^+$	L,B	< 9.4	$\times 10^{-6}$	CL=90%	937
$\overline{p}e^+\mu^+$	L,B	< 1.6	$\times 10^{-5}$	CL=90%	947
$\Sigma^-\mu^+\mu^+$	L	< 7.0	$\times 10^{-4}$	CL=90%	812

$\Lambda_c(2595)^+$

$I(J^P) = 0(\frac{1}{2}^-)$

The spin-parity follows from the fact that $\Sigma_c(2455)\pi$ decays, with little available phase space, are dominant. This assumes that $J^P = 1/2^+$ for the $\Sigma_c(2455)$.

Mass $m = 2592.25 \pm 0.28$ MeV
$m - m_{\Lambda_c^+} = 305.79 \pm 0.24$ MeV
Full width $\Gamma = 2.6 \pm 0.6$ MeV

$\Lambda_c^+\pi\pi$ and its submode $\Sigma_c(2455)\pi$ — the latter just barely — are the only strong decays allowed to an excited Λ_c^+ having this mass; and the submode seems to dominate.

$\Lambda_c(2595)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+\pi^+\pi^-$	[u] ≈ 67 %	117
$\Sigma_c(2455)^{++}\pi^-$	24 ± 7 %	†
$\Sigma_c(2455)^0\pi^+$	24 ± 7 %	†
$\Lambda_c^+\pi^+\pi^-$ 3-body	18 ± 10 %	117
$\Lambda_c^+\pi^0$	[v] not seen	258
$\Lambda_c^+\gamma$	not seen	288

$\Lambda_c(2625)^+$

$I(J^P) = 0(\frac{3}{2}^-)$

J^P has not been measured; $\frac{3}{2}^-$ is the quark-model prediction.

Mass $m = 2628.11 \pm 0.19$ MeV (S = 1.1)
$m - m_{\Lambda_c^+} = 341.65 \pm 0.13$ MeV (S = 1.1)
Full width $\Gamma < 0.97$ MeV, CL = 90%

$\Lambda_c^+\pi\pi$ and its submode $\Sigma(2455)\pi$ are the only strong decays allowed to an excited Λ_c^+ having this mass.

$\Lambda_c(2625)^+$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda_c^+\pi^+\pi^-$	[u] $\approx 67\%$		184
$\Sigma_c(2455)^{++}\pi^-$	<5	90%	102
$\Sigma_c(2455)^0\pi^+$	<5	90%	102
$\Lambda_c^+\pi^+\pi^-$ 3-body	large		184
$\Lambda_c^+\pi^0$	[v] not seen		293
$\Lambda_c^+\gamma$	not seen		319

$\Lambda_c(2880)^+$

$I(J^P) = 0(\frac{5}{2}^+)$

There is some good evidence that indeed $J^P = 5/2^+$

Mass $m = 2881.53 \pm 0.35$ MeV
$m - m_{\Lambda_c^+} = 595.1 \pm 0.4$ MeV
Full width $\Gamma = 5.8 \pm 1.1$ MeV

$\Lambda_c(2880)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \pi^+ \pi^-$	seen	471
$\Sigma_c(2455)^{0,++} \pi^\pm$	seen	376
$\Sigma_c(2520)^{0,++} \pi^\pm$	seen	317
$p D^0$	seen	316

$\Lambda_c(2940)^+$

$I(J^P) = 0(?^?)$

Mass $m = 2939.3^{+1.4}_{-1.5}$ MeV
Full width $\Gamma = 17^{+8}_{-6}$ MeV

$\Lambda_c(2940)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$p D^0$	seen	420
$\Sigma_c(2455)^{0,++} \pi^\pm$	seen	–

$\Sigma_c(2455)$

$I(J^P) = 1(\frac{1}{2}^+)$

$\Sigma_c(2455)^{++}$ mass $m = 2453.98 \pm 0.16$ MeV
$\Sigma_c(2455)^+$ mass $m = 2452.9 \pm 0.4$ MeV
$\Sigma_c(2455)^0$ mass $m = 2453.74 \pm 0.16$ MeV
$m_{\Sigma_c^{++}} - m_{\Lambda_c^+} = 167.52 \pm 0.08$ MeV
$m_{\Sigma_c^{+}} - m_{\Lambda_c^+} = 166.4 \pm 0.4$ MeV
$m_{\Sigma_c^{0}} - m_{\Lambda_c^+} = 167.27 \pm 0.08$ MeV
$m_{\Sigma_c^{++}} - m_{\Sigma_c^0} = 0.24 \pm 0.09$ MeV (S = 1.1)
$m_{\Sigma_c^{+}} - m_{\Sigma_c^0} = -0.9 \pm 0.4$ MeV
$\Sigma_c(2455)^{++}$ full width $\Gamma = 2.26 \pm 0.25$ MeV
$\Sigma_c(2455)^+$ full width $\Gamma < 4.6$ MeV, CL = 90%
$\Sigma_c(2455)^0$ full width $\Gamma = 2.16 \pm 0.26$ MeV (S = 1.1)

$\Lambda_c^+ \pi$ is the only strong decay allowed to a Σ_c having this mass.

$\Sigma_c(2455)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \pi$	≈ 100 %	94

$\Sigma_c(2520)$

$I(J^P) = 1(\frac{3}{2}^+)$

J^P has not been measured; $\frac{3}{2}^+$ is the quark-model prediction.

$\Sigma_c(2520)^{++}$ mass $m = 2517.9 \pm 0.6$ MeV (S = 1.6)
$\Sigma_c(2520)^{+}$ mass $m = 2517.5 \pm 2.3$ MeV
$\Sigma_c(2520)^{0}$ mass $m = 2518.8 \pm 0.6$ MeV (S = 1.5)
$m_{\Sigma_c(2520)^{++}} - m_{\Lambda_c^+} = 231.4 \pm 0.6$ MeV (S = 1.6)
$m_{\Sigma_c(2520)^{+}} - m_{\Lambda_c^+} = 231.0 \pm 2.3$ MeV
$m_{\Sigma_c(2520)^{0}} - m_{\Lambda_c^+} = 232.3 \pm 0.5$ MeV (S = 1.6)
$m_{\Sigma_c(2520)^{++}} - m_{\Sigma_c(2520)^{0}}$
$\Sigma_c(2520)^{++}$ full width $\Gamma = 14.9 \pm 1.5$ MeV
$\Sigma_c(2520)^{+}$ full width $\Gamma < 17$ MeV, CL = 90%
$\Sigma_c(2520)^{0}$ full width $\Gamma = 14.5 \pm 1.5$ MeV

$\Lambda_c^+ \pi$ is the only strong decay allowed to a Σ_c having this mass.

$\Sigma_c(2520)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \pi$	≈ 100 %	179

$\Sigma_c(2800)$

$I(J^P) = 1(?^?)$

$\Sigma_c(2800)^{++}$ mass $m = 2801^{+4}_{-6}$ MeV
$\Sigma_c(2800)^{+}$ mass $m = 2792^{+14}_{-5}$ MeV
$\Sigma_c(2800)^{0}$ mass $m = 2806^{+5}_{-7}$ MeV (S = 1.3)
$m_{\Sigma_c(2800)^{++}} - m_{\Lambda_c^+} = 514^{+4}_{-6}$ MeV
$m_{\Sigma_c(2800)^{+}} - m_{\Lambda_c^+} = 505^{+14}_{-5}$ MeV
$m_{\Sigma_c(2800)^{0}} - m_{\Lambda_c^+} = 519^{+5}_{-7}$ MeV (S = 1.3)
$\Sigma_c(2800)^{++}$ full width $\Gamma = 75^{+22}_{-17}$ MeV
$\Sigma_c(2800)^{+}$ full width $\Gamma = 62^{+60}_{-40}$ MeV
$\Sigma_c(2800)^{0}$ full width $\Gamma = 72^{+22}_{-15}$ MeV

$\Sigma_c(2800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \pi$	seen	443

Ξ_c^+

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

J^P has not been measured; $\frac{1}{2}^+$ is the quark-model prediction.

Mass $m = 2467.8^{+0.4}_{-0.6}$ MeV
Mean life $\tau = (442 \pm 26) \times 10^{-15}$ s (S = 1.3)
$c\tau = 132$ μm

Ξ_c^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
No absolute branching fractions have been measured. The following are branching *ratios* relative to $\Xi^-2\pi^+$.				
Cabibbo-favored ($S=-2$) decays — relative to $\Xi^-2\pi^+$				
$p2K_S^0$		0.087 ± 0.021		767
$\Lambda\overline{K}^0\pi^+$		—		852
$\Sigma(1385)^+\overline{K}^0$	[r]	1.0 ± 0.5		746
$\Lambda K^-2\pi^+$		0.323 ± 0.033		787
$\Lambda\overline{K}^*(892)^0\pi^+$	[r]	< 0.16	90%	608
$\Sigma(1385)^+K^-\pi^+$	[r]	< 0.23	90%	678
$\Sigma^+K^-\pi^+$		0.94 ± 0.10		810
$\Sigma^+\overline{K}^*(892)^0$	[r]	0.81 ± 0.15		658
$\Sigma^0K^-2\pi^+$		0.27 ± 0.12		735
$\Xi^0\pi^+$		0.55 ± 0.16		877
$\Xi^-2\pi^+$		**DEFINED AS 1**		851
$\Xi(1530)^0\pi^+$	[r]	< 0.10	90%	750
$\Xi^0\pi^+\pi^0$		2.3 ± 0.7		856
$\Xi^0\pi^-2\pi^+$		1.7 ± 0.5		818
$\Xi^0e^+\nu_e$		$2.3\ ^{+0.7}_{-0.8}$		884
$\Omega^-K^+\pi^+$		0.07 ± 0.04		399
Cabibbo-suppressed decays — relative to $\Xi^-2\pi^+$				
$pK^-\pi^+$		0.21 ± 0.04		944
$p\overline{K}^*(892)^0$	[r]	0.116 ± 0.030		828
$\Sigma^+\pi^+\pi^-$		0.48 ± 0.20		922
$\Sigma^-2\pi^+$		0.18 ± 0.09		918
$\Sigma^+K^+K^-$		0.15 ± 0.06		579
$\Sigma^+\phi$	[r]	< 0.11	90%	549
$\Xi(1690)^0K^+$, $\Xi(1690)^0 \to \Sigma^+K^-$		< 0.05	90%	501

Ξ_c^0

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

J^P has not been measured; $\frac{1}{2}^+$ is the quark-model prediction.

Mass $m = 2470.88^{+0.34}_{-0.80}$ MeV (S = 1.1)

$m_{\Xi_c^0} - m_{\Xi_c^+} = 3.1^{+0.4}_{-0.5}$ MeV

Mean life $\tau = (112^{+13}_{-10}) \times 10^{-15}$ s

$c\tau = 33.6\ \mu$m

Decay asymmetry parameters

$\Xi^-\pi^+$ $\alpha = -0.6 \pm 0.4$

No absolute branching fractions have been measured. Several measurements of ratios of fractions may be found in the Listings that follow.

Ξ_c^0 DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
No absolute branching fractions have been measured. The following are branching *ratios* relative to $\Xi^-\pi^+$.		
Cabibbo-favored (S = −2) decays — relative to $\Xi^-\pi^+$		
$pK^-K^-\pi^+$	0.34 ±0.04	676
$pK^-\overline{K}^*(892)^0$	0.21 ±0.05	413
$pK^-K^-\pi^+$ (no $\overline{K}^{*0}$)	0.21 ±0.04	676
ΛK_S^0	0.210±0.028	906
$\Lambda K^-\pi^+$	1.07 ±0.14	856
$\Lambda\overline{K}^0\pi^+\pi^-$	seen	787
$\Lambda K^-\pi^+\pi^+\pi^-$	seen	703
$\Xi^-\pi^+$	**DEFINED AS 1**	875
$\Xi^-\pi^+\pi^+\pi^-$	3.3 ±1.4	816
Ω^-K^+	0.297±0.024	522
$\Xi^-e^+\nu_e$	3.1 ±1.1	882
$\Xi^-\ell^+$ anything	1.0 ±0.5	–
Cabibbo-suppressed decays — relative to $\Xi^-\pi^+$		
Ξ^-K^+	0.028±0.006	790
ΛK^+K^- (no ϕ)	0.029±0.007	648
$\Lambda\phi$	0.034±0.007	621

$\Xi_c'^+$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

J^P has not been measured; $\frac{1}{2}^+$ is the quark-model prediction.

Mass $m = 2575.6 \pm 3.1$ MeV

$m_{\Xi_c'^+} - m_{\Xi_c^+} = 107.8 \pm 3.0$ MeV

The $\Xi_c'^+$–Ξ_c^+ mass difference is too small for any strong decay to occur.

$\Xi_c'^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_c^+\gamma$	seen	106

$\Xi_c'^0$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

J^P has not been measured; $\frac{1}{2}^+$ is the quark-model prediction.

Mass $m = 2577.9 \pm 2.9$ MeV

$m_{\Xi_c'^0} - m_{\Xi_c^0} = 107.0 \pm 2.9$ MeV

The $\Xi_c'^0 - \Xi_c^0$ mass difference is too small for any strong decay to occur.

$\Xi_c'^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_c^0\gamma$	seen	105

$\Xi_c(2645)$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$

J^P has not been measured; $\frac{3}{2}^+$ is the quark-model prediction.

$\Xi_c(2645)^+$ mass $m = 2645.9^{+0.5}_{-0.6}$ MeV (S = 1.1)
$\Xi_c(2645)^0$ mass $m = 2645.9 \pm 0.5$ MeV
$m_{\Xi_c(2645)^+} - m_{\Xi_c^0} = 175.0^{+0.8}_{-0.6}$ MeV (S = 1.2)
$m_{\Xi_c(2645)^0} - m_{\Xi_c^+} = 178.1 \pm 0.6$ MeV
$m_{\Xi_c(2645)^+} - m_{\Xi_c(2645)^0} = 0.0 \pm 0.5$ MeV
$\Xi_c(2645)^+$ full width $\Gamma < 3.1$ MeV, CL = 90%
$\Xi_c(2645)^0$ full width $\Gamma < 5.5$ MeV, CL = 90%

$\Xi_c\pi$ is the only strong decay allowed to a Ξ_c resonance having this mass.

$\Xi_c(2645)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_c^0\pi^+$	seen	102
$\Xi_c^+\pi^-$	seen	107

$\Xi_c(2790)$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$

J^P has not been measured; $\frac{1}{2}^-$ is the quark-model prediction.

$\Xi_c(2790)^+$ mass $= 2789.1 \pm 3.2$ MeV
$\Xi_c(2790)^0$ mass $= 2791.8 \pm 3.3$ MeV
$m_{\Xi_c(2790)^+} - m_{\Xi_c^0} = 318.2 \pm 3.2$ MeV
$m_{\Xi_c(2790)^0} - m_{\Xi_c^+} = 324.0 \pm 3.3$ MeV
$\Xi_c(2790)^+$ width < 15 MeV, CL = 90%
$\Xi_c(2790)^0$ width < 12 MeV, CL = 90%

$\Xi_c(2790)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_c'\pi$	seen	159

$\Xi_c(2815)$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$

J^P has not been measured; $\frac{3}{2}^-$ is the quark-model prediction.

$\Xi_c(2815)^+$ mass $m = 2816.6 \pm 0.9$ MeV
$\Xi_c(2815)^0$ mass $m = 2819.6 \pm 1.2$ MeV
$m_{\Xi_c(2815)^+} - m_{\Xi_c^+} = 348.8 \pm 0.9$ MeV
$m_{\Xi_c(2815)^0} - m_{\Xi_c^0} = 348.7 \pm 1.2$ MeV
$m_{\Xi_c(2815)^+} - m_{\Xi_c(2815)^0} = -3.1 \pm 1.3$ MeV
$\Xi_c(2815)^+$ full width $\Gamma < 3.5$ MeV, CL = 90%
$\Xi_c(2815)^0$ full width $\Gamma < 6.5$ MeV, CL = 90%

The $\Xi_c\pi\pi$ modes are consistent with being entirely via $\Xi_c(2645)\pi$.

$\Xi_c(2815)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_c^+\pi^+\pi^-$	seen	196
$\Xi_c^0\pi^+\pi^-$	seen	191

$\Xi_c(2980)$

$I(J^P) = \frac{1}{2}(?^?)$

$\Xi_c(2980)^+$ $m = 2971.4 \pm 3.3$ MeV (S = 2.1)
$\Xi_c(2980)^0$ $m = 2968.0 \pm 2.6$ MeV (S = 1.2)
$\Xi_c(2980)^+$ width $\Gamma = 26 \pm 7$ MeV (S = 1.5)
$\Xi_c(2980)^0$ width $\Gamma = 20 \pm 7$ MeV (S = 1.3)

$\Xi_c(2980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \overline{K}\pi$	seen	231
$\Sigma_c(2455)\overline{K}$	seen	134
$\Lambda_c^+ \overline{K}$	not seen	414
$\Xi_c\, 2\pi$	seen	–
$\Xi_c(2645)\pi$	seen	277

$\Xi_c(3080)$

$I(J^P) = \frac{1}{2}(?^?)$

$\Xi_c(3080)^+$ $m = 3077.0 \pm 0.4$ MeV
$\Xi_c(3080)^0$ $m = 3079.9 \pm 1.4$ MeV (S = 1.3)
$\Xi_c(3080)^+$ width $\Gamma = 5.8 \pm 1.0$ MeV
$\Xi_c(3080)^0$ width $\Gamma = 5.6 \pm 2.2$ MeV

$\Xi_c(3080)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_c^+ \overline{K}\pi$	seen	415
$\Sigma_c(2455)\overline{K}$	seen	342
$\Sigma_c(2455)\overline{K} + \Sigma_c(2520)\overline{K}$	seen	–
$\Lambda_c^+ \overline{K}$	not seen	536
$\Lambda_c^+ \overline{K}\pi^+\pi^-$	not seen	143

Ω_c^0

$I(J^P) = 0(\frac{1}{2}^+)$

J^P has not been measured; $\frac{1}{2}^+$ is the quark-model prediction.

Mass $m = 2695.2 \pm 1.7$ MeV (S = 1.3)
Mean life $\tau = (69 \pm 12) \times 10^{-15}$ s
$c\tau = 21\ \mu$m

No absolute branching fractions have been measured.

Ω_c^0 DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Sigma^+ K^- K^- \pi^+$	seen	689
$\Xi^0 K^- \pi^+$	seen	901
$\Xi^- K^- \pi^+ \pi^+$	seen	830
$\Omega^- e^+ \nu_e$	seen	829
$\Omega^- \pi^+$	seen	821
$\Omega^- \pi^+ \pi^0$	seen	797
$\Omega^- \pi^- \pi^+ \pi^+$	seen	753

$\Omega_c(2770)^0$ $I(J^P) = 0(\frac{3}{2}^+)$

J^P has not been measured; $\frac{3}{2}^+$ is the quark-model prediction.

Mass $m = 2765.9 \pm 2.0$ MeV (S = 1.2)

$m_{\Omega_c(2770)^0} - m_{\Omega_c^0} = 70.7^{+0.8}_{-0.9}$ MeV

The $\Omega_c(2770)^0$–Ω_c^0 mass difference is too small for any strong decay to occur.

$\Omega_c(2770)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Omega_c^0\gamma$	presumably 100%	70

BOTTOM BARYONS ($B = -1$)

$\Lambda_b^0 = udb$, $\Xi_b^0 = usb$, $\Xi_b^- = dsb$, $\Omega_b^- = ssb$

Λ_b^0 $I(J^P) = 0(\frac{1}{2}^+)$

$I(J^P)$ not yet measured; $0(\frac{1}{2}^+)$ is the quark model prediction.

Mass $m = 5619.5 \pm 0.4$ MeV

$m_{\Lambda_b^0} - m_{B^0} = 339.2 \pm 1.4$ MeV

$m_{\Lambda_b^0} - m_{B^+} = 339.7 \pm 0.7$ MeV

Mean life $\tau = (1.451 \pm 0.013) \times 10^{-12}$ s

$c\tau = 435\ \mu$m

$A_{CP}(\Lambda_b \to p\pi^-) = 0.03 \pm 0.18$

$A_{CP}(\Lambda_b \to pK^-) = 0.37 \pm 0.17$

α decay parameter for $\Lambda_b \to J/\psi\Lambda = 0.05 \pm 0.18$

The branching fractions B(b-baryon $\to \Lambda\ell^-\overline{\nu}_\ell$ anything) and B($\Lambda_b^0 \to \Lambda_c^+\ell^-\overline{\nu}_\ell$ anything) are not pure measurements because the underlying measured products of these with B($b \to b$-baryon) were used to determine B($b \to b$-baryon), as described in the note "Production and Decay of b-Flavored Hadrons."

For inclusive branching fractions, *e.g.*, $\Lambda_b \to \overline{\Lambda}_c$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

Λ_b^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$J/\psi(1S)\Lambda \times$ B($b \to \Lambda_b^0$)	$(5.8 \pm 0.8) \times 10^{-5}$		1740
$pD^0\pi^-$	$(5.9\ ^{+4.0}_{-3.2}) \times 10^{-4}$		2370
pD^0K^-	$(4.3\ ^{+3.0}_{-2.4}) \times 10^{-5}$		2269
$\Lambda_c^+\pi^-$	$(5.7\ ^{+4.0}_{-2.6}) \times 10^{-3}$	S=1.6	2342
$\Lambda_c^+K^-$	$(4.2\ ^{+2.6}_{-1.9}) \times 10^{-4}$		2314
$\Lambda_c^+ a_1(1260)^-$	seen		2153
$\Lambda_c^+\pi^+\pi^-\pi^-$	$(8\ ^{+5}_{-4}) \times 10^{-3}$	S=1.6	2323

$\Lambda_c(2595)^+\pi^-$, $\Lambda_c(2595)^+ \to \Lambda_c^+\pi^+\pi^-$		$(3.7\ ^{+2.8}_{-2.3}) \times 10^{-4}$		2210
$\Lambda_c(2625)^+\pi^-$, $\Lambda_c(2625)^+ \to \Lambda_c^+\pi^+\pi^-$		$(3.6\ ^{+2.7}_{-2.1}) \times 10^{-4}$		2193
$\Sigma_c(2455)^0\pi^+\pi^-$, $\Sigma_c^0 \to \Lambda_c^+\pi^-$		$(6\ ^{+5}_{-4}) \times 10^{-4}$		2265
$\Sigma_c(2455)^{++}\pi^-\pi^-$, $\Sigma_c^{++} \to \Lambda_c^+\pi^+$		$(3.5\ ^{+2.8}_{-2.3}) \times 10^{-4}$		2265
$\Lambda_c^+\ell^-\overline{\nu}_\ell$ anything	[x]	(9.9 ±2.2) %		–
$\Lambda_c^+\ell^-\overline{\nu}_\ell$		$(6.5\ ^{+3.2}_{-2.5})$ %	S=1.8	2345
$\Lambda_c^+\pi^+\pi^-\ell^-\overline{\nu}_\ell$		(5.6 ±3.1) %		2335
$\Lambda_c(2595)^+\ell^-\overline{\nu}_\ell$		$(8 \pm 5) \times 10^{-3}$		2212
$\Lambda_c(2625)^+\ell^-\overline{\nu}_\ell$		$(1.4\ ^{+0.9}_{-0.7})$ %		2195
$p h^-$	[y]	$< 2.3 \times 10^{-5}$	CL=90%	2730
$p\pi^-$		$(4.1 \pm 0.8) \times 10^{-6}$		2730
pK^-		$(4.9 \pm 0.9) \times 10^{-6}$		2708
$\Lambda\mu^+\mu^-$		$(1.08 \pm 0.28) \times 10^{-6}$		2695
$\Lambda\gamma$		$< 1.3 \times 10^{-3}$	CL=90%	2699

$\Lambda_b(5912)^0$

$J^P = \frac{1}{2}^-$

Mass $m = 5912.1 \pm 0.4$ MeV
Full width $\Gamma < 0.66$ MeV, CL = 90%

$\Lambda_b(5912)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0\pi^+\pi^-$	seen	86

$\Lambda_b(5920)^0$

$J^P = \frac{3}{2}^-$

Mass $m = 5919.73 \pm 0.32$ MeV
Full width $\Gamma < 0.63$ MeV, CL = 90%

$\Lambda_b(5920)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0\pi^+\pi^-$	seen	108

Σ_b

$I(J^P) = 1(\frac{1}{2}^+)$
I, J, P need confirmation.

Mass $m(\Sigma_b^+) = 5811.3 \pm 1.9$ MeV
Mass $m(\Sigma_b^-) = 5815.5 \pm 1.8$ MeV
$m_{\Sigma_b^+} - m_{\Sigma_b^-} = -4.2 \pm 1.1$ MeV
$\Gamma(\Sigma_b^+) = 9.7^{+4.0}_{-3.0}$ MeV
$\Gamma(\Sigma_b^-) = 4.9^{+3.3}_{-2.4}$ MeV

Σ_b DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0\pi$	dominant	134

Σ_b^*

$I(J^P) = 1(\frac{3}{2}^+)$
I, J, P need confirmation.

Mass $m(\Sigma_b^{*+}) = 5832.1 \pm 1.9$ MeV
Mass $m(\Sigma_b^{*-}) = 5835.1 \pm 1.9$ MeV
$m_{\Sigma_b^{*+}} - m_{\Sigma_b^{*-}} = -3.0^{+1.0}_{-0.9}$ MeV
$\Gamma(\Sigma_b^{*+}) = 11.5 \pm 2.8$ MeV
$\Gamma(\Sigma_b^{*-}) = 7.5 \pm 2.3$ MeV
$m_{\Sigma_b^*} - m_{\Sigma_b} = 21.2 \pm 2.0$ MeV

Σ_b^* DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0 \pi$	dominant	161

Ξ_b^0, Ξ_b^-

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$
I, J, P need confirmation.

$m(\Xi_b^-) = 5794.9 \pm 0.9$ MeV (S = 1.1)
$m(\Xi_b^0) = 5793.1 \pm 2.5$ MeV (S = 1.1)
$m_{\Xi_b^-} - m_{\Lambda_b^0} = 176.2 \pm 0.9$ MeV
$m_{\Xi_b^0} - m_{\Lambda_b^0} = 174.8 \pm 2.5$ MeV
$m_{\Xi_b^-} - m_{\Xi_b^0} = 3 \pm 6$ MeV
Mean life $\tau_{\Xi_b^-} = (1.56^{+0.27}_{-0.25}) \times 10^{-12}$ s
Mean life $\tau_{\Xi_b} = (1.49^{+0.19}_{-0.18}) \times 10^{-12}$ s

Ξ_b DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\Xi_b \to \Xi^- \ell^- \overline{\nu}_\ell X \times$ B($\overline{b} \to \Xi_b$)	$(3.9 \pm 1.2) \times 10^{-4}$	1.4	–
$\Xi_b^- \to J/\psi \Xi^- \times$ B($b \to \Xi_b^-$)	$(1.02^{+0.26}_{-0.21}) \times 10^{-5}$		1783
$\Xi_b^0 \to p D^0 K^- \times$ B($\overline{b} \to \Xi_b$)	$(1.8^{+1.3}_{-1.1}) \times 10^{-6}$		–
$\Xi_b^0 \to \Lambda_c^+ K^- \times$ B($\overline{b} \to \Xi_b$)	$(8 \pm 7) \times 10^{-7}$		–

$\Xi_b(5945)^0$

$J^P = \frac{3}{2}^+$

Mass $m = 5949.3 \pm 1.2$ MeV
Full width $\Gamma = 2.1 \pm 1.7$ MeV

$\Xi_b(5945)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_b^- \pi^+$	seen	69

Ω_b^-

$I(J^P) = 0(\frac{1}{2}^+)$
I, J, P need confirmation.

Mass $m = 6048.8 \pm 3.2$ MeV (S = 1.5)
$m_{\Omega_b^-} - m_{\Lambda_b^0} = 426.4 \pm 2.2$ MeV
Mean life $\tau = (1.1^{+0.5}_{-0.4}) \times 10^{-12}$ s

Ω_b^- DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\Omega^- \times$B($b \rightarrow \Omega_b$)	$(2.9^{+1.1}_{-0.8}) \times 10^{-6}$	1808

b-baryon ADMIXTURE (Λ_b, Ξ_b, Σ_b, Ω_b)

Mean life $\tau = (1.449 \pm 0.015) \times 10^{-12}$ s

These branching fractions are actually an average over weakly decaying b-baryons weighted by their production rates at the LHC, LEP, and Tevatron, branching ratios, and detection efficiencies. They scale with the b-baryon production fraction B($b \rightarrow$ b-baryon).

The branching fractions B(b-baryon $\rightarrow$ $\Lambda\ell^-\overline{\nu}_\ell$ anything) and B($\Lambda_b^0 \rightarrow \Lambda_c^+\ell^-\overline{\nu}_\ell$ anything) are not pure measurements because the underlying measured products of these with B($b \rightarrow$ b-baryon) were used to determine B($b \rightarrow$ b-baryon), as described in the note "Production and Decay of b-Flavored Hadrons."

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

b-baryon ADMIXTURE DECAY MODES (Λ_b,Ξ_b,Σ_b,Ω_b)	Fraction (Γ_i/Γ)	p (MeV/c)
$p\mu^-\overline{\nu}$ anything	$(5.3^{+2.2}_{-1.9})$ %	–
$p\ell\overline{\nu}_\ell$ anything	(5.1 ± 1.2) %	–
p anything	(64 ±21) %	–
$\Lambda\ell^-\overline{\nu}_\ell$ anything	(3.5± 0.6) %	–
$\Lambda/\overline{\Lambda}$ anything	(36 ± 7) %	–
$\Xi^-\ell^-\overline{\nu}_\ell$ anything	(6.0± 1.6) $\times 10^{-3}$	–

NOTES

This Summary Table only includes established baryons. The Particle Listings include evidence for other baryons. The masses, widths, and branching fractions for the resonances in this Table are Breit-Wigner parameters, but pole positions are also given for most of the N and Δ resonances.

For most of the resonances, the parameters come from various partial-wave analyses of more or less the same sets of data, and it is not appropriate to treat the results of the analyses as independent or to average them together. Furthermore, the systematic errors on the results are not well understood. Thus, we usually only give ranges for the parameters. We then also give a best guess for the mass (as part of the name of the resonance) and for the width. The *Note on N and Δ Resonances* and the *Note on Λ and Σ Resonances* in the Particle Listings review the partial-wave analyses.

When a quantity has "(S = ...)" to its right, the error on the quantity has been enlarged by the "scale factor" S, defined as $S = \sqrt{\chi^2/(N-1)}$, where N is the number of measurements used in calculating the quantity. We do this when $S > 1$, which often indicates that the measurements are inconsistent. When $S > 1.25$, we also show in the Particle Listings an ideogram of the measurements. For more about S, see the Introduction.

A decay momentum p is given for each decay mode. For a 2-body decay, p is the momentum of each decay product in the rest frame of the decaying particle. For a 3-or-more-body decay, p is the largest momentum any of the products can have in this frame. For any resonance, the *nominal* mass is used in calculating p. A dagger ("†") in this column indicates that the mode is forbidden when the nominal masses of resonances are used, but is in fact allowed due to the nonzero widths of the resonances.

[*a*] The masses of the p and n are most precisely known in u (unified atomic mass units). The conversion factor to MeV, 1 u = 931.494061(21) MeV, is less well known than are the masses in u.

[*b*] The $|m_p - m_{\overline{p}}|/m_p$ and $|q_p + q_{\overline{p}}|/e$ are not independent, and both use the more precise measurement of $|q_{\overline{p}}/m_{\overline{p}}|/(q_p/m_p)$.

[*c*] The limit is from neutrality-of-matter experiments; it assumes $q_n = q_p + q_e$. See also the charge of the neutron.

[*d*] The μp and $e p$ values for the charge radius are much too different to average them. The disagreement is not yet understood.

[*e*] The first limit is for $p \rightarrow$ anything or "disappearance" modes of a bound proton. The second entry, a rough range of limits, assumes the dominant decay modes are among those investigated. For antiprotons the best limit, inferred from the observation of cosmic ray $\overline{p}$'s is $\tau_{\overline{p}} > 10^7$ yr, the cosmic-ray storage time, but this limit depends on a number of assumptions. The best direct observation of stored antiprotons gives $\tau_{\overline{p}}/\mathrm{B}(\overline{p} \rightarrow e^- \gamma) > 7 \times 10^5$ yr.

[*f*] There is some controversy about whether nuclear physics and model dependence complicate the analysis for bound neutrons (from which the best limit comes). The first limit here is from reactor experiments with free neutrons.

[*g*] Lee and Yang in 1956 proposed the existence of a mirror world in an attempt to restore global parity symmetry—thus a search for oscillations between the two worlds. Oscillations between the worlds would be maximal when the magnetic fields B and B' were equal. The limit for any B' in the range 0 to 12.5 μT is >12 s (95% CL).

[*h*] The parameters g_A, g_V, and g_{WM} for semileptonic modes are defined by $\overline{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i})\,\sigma_{\lambda\nu}\,q^\nu]B_i$, and ϕ_{AV} is defined by

$g_A/g_V = |g_A/g_V|e^{i\phi_{AV}}$. See the "Note on Baryon Decay Parameters" in the neutron Particle Listings in the Full *Review of Particle Physics*.

[*i*] Time-reversal invariance requires this to be 0° or 180°.

[*j*] This coefficient is zero if time invariance is not violated.

[*k*] This limit is for γ energies between 15 and 340 keV.

[*l*] The decay parameters γ and Δ are calculated from α and ϕ using

$$\gamma = \sqrt{1-\alpha^2}\,\cos\phi\,, \qquad \tan\Delta = -\frac{1}{\alpha}\,\sqrt{1-\alpha^2}\,\sin\phi\,.$$

See the "Note on Baryon Decay Parameters" in the neutron Particle Listings in the Full *Review of Particle Physics*.

[*n*] See Particle Listings in the Full *Review of Particle Physics* for the pion momentum range used in this measurement.

[*o*] The error given here is only an educated guess. It is larger than the error on the weighted average of the published values.

[*p*] A theoretical value using QED.

[*q*] See the note on "Λ_c^+ Branching Fractions" in the Λ_c^+ Particle Listings in the Full *Review of Particle Physics*.

[*r*] This branching fraction includes all the decay modes of the final-state resonance.

[*s*] An ℓ indicates an e or a μ mode, not a sum over these modes.

[*t*] The value is for the sum of the charge states or particle/antiparticle states indicated.

[*u*] Assuming isospin conservation, so that the other third is $\Lambda_c^+\pi^0\pi^0$.

[*v*] A test that the isospin is indeed 0, so that the particle is indeed a Λ_c^+.

[*x*] Not a pure measurement. See note at head of Λ_b^0 Decay Modes.

[*y*] Here h^- means π^- or K^-.

SEARCHES FOR MONOPOLES, SUPERSYMMETRY, TECHNICOLOR, COMPOSITENESS, EXTRA DIMENSIONS, etc.

Magnetic Monopole Searches

Isolated supermassive monopole candidate events have not been confirmed. The most sensitive experiments obtain negative results.

Best cosmic-ray supermassive monopole flux limit:

$< 1.4 \times 10^{-16}$ cm^{-2}sr^{-1}s^{-1} for $1.1 \times 10^{-4} < \beta < 1$

Supersymmetric Particle Searches

Limits are based on the Minimal Supersymmetric Standard Model (MSSM) with additional assumptions as follows:

1) $\widetilde{\chi}_1^0$ (or $\widetilde{\gamma}$) is lightest supersymmetric particle; 2) R-parity is conserved; 3) With the exception of $\widetilde{t}$ and $\widetilde{b}$, all scalar quarks are assumed to be degenerate in mass and $m_{\widetilde{q}_R} = m_{\widetilde{q}_L}$. 4) Limits for charged sleptons refer to the $\widetilde{\ell}_R$ states. 5) Unless otherwise stated, gaugino mass unification at the GUT scale is assumed. For squarks and gluinos, the Constrained MSSM (CMSSM) limits and simplified model limits are presented.

See the Particle Listings in the Full *Review of Particle Physics* for a Note giving details of supersymmetry.

$\widetilde{\chi}_i^0$ — neutralinos (mixtures of $\widetilde{\gamma}$, $\widetilde{Z}^0$, and $\widetilde{H}_i^0$)

Mass $m_{\widetilde{\chi}_1^0} > 46$ GeV, CL = 95%
[all tanβ, all m_0, all $m_{\widetilde{\chi}_2^0} - m_{\widetilde{\chi}_1^0}$]

Mass $m_{\widetilde{\chi}_2^0} > 62.4$ GeV, CL = 95%
[1<tanβ<40, all m_0, all $m_{\widetilde{\chi}_2^0} - m_{\widetilde{\chi}_1^0}$]

Mass $m_{\widetilde{\chi}_3^0} > 99.9$ GeV, CL = 95%
[1<tanβ<40, all m_0, all $m_{\widetilde{\chi}_2^0} - m_{\widetilde{\chi}_1^0}$]

Mass $m_{\widetilde{\chi}_4^0} > 116$ GeV, CL = 95%
[1<tanβ<40, all m_0, all $m_{\widetilde{\chi}_2^0} - m_{\widetilde{\chi}_1^0}$]

$\widetilde{\chi}_i^\pm$ — charginos (mixtures of $\widetilde{W}^\pm$ and $\widetilde{H}_i^\pm$)

Mass $m_{\widetilde{\chi}_1^\pm} > 94$ GeV, CL = 95%
[tan$\beta < 40$, $m_{\widetilde{\chi}_1^\pm} - m_{\widetilde{\chi}_1^0} > 3$ GeV, all m_0]

$\widetilde{\nu}$ — sneutrino

Mass $m > 94$ GeV, CL = 95%
[$1 \leq$ tan$\beta \leq 40$, $m_{\widetilde{e}_R} - m_{\widetilde{\chi}_1^0} > 10$ GeV]

$\widetilde{e}$ — scalar electron (selectron)

Mass $m >$ 107 GeV, CL = 95% [all $m_{\widetilde{e}_R}$–$m_{\widetilde{\chi}^0_1}$]

$\widetilde{\mu}$ — scalar muon (smuon)

Mass $m >$ 94 GeV, CL = 95%
[$1 \leq \tan\beta \leq 40$, $m_{\widetilde{\mu}_R}$–$m_{\widetilde{\chi}^0_1} > 10$ GeV]

$\widetilde{\tau}$ — scalar tau (stau)

Mass $m >$ 81.9 GeV, CL = 95%
[$m_{\widetilde{\tau}_R} - m_{\widetilde{\chi}^0_1} >$15 GeV, all θ_τ]

$\widetilde{q}$ – scalar quark partners (squarks) of the first two quark generations

The first of these limits is within CMSSM with cascade decays, evaluated assuming a fixed value of the parameters μ and tanβ. Limits assume two-generations of mass degenerate squarks ($\widetilde{q}_L$ and $\widetilde{q}_R$) and gaugino mass parameters that are constrained by the unification condition at the grand unification scale. The second limit assumes a simplified model with a 100% branching ratio for the prompt decay $\widetilde{q} \rightarrow q\widetilde{\chi}^0_1$.

Mass $m >$ 1110 GeV, CL = 95% [tanβ=10, $\mu >$0, A_0=0]
Mass $m >$ 750 GeV, CL = 95%
[jets + $\not\!\!E_T$, $\widetilde{q} \rightarrow q\widetilde{\chi}^0_1$ simplified model, $m_{\widetilde{\chi}^0_1}$= 0 GeV]

$\widetilde{b}$ — scalar bottom (sbottom)

Mass $m >$ 89 GeV, CL = 95%
[$\widetilde{b} \rightarrow b\widetilde{\chi}^0_1$, $m_{\widetilde{b}_1} - m_{\widetilde{\chi}^0_1} >$ 8 GeV, all θ_b]
Mass $m >$ 600 GeV, CL = 95%
[jets + $\not\!\!E_T$, $\widetilde{b} \rightarrow b\widetilde{\chi}^0_1$ simplified model, $m_{\widetilde{\chi}^0_1}$= 0 GeV]

$\widetilde{t}$ — scalar top (stop)

Mass $m >$ 95.7 GeV, CL = 95%
[$\widetilde{t} \rightarrow c\widetilde{\chi}^0_1$, $m_{\widetilde{t}} - m_{\widetilde{\chi}^0_1} >$ 10 GeV, all θ_t]
Mass $m >$ 650 GeV, CL = 95%
[1 $\ell^\pm$ + jets + $\not\!\!E_T$, $\widetilde{t} \rightarrow t\widetilde{\chi}^0_1$ simplified model, $m_{\widetilde{\chi}^0_1}$=0 GeV]

$\widetilde{g}$ — gluino

The first of these limits is within the CMSSM for ($m_{\widetilde{g}} \gtrsim 5$ GeV), and includes the effects of cascade decays, evaluated assuming a fixed value of the parameters μ and tanβ. Limit assumes GUT relations between gaugino masses and the gauge couplings. The second limit assumes a simplified model with a 100% branching ratio for the prompt 3 body decay $\widetilde{g} \rightarrow q\overline{q}\widetilde{\chi}^0_1$, independent of the squark mass.

Mass $m >$ 800 GeV, CL = 95% [any $m_{\widetilde{q}}$]
Mass $m >$ 950 GeV, CL = 95%
[jets + $\not\!\!E_T$, $\widetilde{g} \rightarrow q\overline{q}\widetilde{\chi}^0_1$ simplified model, $m_{\widetilde{\chi}^0_1}$ = 0 GeV]

Technicolor

The limits for technicolor (and top-color) particles are quite varied depending on assumptions. See the Technicolor section of the full *Review* (the data listings).

Quark and Lepton Compositeness, Searches for

Scale Limits Λ for Contact Interactions (the lowest dimensional interactions with four fermions)

If the Lagrangian has the form

$$\pm \frac{g^2}{2\Lambda^2}\, \overline{\psi}_L \gamma_\mu \psi_L \overline{\psi}_L \gamma^\mu \psi_L$$

(with $g^2/4\pi$ set equal to 1), then we define $\Lambda \equiv \Lambda^{\pm}_{LL}$. For the full definitions and for other forms, see the Note in the Listings on Searches for Quark and Lepton Compositeness in the full *Review* and the original literature.

$\Lambda^{+}_{LL}(eeee)$	$>$	8.3 TeV, CL = 95%
$\Lambda^{-}_{LL}(eeee)$	$>$	10.3 TeV, CL = 95%
$\Lambda^{+}_{LL}(ee\mu\mu)$	$>$	8.5 TeV, CL = 95%
$\Lambda^{-}_{LL}(ee\mu\mu)$	$>$	9.5 TeV, CL = 95%
$\Lambda^{+}_{LL}(ee\tau\tau)$	$>$	7.9 TeV, CL = 95%
$\Lambda^{-}_{LL}(ee\tau\tau)$	$>$	7.2 TeV, CL = 95%
$\Lambda^{+}_{LL}(\ell\ell\ell\ell)$	$>$	9.1 TeV, CL = 95%
$\Lambda^{-}_{LL}(\ell\ell\ell\ell)$	$>$	10.3 TeV, CL = 95%
$\Lambda^{+}_{LL}(eeuu)$	$>$	23.3 TeV, CL = 95%
$\Lambda^{-}_{LL}(eeuu)$	$>$	12.5 TeV, CL = 95%
$\Lambda^{+}_{LL}(eedd)$	$>$	11.1 TeV, CL = 95%
$\Lambda^{-}_{LL}(eedd)$	$>$	26.4 TeV, CL = 95%
$\Lambda^{+}_{LL}(eecc)$	$>$	9.4 TeV, CL = 95%
$\Lambda^{-}_{LL}(eecc)$	$>$	5.6 TeV, CL = 95%
$\Lambda^{+}_{LL}(eebb)$	$>$	9.4 TeV, CL = 95%
$\Lambda^{-}_{LL}(eebb)$	$>$	10.2 TeV, CL = 95%
$\Lambda^{+}_{LL}(\mu\mu qq)$	$>$	9.6 TeV, CL = 95%
$\Lambda^{-}_{LL}(\mu\mu qq)$	$>$	13.1 TeV, CL = 95%
$\Lambda(\ell\nu\ell\nu)$	$>$	3.10 TeV, CL = 90%
$\Lambda(e\nu qq)$	$>$	2.81 TeV, CL = 95%
$\Lambda^{+}_{LL}(qqqq)$	$>$	7.6 TeV, CL = 95%
$\Lambda^{-}_{LL}(qqqq)$	$>$	7.6 TeV, CL = 95%
$\Lambda^{+}_{LL}(\nu\nu qq)$	$>$	5.0 TeV, CL = 95%
$\Lambda^{-}_{LL}(\nu\nu qq)$	$>$	5.4 TeV, CL = 95%

Excited Leptons

The limits from $\ell^{*+}\ell^{*-}$ do not depend on λ (where λ is the $\ell\ell^*$ transition coupling). The λ-dependent limits assume chiral coupling.

$e^{*\pm}$ — excited electron

Mass $m >$ 103.2 GeV, CL = 95% (from e^*e^*)
Mass $m >$ 2.200×10^3 GeV, CL = 95% (from $e\,e^*$)
Mass $m >$ 356 GeV, CL = 95% (if $\lambda_\gamma = 1$)

$\mu^{*\pm}$ — excited muon

Mass $m >$ 103.2 GeV, CL = 95% (from $\mu^*\mu^*$)
Mass $m >$ 2.200×10^3 GeV, CL = 95% (from $\mu\mu^*$)

$\tau^{*\pm}$ — excited tau

Mass $m >$ 103.2 GeV, CL = 95% (from $\tau^*\tau^*$)
Mass $m >$ 185 GeV, CL = 95% (from $\tau\tau^*$)

ν^* — excited neutrino

Mass $m >$ 102.6 GeV, CL = 95% (from $\nu^*\nu^*$)
Mass $m >$ 213 GeV, CL = 95% (from $\nu\nu^*$)

q^* — excited quark

Mass $m >$ 338 GeV, CL = 95% (from q^*q^*)
Mass $m >$ 3.500×10^3 GeV, CL = 95% (from q^*X)

Color Sextet and Octet Particles

Color Sextet Quarks (q_6)

Mass $m >$ 84 GeV, CL = 95% (Stable q_6)

Color Octet Charged Leptons (ℓ_8)

Mass $m >$ 86 GeV, CL = 95% (Stable ℓ_8)

Color Octet Neutrinos (ν_8)

Mass $m >$ 110 GeV, CL = 90% ($\nu_8 \rightarrow \nu g$)

Extra Dimensions

Please refer to the Extra Dimensions section of the full *Review* for a discussion of the model-dependence of these bounds, and further constraints.

Constraints on the fundamental gravity scale

$M_{TT} >$ 3.2 TeV, CL = 95% ($pp \rightarrow e^+e^-,\ \mu^+\mu^-,\ \gamma\gamma$)
$M_C >$ 4.16 TeV, CL = 95% ($pp \rightarrow \ell\bar{\ell}$)
$M_D >$ 2.16 TeV, CL = 95% ($pp \rightarrow G \rightarrow \ell\bar{\ell}$)

Constraints on the radius of the extra dimensions, for the case of two-flat dimensions of equal radii

$R <$ 30 μm, CL = 95% (direct tests of Newton's law)
$R <$ 23 μm, CL = 95% ($pp \rightarrow jG$)
$R <$ 0.16–916 nm (astrophysics; limits depend on technique and assumptions)