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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

$\pi^{\pm} \rightarrow \ell^{\pm}\nu\gamma$ form factors [a]

$F_V = 0.017 \pm 0.008$
$F_A = 0.0115 \pm 0.0005$ (S = 1.2)
$R = 0.059^{+0.009}_{-0.008}$

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

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

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]	(1.61 ±0.23) $\times 10^{-7}$		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 $\tau = (8.4 \pm 0.6) \times 10^{-17}$ s (S = 3.0)
$c\tau = 25.1$ 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		(98.798 ± 0.032) %	S=1.1	67
$e^+ e^- \gamma$		(1.198 ± 0.032) %	S=1.1	67
γ positronium		$(1.82\pm0.29)\times10^{-9}$		67
$e^+ e^+ e^- e^-$		$(3.14\pm0.30)\times10^{-5}$		67
$e^+ e^-$		$(6.2\pm0.5)\times10^{-8}$		67
4γ		$< 2\times10^{-8}$	CL=90%	67
$\nu\overline{\nu}$	[e]	$< 2.7\times10^{-7}$	CL=90%	67
$\nu_e\overline{\nu}_e$		$< 1.7\times10^{-6}$	CL=90%	67
$\nu_\mu\overline{\nu}_\mu$		$< 1.6\times10^{-6}$	CL=90%	67
$\nu_\tau\overline{\nu}_\tau$		$< 2.1\times10^{-6}$	CL=90%	67
$\gamma\nu\overline{\nu}$		$< 6\times10^{-4}$	CL=90%	67
Charge conjugation (*C*) or Lepton Family number (*LF*) violating modes				
3γ	*C*	$< 3.1\times10^{-8}$	CL=90%	67
$\mu^+ e^-$	*LF*	$< 3.8\times10^{-10}$	CL=90%	26
$\mu^- e^+$	*LF*	$< 3.4\times10^{-9}$	CL=90%	26
$\mu^+ e^- + \mu^- e^+$	*LF*	$< 1.72\times10^{-8}$	CL=90%	26

η

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

Mass $m = 547.51 \pm 0.18$ MeV [f] (S = 5.8)
Full width $\Gamma = 1.30 \pm 0.07$ keV [g]

C-nonconserving decay parameters

$\pi^+\pi^-\pi^0$ Left-right asymmetry = $(0.09 \pm 0.17) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ Sextant asymmetry = $(0.18 \pm 0.16) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ Quadrant asymmetry = $(-0.17 \pm 0.17) \times 10^{-2}$
$\pi^+\pi^-\gamma$ Left-right asymmetry = $(0.9 \pm 0.4) \times 10^{-2}$
$\pi^+\pi^-\gamma$ β (D-wave) = -0.02 ± 0.07 (S = 1.3)

Dalitz plot parameter

$\pi^0\pi^0\pi^0$ $\alpha = -0.031 \pm 0.004$ (S = 1.1)

η DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
		Neutral modes		
neutral modes		(71.9 ± 0.5) %	S=1.3	–
2γ	[g]	(39.38 ± 0.26) %	S=1.2	274
$3\pi^0$		(32.51 ± 0.28) %	S=1.2	179
$\pi^0 2\gamma$		$(4.4 \pm 1.6) \times 10^{-4}$	S=2.0	257
$\pi^0 \pi^0 \gamma\gamma$		$< 1.2 \times 10^{-3}$	CL=90%	238
other neutral modes				
		Charged modes		
charged modes		(28.0 ± 0.5) %	S=1.3	–
$\pi^+\pi^-\pi^0$		(22.7 ± 0.4) %	S=1.3	174
$\pi^+\pi^-\gamma$		(4.69 ± 0.11) %	S=1.2	236
$e^+e^-\gamma$		$(6.0 \pm 0.8) \times 10^{-3}$	S=1.4	274
$\mu^+\mu^-\gamma$		$(3.1 \pm 0.4) \times 10^{-4}$		253
e^+e^-		$< 7.7 \times 10^{-5}$	CL=90%	274
$\mu^+\mu^-$		$(5.8 \pm 0.8) \times 10^{-6}$		253
$e^+e^-e^+e^-$		$< 6.9 \times 10^{-5}$	CL=90%	274
$\pi^+\pi^-e^+e^-$		$(4.0 {}^{+5.3}_{-2.5}) \times 10^{-4}$	S=2.1	235
$\pi^+\pi^-2\gamma$		$< 2.0 \times 10^{-3}$		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
$\pi^0\pi^0$	P,CP	$< 4.3 \times 10^{-4}$	CL=90%	238
$\pi^0\pi^0\gamma$	C	$< 5 \times 10^{-4}$	CL=90%	238
$\pi^0\pi^0\pi^0\gamma$	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
$\pi^0e^+e^-$	C [h]	$< 4 \times 10^{-5}$	CL=90%	257
$\pi^0\mu^+\mu^-$	C [h]	$< 5 \times 10^{-6}$	CL=90%	210
$\mu^+e^- + \mu^-e^+$	LF	$< 6 \times 10^{-6}$	CL=90%	264

$f_0(600)$ [i] or σ

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

Mass $m = (400\text{–}1200)$ MeV
Full width $\Gamma = (600\text{–}1000)$ MeV

$f_0(600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	–
$\gamma\gamma$	seen	–

$\rho(770)$ [j]

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

Mass $m = 775.5 \pm 0.4$ MeV
Full width $\Gamma = 149.4 \pm 1.0$ MeV
$\Gamma_{ee} = 7.02 \pm 0.11$ keV

$\rho(770)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$		~ 100 %		363
$\rho(770)^{\pm}$ decays				
$\pi^{\pm}\gamma$		$(4.5 \pm 0.5) \times 10^{-4}$	S=2.2	375
$\pi^{\pm}\eta$		$< 6 \times 10^{-3}$	CL=84%	153
$\pi^{\pm}\pi^{+}\pi^{-}\pi^{0}$		$< 2.0 \times 10^{-3}$	CL=84%	254
$\rho(770)^{0}$ decays				
$\pi^{+}\pi^{-}\gamma$		$(9.9 \pm 1.6) \times 10^{-3}$		362
$\pi^{0}\gamma$		$(6.0 \pm 0.8) \times 10^{-4}$		376
$\eta\gamma$		$(2.95 \pm 0.30) \times 10^{-4}$	S=1.2	194
$\pi^{0}\pi^{0}\gamma$		$(4.5 \pm 0.8) \times 10^{-5}$		363
$\mu^{+}\mu^{-}$	[k]	$(4.55 \pm 0.28) \times 10^{-5}$		373
$e^{+}e^{-}$	[k]	$(4.70 \pm 0.08) \times 10^{-5}$		388
$\pi^{+}\pi^{-}\pi^{0}$		$(1.01^{+0.54}_{-0.36} \pm 0.34) \times 10^{-4}$		323
$\pi^{+}\pi^{-}\pi^{+}\pi^{-}$		$(1.8 \pm 0.9) \times 10^{-5}$		251
$\pi^{+}\pi^{-}\pi^{0}\pi^{0}$		$< 4 \times 10^{-5}$	CL=90%	257

$\omega(782)$

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

Mass $m = 782.65 \pm 0.12$ MeV (S = 1.9)
Full width $\Gamma = 8.49 \pm 0.08$ MeV
$\Gamma_{ee} = 0.60 \pm 0.02$ keV

$\omega(782)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi^+\pi^-\pi^0$		(89.1 ± 0.7) %	S=1.1	327
$\pi^0\gamma$		$(8.90^{+0.27}_{-0.23})$ %	S=1.1	380
$\pi^+\pi^-$		(1.70 ± 0.27) %	S=1.4	366
neutrals (excluding $\pi^0\gamma$)		$(1.6\ ^{+7.4}_{-1.1}) \times 10^{-3}$		–
$\eta\gamma$		$(4.9 \pm 0.5) \times 10^{-4}$		200
$\pi^0 e^+ e^-$		$(7.7 \pm 0.9) \times 10^{-4}$	S=1.1	380
$\pi^0\mu^+\mu^-$		$(9.6 \pm 2.3) \times 10^{-5}$		349
e^+e^-		$(7.18\pm0.12) \times 10^{-5}$	S=1.1	391
$\pi^+\pi^-\pi^0\pi^0$		< 2 %	CL=90%	262
$\pi^+\pi^-\gamma$		$< 3.6 \times 10^{-3}$	CL=95%	366
$\pi^+\pi^-\pi^+\pi^-$		$< 1 \times 10^{-3}$	CL=90%	256
$\pi^0\pi^0\gamma$		$(6.7 \pm 1.1) \times 10^{-5}$		367
$\eta\pi^0\gamma$		$< 3.3 \times 10^{-5}$	CL=90%	163
$\mu^+\mu^-$		$(9.0 \pm 3.1) \times 10^{-5}$		377
3γ		$< 1.9 \times 10^{-4}$	CL=95%	391
Charge conjugation (C) violating modes				
$\eta\pi^0$	C	$< 1 \times 10^{-3}$	CL=90%	163
$3\pi^0$	C	$< 3 \times 10^{-4}$	CL=90%	330

$\eta'(958)$

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

Mass $m = 957.78 \pm 0.14$ MeV
Full width $\Gamma = 0.203 \pm 0.016$ MeV (S = 1.3)

$\eta'(958)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi^+\pi^-\eta$	(44.5 ± 1.4) %	S=1.1	232
$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.4 ± 0.9) %	S=1.1	165
$\pi^0\pi^0\eta$	(20.8 ± 1.2) %	S=1.2	239
$\omega\gamma$	(3.03 ± 0.31) %		159
$\gamma\gamma$	(2.12 ± 0.14) %	S=1.3	479
$3\pi^0$	$(1.55\pm0.26) \times 10^{-3}$		430
$\mu^+\mu^-\gamma$	$(1.04\pm0.26) \times 10^{-4}$		467
$\pi^+\pi^-\pi^0$	< 5 %	CL=90%	428
$\pi^0\rho^0$	< 4 %	CL=90%	111
$\pi^+\pi^+\pi^-\pi^-$	< 1 %	CL=90%	372
$\pi^+\pi^+\pi^-\pi^-$ neutrals	< 1 %	CL=95%	–

$\pi^+\pi^+\pi^-\pi^-\pi^0$			< 1	%	CL=90%	298
6π			< 1	%	CL=90%	211
$\pi^+\pi^-e^+e^-$			< 6	$\times 10^{-3}$	CL=90%	458
γe^+e^-			< 9	$\times 10^{-4}$	CL=90%	479
$\pi^0\gamma\gamma$			< 8	$\times 10^{-4}$	CL=90%	469
$4\pi^0$			< 5	$\times 10^{-4}$	CL=90%	380
e^+e^-			< 2.1	$\times 10^{-7}$	CL=90%	479

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

$\pi^+\pi^-$	P,CP		< 2	%	CL=90%	458
$\pi^0\pi^0$	P,CP		< 9	$\times 10^{-4}$	CL=90%	459
$\pi^0e^+e^-$	C	[h]	< 1.4	$\times 10^{-3}$	CL=90%	469
ηe^+e^-	C	[h]	< 2.4	$\times 10^{-3}$	CL=90%	322
3γ	C		< 1.0	$\times 10^{-4}$	CL=90%	479
$\mu^+\mu^-\pi^0$	C	[h]	< 6.0	$\times 10^{-5}$	CL=90%	445
$\mu^+\mu^-\eta$	C	[h]	< 1.5	$\times 10^{-5}$	CL=90%	274
$e\mu$	LF		< 4.7	$\times 10^{-4}$	CL=90%	473

$f_0(980)$ [l]

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

Mass $m = 980 \pm 10$ MeV
Full width $\Gamma = 40$ to 100 MeV

$f_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	471
$K\overline{K}$	seen	†
$\gamma\gamma$	seen	490

$a_0(980)$ [l]

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

Mass $m = 984.7 \pm 1.2$ MeV (S = 1.5)
Full width $\Gamma = 50$ to 100 MeV

$a_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	dominant	322
$K\overline{K}$	seen	†
$\gamma\gamma$	seen	492

$\phi(1020)$

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

Mass $m = 1019.460 \pm 0.019$ MeV
Full width $\Gamma = 4.26 \pm 0.05$ MeV (S = 1.7)

ϕ(1020) DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$K^+ K^-$	(49.2 ± 0.6) %	S=1.2	127
$K^0_L K^0_S$	(34.0 ± 0.5) %	S=1.1	110
$\rho\pi + \pi^+\pi^-\pi^0$	(15.3 ± 0.4) %	S=1.2	–
$\eta\gamma$	(1.301 ± 0.024) %	S=1.1	363
$\pi^0\gamma$	$(1.25 \pm 0.07) \times 10^{-3}$		501
e^+e^-	$(2.97 \pm 0.04) \times 10^{-4}$	S=1.1	510
$\mu^+\mu^-$	$(2.86 \pm 0.19) \times 10^{-4}$		499
ηe^+e^-	$(1.15 \pm 0.10) \times 10^{-4}$		363
$\pi^+\pi^-$	$(7.3 \pm 1.3) \times 10^{-5}$		490
$\omega\pi^0$	$(5.2 {}^{+1.3}_{-1.1}) \times 10^{-5}$		171
$\omega\gamma$	< 5 %	CL=84%	209
$\rho\gamma$	$< 1.2 \times 10^{-5}$	CL=90%	215
$\pi^+\pi^-\gamma$	$(4.1 \pm 1.3) \times 10^{-5}$		490
$f_0(980)\gamma$	$(4.40 \pm 0.21) \times 10^{-4}$		39
$\pi^0\pi^0\gamma$	$(1.09 \pm 0.06) \times 10^{-4}$		492
$\pi^+\pi^-\pi^+\pi^-$	$(3.9 {}^{+2.8}_{-2.2}) \times 10^{-6}$		410
$\pi^+\pi^+\pi^-\pi^-\pi^0$	$< 4.6 \times 10^{-6}$	CL=90%	342
$\pi^0 e^+e^-$	$(1.12 \pm 0.28) \times 10^{-5}$		501
$\pi^0\eta\gamma$	$(8.3 \pm 0.5) \times 10^{-5}$		346
$a_0(980)\gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		34
$\eta'(958)\gamma$	$(6.2 \pm 0.7) \times 10^{-5}$	S=1.1	60
$\eta\pi^0\pi^0\gamma$	$< 2 \times 10^{-5}$	CL=90%	293
$\mu^+\mu^-\gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		499
$\rho\gamma\gamma$	$< 5 \times 10^{-4}$	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

$h_1(1170)$

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

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	307

$b_1(1235)$

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

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]			
$\pi^{\pm}\gamma$	$(1.6\pm0.4)\times10^{-3}$		607
$\eta\rho$	seen		†
$\pi^+\pi^+\pi^-\pi^0$	< 50 %	84%	535
$(K\overline{K})^{\pm}\pi^0$	< 8 %	90%	248
$K^0_S K^0_L \pi^{\pm}$	< 6 %	90%	235
$K^0_S K^0_S \pi^{\pm}$	< 2 %	90%	235
$\phi\pi$	< 1.5 %	84%	147

$a_1(1260)$ [m]

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

Mass $m = 1230 \pm 40$ MeV [n]
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	189
$f_0(1370)\pi$	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 $m = 1275.4 \pm 1.1$ MeV
Full width $\Gamma = 185.2^{+3.1}_{-2.5}$ MeV (S = 1.5)

$f_2(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$(84.7\ ^{+2.5}_{-1.2})$ %	S=1.2	623
$\pi^+\pi^-2\pi^0$	$(7.1\ ^{+1.4}_{-2.7})$ %	S=1.3	563
$K\overline{K}$	(4.6 ± 0.4) %	S=2.7	404
$2\pi^+2\pi^-$	(2.8 ± 0.4) %	S=1.2	559
$\eta\eta$	$(4.0\pm0.8)\times10^{-3}$	S=2.1	327

$4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$		565
$\gamma\gamma$	$(1.41 \pm 0.13) \times 10^{-5}$		638
$\eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%	478
$K^0 K^- \pi^+ +$ 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 $m = 1281.8 \pm 0.6$ MeV (S = 1.6)
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
$\eta\pi\pi$	(52 ± 16) %		482
$a_0(980)\pi$ [ignoring $a_0(980) \rightarrow K\overline{K}$]	(36 ± 7) %		234
$\eta\pi\pi$ [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		†
$\gamma\rho^0$	(5.5 ± 1.3) %	S=2.8	406
$\phi\gamma$	$(7.4 \pm 2.6) \times 10^{-4}$		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	244
$\eta\pi^0\pi^0$	seen	490
$\eta(\pi\pi)_{S\text{-wave}}$	seen	–

$\pi(1300)$

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

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

$\pi(1300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	404
$\pi(\pi\pi)_{S\text{-wave}}$	seen	–

$a_2(1320)$

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

Mass $m = 1318.3 \pm 0.6$ MeV (S = 1.2)
Full width $\Gamma = 107 \pm 5$ MeV [n]

$a_2(1320)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\rho\pi$	(70.1 ± 2.7) %	S=1.2	417
$\eta\pi$	(14.5 ± 1.2) %		536
$\omega\pi\pi$	(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
$\pi^+\pi^-\pi^-$	< 8 %	CL=90%	621
e^+e^-	$< 6 \times 10^{-9}$	CL=90%	659

$f_0(1370)$ [l]

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

Mass $m = 1200$ to 1500 MeV
Full width $\Gamma = 200$ 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	†
$2(\pi\pi)_{S\text{-wave}}$	seen	–
$\pi(1300)\pi$	seen	†

$a_1(1260)\pi$	seen	35
$\eta\eta$	seen	412
$K\overline{K}$	seen	475
$\gamma\gamma$	seen	685
e^+e^-	not seen	685

$\pi_1(1400)$ [o]

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

Mass $m = 1376 \pm 17$ MeV
Full width $\Gamma = 300 \pm 40$ MeV

$\pi_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^0$	seen	570
$\eta\pi^-$	seen	569

$\eta(1405)$ [p]

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

Mass $m = 1409.8 \pm 2.5$ MeV [n] (S = 2.2)
Full width $\Gamma = 51.1 \pm 3.4$ MeV [n] (S = 2.0)

$\eta(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\overline{K}\pi$	seen		425
$\eta\pi\pi$	seen		563
$a_0(980)\pi$	seen		342
$\eta(\pi\pi)_{S\text{-wave}}$	seen		–
$f_0(980)\eta$	seen		†
4π	seen		639
$\rho\rho$	<58 %	99.85%	†
$K^*(892)K$	seen		125

$f_1(1420)$ [q]

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

Mass $m = 1426.3 \pm 0.9$ 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

$\omega(1420)$ [r]

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

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

$a_0(1450)$ [l]

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

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

$\rho(1450)$ [s]

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

Mass $m = 1459 \pm 11$ MeV [n] (S = 3.4)
Full width $\Gamma = 171 \pm 50$ MeV [n] (S = 4.9)

$\rho(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\pi\pi$	seen		717
4π	seen		666
$\omega\pi$	<2.0 %	95%	508
e^+e^-	seen		730
$\eta\rho$	<4 %		304
$a_2(1320)\pi$	not seen		39
$\phi\pi$	<1 %		355
$K\overline{K}$	$<1.6 \times 10^{-3}$	95%	537
$\eta\gamma$	possibly seen		627

$\eta(1475)$ [p]

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

Mass $m = 1476 \pm 4$ MeV (S = 1.4)
Full width $\Gamma = 87 \pm 9$ MeV (S = 1.6)

$\eta(1475)$ 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	393
$\gamma\gamma$	seen	738

$f_0(1500)$ [o]

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

Mass $m = 1507 \pm 5$ MeV (S = 1.2)
Full width $\Gamma = 109 \pm 7$ MeV

$f_0(1500)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\eta\eta'(958)$	(1.9 ± 0.8) %	1.7	37
$\eta\eta$	(5.1 ± 0.9) %	1.4	518
4π	(49.5 ± 3.3) %	1.2	692
$4\pi^0$	seen		692
$2\pi^+2\pi^-$	seen		688
$\pi\pi$	(34.9 ± 2.3) %	1.2	741
$\pi^+\pi^-$	seen		741
$2\pi^0$	seen		741
$K\overline{K}$	(8.6 ± 1.0) %	1.1	569
$\gamma\gamma$	not seen		754

$f_2'(1525)$

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

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

$f_2'(1525)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	(88.8 ± 3.1) %	581
$\eta\eta$	(10.3 ± 3.1) %	531
$\pi\pi$	$(8.2 \pm 1.5) \times 10^{-3}$	750
$\gamma\gamma$	$(1.11 \pm 0.14) \times 10^{-6}$	763

$\pi_1(1600)$ [o]

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

Mass $m = 1653^{+18}_{-15}$ MeV (S = 1.6)
Full width $\Gamma = 225^{+45}_{-28}$ MeV (S = 1.5)

$\pi_1(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	seen	799
$\rho^0\pi^-$	seen	635
$f_2(1270)\pi^-$	not seen	310
$b_1(1235)\pi$	seen	350
$\eta'(958)\pi^-$	seen	537
$f_1(1285)\pi$	seen	307

$\eta_2(1645)$

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

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	496
$f_2(1270)\eta$	not seen	†

$\omega(1650)$ [t]

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

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	646
$\omega\pi\pi$	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 [n]

$\omega_3(1670)$ 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 $m = 1672.4 \pm 3.2$ MeV [n] (S = 1.4)
Full width $\Gamma = 259 \pm 9$ MeV [n] (S = 1.3)

$\pi_2(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
3π	(95.8 ± 1.4) %		809
$f_2(1270)\pi$	(56.2 ± 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
$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%	154
$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%	366
$f_1(1285)\pi$	possibly seen		323
$a_2(1320)\pi$	not seen		292

$\phi(1680)$

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

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

$\phi(1680)$ 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

$\rho_3(1690)$

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

Mass $m = 1688.8 \pm 2.1$ MeV [n]
Full width $\Gamma = 161 \pm 10$ MeV [n] (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		334

$\rho(1700)$ [s]

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

Mass $m = 1720 \pm 20$ MeV [n] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)
Full width $\Gamma = 250 \pm 100$ MeV [n] ($\eta\rho^0$ 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	650
$\rho^\pm\pi^\mp\pi^0$	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

$f_0(1710)$ [u]

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

Mass $m = 1718 \pm 6$ MeV (S = 1.2)
Full width $\Gamma = 137 \pm 8$ MeV (S = 1.1)

f_0(1710) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	703
$\eta\eta$	seen	662
$\pi\pi$	seen	849

$\pi(1800)$

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

Mass $m = 1812 \pm 14$ MeV (S = 2.3)
Full width $\Gamma = 207 \pm 13$ MeV

π(1800) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-\pi^-$	seen	879
$f_0(600)\pi^-$	seen	–
$f_0(980)\pi^-$	seen	631
$f_0(1370)\pi^-$	seen	368
$f_0(1500)\pi^-$	not seen	248
$\rho\pi^-$	not seen	732
$\eta\eta\pi^-$	seen	661
$a_0(980)\eta$	seen	470
$f_0(1500)\pi^-$	seen	248
$\eta\eta'(958)\pi^-$	seen	376
$K_0^*(1430)K^-$	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

$f_2(1950)$

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

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
4π	seen	925
$\eta\eta$	seen	803
$K\overline{K}$	seen	837
$\gamma\gamma$	seen	972

$f_2(2010)$

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

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	†

$a_4(2040)$

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

Mass $m = 2001 \pm 10$ MeV
Full width $\Gamma = 313 \pm 31$ MeV

a_4(2040) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	870
$\pi^+\pi^-\pi^0$	seen	977
$\rho\pi$	seen	844
$f_2(1270)\pi$	seen	583
$\omega\pi^-\pi^0$	seen	822
$\omega\rho$	seen	628
$\eta\pi^0$	seen	920
$\eta'(958)\pi$	seen	764

f_4(2050)

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

Mass $m = 2025 \pm 10$ MeV (S = 1.8)
Full width $\Gamma = 225 \pm 18$ MeV (S = 1.7)

f_4(2050) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\omega$	not seen	642
$\pi\pi$	(17.0 ± 1.5) %	1003
$K\overline{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$	884
$\eta\eta$	$(2.1\pm0.8) \times 10^{-3}$	852
$4\pi^0$	< 1.2 %	967
$a_2(1320)\pi$	seen	572

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

STRANGE MESONS ($S = \pm1$, $C = B = 0$)

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

$K^\pm$

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

Mass $m = 493.677 \pm 0.016$ MeV [v] (S = 2.8)
Mean life $\tau = (1.2385 \pm 0.0024) \times 10^{-8}$ s (S = 2.0)
$c\tau = 3.713$ m

Slope parameter g [w]

(See Particle Listings for quadratic coefficients an alternative parameterization related to $\pi\pi$ scattering)

$K^+ \to \pi^+\pi^+\pi^- = -0.2154 \pm 0.0035$ (S = 1.4)
$K^- \to \pi^-\pi^-\pi^+ = -0.217 \pm 0.007$ (S = 2.5)
$K^\pm \to \pi^\pm\pi^+\pi^-$ $(g_+ - g_-) / (g_+ + g_-) = (1.5 \pm 2.9) \times 10^{-4}$
$K^\pm \to \pi^\pm\pi^0\pi^0 = 0.626 \pm 0.007$
$K^\pm \to \pi^\pm\pi^0\pi^0$ $(g_+ - g_-) / (g_+ + g_-) = (0.02 \pm 0.19)\%$

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

Assuming μ-e universality

$\lambda_+(K^+_{\mu3}) = \lambda_+(K^+_{e3}) = (2.96 \pm 0.05) \times 10^{-2}$
$\lambda_0(K^+_{\mu3}) = (1.96 \pm 0.12) \times 10^{-2}$

Not assuming μ-e universality

$\lambda_+(K^+_{e3}) = (2.96 \pm 0.06) \times 10^{-2}$
$\lambda_+(K^+_{\mu3}) = (2.96 \pm 0.17) \times 10^{-2}$
$\lambda_0(K^+_{\mu3}) = (1.96 \pm 0.13) \times 10^{-2}$

K_{e3} form factor quadratic fit

λ'_+ $(K^\pm_{e3})$ linear coeff. $= (2.48 \pm 0.17) \times 10^{-2}$
$\lambda''_+(K^\pm_{e3})$ quadratic coeff. $= (0.19 \pm 0.09) \times 10^{-2}$

K^+_{e3} $\left|f_S/f_+\right| = (-0.3^{+0.8}_{-0.7}) \times 10^{-2}$
K^+_{e3} $\left|f_T/f_+\right| = (-1.2 \pm 2.3) \times 10^{-2}$
$K^+_{\mu3}$ $\left|f_S/f_+\right| = (0.2 \pm 0.6) \times 10^{-2}$
$K^+_{\mu3}$ $\left|f_T/f_+\right| = (-0.1 \pm 0.7) \times 10^{-2}$
$K^+ \to e^+\nu_e\gamma$ $\left|F_A + F_V\right| = 0.148 \pm 0.010$
$K^+ \to \mu^+\nu_\mu\gamma$ $\left|F_A + F_V\right| = 0.165 \pm 0.013$
$K^+ \to e^+\nu_e\gamma$ $\left|F_A - F_V\right| < 0.49$
$K^+ \to \mu^+\nu_\mu\gamma$ $\left|F_A - F_V\right| = -0.24$ to 0.04, CL = 90%

Charge Radius

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

CP violation parameters

$\Delta(K^{\pm}_{\pi\mu\mu}) = -0.02 \pm 0.12$

T violation parameters

$K^+ \rightarrow \pi^0 \mu^+ \nu_\mu$ $P_T = (-1.7 \pm 2.5) \times 10^{-3}$

$K^+ \rightarrow \mu^+ \nu_\mu \gamma$ $P_T = (-0.6 \pm 1.9) \times 10^{-2}$

$K^+ \rightarrow \pi^0 \mu^+ \nu_\mu$ $\mathrm{Im}(\xi) = -0.006 \pm 0.008$

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

K^+ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Leptonic and semileptonic modes				
$e^+ \nu_e$		$(1.55 \pm 0.07) \times 10^{-5}$		247
$\mu^+ \nu_\mu$		(63.44 ± 0.14) %	S=1.2	236
$\pi^0 e^+ \nu_e$		(4.98 ± 0.07) %	S=1.3	228
Called K^+_{e3}.				
$\pi^0 \mu^+ \nu_\mu$		(3.32 ± 0.06) %	S=1.2	215
Called $K^+_{\mu 3}$.				
$\pi^0 \pi^0 e^+ \nu_e$		$(2.2 \pm 0.4) \times 10^{-5}$		206
$\pi^+ \pi^- e^+ \nu_e$		$(4.09 \pm 0.09) \times 10^{-5}$		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				
$\pi^+ \pi^0$		(20.92 ± 0.12) %	S=1.1	205
$\pi^+ \pi^0 \pi^0$		(1.757 ± 0.024) %	S=1.1	133
$\pi^+ \pi^+ \pi^-$		(5.590 ± 0.031) %	S=1.1	125
Leptonic and semileptonic modes with photons				
$\mu^+ \nu_\mu \gamma$	[y,z]	$(6.2 \pm 0.8) \times 10^{-3}$		236
$\mu^+ \nu_\mu \gamma(\mathrm{SD}^+)$	[aa]	$< 3.0 \times 10^{-5}$	CL=90%	–
$\mu^+ \nu_\mu \gamma(\mathrm{SD}^+\mathrm{INT})$	[aa]	$< 2.7 \times 10^{-5}$	CL=90%	–
$\mu^+ \nu_\mu \gamma(\mathrm{SD}^- + \mathrm{SD}^-\mathrm{INT})$	[aa]	$< 2.6 \times 10^{-4}$	CL=90%	–
$e^+ \nu_e \gamma(\mathrm{SD}^+)$	[aa]	$(1.52 \pm 0.23) \times 10^{-5}$		–
$e^+ \nu_e \gamma(\mathrm{SD}^-)$	[aa]	$< 1.6 \times 10^{-4}$	CL=90%	–
$\pi^0 e^+ \nu_e \gamma$	[y,z]	$(2.69 \pm 0.20) \times 10^{-4}$		228
$\pi^0 e^+ \nu_e \gamma(\mathrm{SD})$	[aa]	$< 5.3 \times 10^{-5}$	CL=90%	228
$\pi^0 \mu^+ \nu_\mu \gamma$	[y,z]	$(2.4 \pm 0.8) \times 10^{-5}$		215
$\pi^0 \pi^0 e^+ \nu_e \gamma$		$< 5 \times 10^{-6}$	CL=90%	206

Hadronic modes with photons

$\pi^+\pi^0\gamma$		[y,z]	$(2.75 \pm 0.15) \times 10^{-4}$			205
$\pi^+\pi^0\gamma$(DE)		[z,bb]	$(4.4 \pm 0.7) \times 10^{-6}$			205
$\pi^+\pi^0\pi^0\gamma$		[y,z]	$(7.6 {}^{+5.6}_{-3.0}) \times 10^{-6}$			133
$\pi^+\pi^+\pi^-\gamma$		[y,z]	$(1.04 \pm 0.31) \times 10^{-4}$			125
$\pi^+\gamma\gamma$		[z]	$(1.10 \pm 0.32) \times 10^{-6}$			227
$\pi^+ 3\gamma$		[z]	$< 1.0 \times 10^{-4}$	CL=90%		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*		$< 1.2 \times 10^{-8}$	CL=90%		203
$\pi^+\pi^+\mu^-\overline{\nu}_\mu$	*SQ*		$< 3.0 \times 10^{-6}$	CL=95%		151
$\pi^+ e^+ e^-$	*S1*		$(2.88 \pm 0.13) \times 10^{-7}$			227
$\pi^+\mu^+\mu^-$	*S1*		$(8.1 \pm 1.4) \times 10^{-8}$		S=2.7	172
$\pi^+\nu\overline{\nu}$	*S1*		$(1.5 {}^{+1.3}_{-0.9}) \times 10^{-10}$			227
$\pi^+\pi^0\nu\overline{\nu}$	*S1*		$< 4.3 \times 10^{-5}$	CL=90%		205
$\mu^-\nu e^+ e^+$	*LF*		$< 2.0 \times 10^{-8}$	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]	$< 3.0 \times 10^{-9}$	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 $m = 497.648 \pm 0.022$ MeV

$m_{K^0} - m_{K^\pm} = 3.972 \pm 0.027$ MeV (S = 1.2)

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 $\delta = (2.9 \pm 2.7) \times 10^{-4}$
Im $\delta = (-0.2 \pm 2.0) \times 10^{-5}$
Re(y), K_{e3} parameter = $(0.4 \pm 2.5) \times 10^{-3}$
Re(x_-), K_{e3} parameter = $(-0.8 \pm 2.5) \times 10^{-3}$
$\left|m_{K^0} - m_{\overline{K}^0}\right| / m_{\text{average}} < 10^{-18}$, 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 = $(-0.8 \pm 3.1) \times 10^{-3}$

K^0_S

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

Mean life $\tau = (0.8953 \pm 0.0005) \times 10^{-10}$ s (S = 1.1) Assuming *CPT*
Mean life $\tau = (0.8958 \pm 0.0006) \times 10^{-10}$ s (S = 1.2) Not assuming *CPT*
$c\tau = 2.6842$ cm Assuming *CPT*

CP-violation parameters [ee]

Im(η_{+-0}) $= -0.002 \pm 0.009$
Im(η_{000}) $= (-0.1 \pm 1.6) \times 10^{-2}$
$\left|\eta_{000}\right| = \left|A(K^0_S \to 3\pi^0)/A(K^0_L \to 3\pi^0)\right| < 0.018$, CL = 90%
CP asymmetry *A* in $\pi^+\pi^-e^+e^- = (-1 \pm 4)\%$

K^0_S DECAY MODES		Fraction (Γ_i/Γ)	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 $\ell\overline{\ell}$ pairs				
$\pi^+\pi^-\gamma$	[y,ff]	$(1.79 \pm 0.05) \times 10^{-3}$		206
$\pi^+\pi^-e^+e^-$		$(4.69 \pm 0.30) \times 10^{-5}$		206
$\pi^0\gamma\gamma$	[ff]	$(4.9 \pm 1.8) \times 10^{-8}$		231
$\gamma\gamma$		$(2.84 \pm 0.07) \times 10^{-6}$		249

Semileptonic modes

$\pi^{\pm} e^{\mp} \nu_e$		[gg]	$(7.04 \pm 0.09) \times 10^{-4}$		229

CP violating (CP) and $\Delta S = 1$ weak neutral current ($S1$) modes

$3\pi^0$	CP		$< 1.2 \times 10^{-7}$	90%	139
$\mu^+ \mu^-$	$S1$		$< 3.2 \times 10^{-7}$	90%	225
$e^+ e^-$	$S1$		$< 1.4 \times 10^{-7}$	90%	249
$\pi^0 e^+ e^-$	$S1$	[ff]	$(3.0\ ^{+1.5}_{-1.2}) \times 10^{-9}$		231
$\pi^0 \mu^+ \mu^-$	$S1$		$(2.9\ ^{+1.5}_{-1.2}) \times 10^{-9}$		177

K_L^0

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

$m_{K_L} - m_{K_S}$
$= (0.5292 \pm 0.0009) \times 10^{10}\ \hbar\ \mathrm{s}^{-1}$ (S = 1.2) Assuming CPT
$= (3.483 \pm 0.006) \times 10^{-12}$ MeV Assuming CPT
$= (0.5290 \pm 0.0016) \times 10^{10}\ \hbar\ \mathrm{s}^{-1}$ (S = 1.2) Not assuming CPT

Mean life $\tau = (5.114 \pm 0.021) \times 10^{-8}$ s
$c\tau = 15.33$ m

Slope parameter g [w]

(See Particle Listings for quadratic coefficients)

$K_L^0 \rightarrow \pi^+\pi^-\pi^0 = 0.678 \pm 0.008$ (S = 1.5)

K_L decay form factors [x]

Linear parametrization assuming μ-e universality

$\lambda_+(K_{\mu 3}^0) = \lambda_+(K_{e3}^0) = (2.84 \pm 0.04) \times 10^{-2}$
$\lambda_0(K_{\mu 3}^0) = (1.64 \pm 0.11) \times 10^{-2}$

Quadratic parametrization assuming μ-e universality

$\lambda'_+(K_{\mu 3}^0) = \lambda'_+(K_{e3}^0) = (2.42 \pm 0.14) \times 10^{-2}$ (S = 1.3)
$\lambda''_+(K_{\mu 3}^0) = \lambda''_+(K_{e3}^0) = (0.18 \pm 0.05) \times 10^{-2}$ (S = 1.1)
$\lambda_0(K_{\mu 3}^0) = (1.46 \pm 0.13) \times 10^{-2}$

Pole parametrization assuming μ-e universality

M_V^{μ} ($K^0_{\mu 3}$) = M_V^{e} (K^0_{e3}) = 877 ± 5 MeV (S = 1.1)

M_S^{μ} ($K^0_{\mu 3}$) = 1187 ± 50

K^0_{e3} $\left|f_S/f_+\right| = (1.5^{+1.4}_{-1.6}) \times 10^{-2}$

K^0_{e3} $\left|f_T/f_+\right| = (5^{+4}_{-5}) \times 10^{-2}$

$K^0_{\mu 3}$ $\left|f_T/f_+\right| = (12 \pm 12) \times 10^{-2}$

$K_L \rightarrow e^+ e^- \gamma$: $\alpha_{K^*} = -0.33 \pm 0.05$

$K_L \rightarrow \mu^+ \mu^- \gamma$: $\alpha_{K^*} = -0.158 \pm 0.027$

$K_L \rightarrow e^+ e^- e^+ e^-$: $\alpha^{\text{eff}}_{K^*} = -0.14 \pm 0.22$

$K_L \rightarrow \pi^+ \pi^- e^+ e^-$: $a_1/a_2 = -0.734 \pm 0.022$ GeV^2

$K_L \rightarrow \pi^0 2\gamma$: $a_V = -0.54 \pm 0.12$ (S = 2.8)

CP-violation parameters [ee]

$A_L = (0.332 \pm 0.006)\%$

$\left|\eta_{00}\right| = (2.225 \pm 0.007) \times 10^{-3}$

$\left|\eta_{+-}\right| = (2.236 \pm 0.007) \times 10^{-3}$

$\left|\epsilon\right| = (2.232 \pm 0.007) \times 10^{-3}$

$\left|\eta_{00}/\eta_{+-}\right| = 0.9950 \pm 0.0008$ [hh] (S = 1.6)

$\text{Re}(\epsilon'/\epsilon) = (1.66 \pm 0.26) \times 10^{-3}$ [hh] (S = 1.6)

Assuming *CPT*

$\phi_{+-} = (43.52 \pm 0.05)^\circ$ (S = 1.2)

$\phi_{00} = (43.50 \pm 0.06)^\circ$ (S = 1.2)

$\phi_{\epsilon} = \phi_{\text{SW}} = (43.51 \pm 0.05)^\circ$ (S = 1.1)

Not assuming *CPT*

$\phi_{+-} = (43.4 \pm 0.7)^\circ$ (S = 1.3)

$\phi_{00} = (43.7 \pm 0.8)^\circ$ (S = 1.2)

$\phi_{\epsilon} = (43.5 \pm 0.7)^\circ$ (S = 1.3)

CP asymmetry *A* in $K^0_L \rightarrow \pi^+ \pi^- e^+ e^- = (13.7 \pm 1.5)\%$

β_{CP} from $K^0_L \rightarrow e^+ e^- e^+ e^- = -0.19 \pm 0.07$

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

j for $K^0_L \rightarrow \pi^+ \pi^- \pi^0 = 0.0012 \pm 0.0008$

f for $K^0_L \rightarrow \pi^+ \pi^- \pi^0 = 0.004 \pm 0.006$

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

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

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

T-violation parameters

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

CPT invariance tests

$\phi_{00} - \phi_{+-} = (0.2 \pm 0.4)^\circ$
$\mathrm{Re}(\frac{2}{3}\eta_{+-} + \frac{1}{3}\eta_{00}) - \frac{\delta_L}{2} = (-3 \pm 35) \times 10^{-6}$

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

Re $x = -0.002 \pm 0.006$
Im $x = 0.0012 \pm 0.0021$

K^0_L DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Semileptonic modes				
$\pi^\pm e^\mp \nu_e$	[gg]	(40.53 ± 0.15) %	S=2.1	229
Called K^0_{e3}.				
$\pi^\pm \mu^\mp \nu_\mu$	[gg]	(27.02 ± 0.07) %		216
Called $K^0_{\mu 3}$.				
$(\pi\mu\,\mathrm{atom})\nu$		$(1.05 \pm 0.11) \times 10^{-7}$		188
$\pi^0\pi^\pm e^\mp \nu$	[gg]	$(5.20 \pm 0.11) \times 10^{-5}$		207
Hadronic modes, including Charge conjugation×Parity Violating (*CPV*) modes				
$3\pi^0$		(19.56 ± 0.14) %	S=1.9	139
$\pi^+\pi^-\pi^0$		(12.56 ± 0.05) %		133
$\pi^+\pi^-$	*CPV*	$(1.976 \pm 0.008) \times 10^{-3}$		206
$\pi^0\pi^0$	*CPV*	$(8.69 \pm 0.04) \times 10^{-4}$	S=1.1	209
Semileptonic modes with photons				
$\pi^\pm e^\mp \nu_e \gamma$	[y,gg,ii]	$(3.79 \pm 0.08) \times 10^{-3}$		229
$\pi^\pm \mu^\mp \nu_\mu \gamma$		$(5.64 \pm 0.23) \times 10^{-4}$		216
Hadronic modes with photons or $\ell\overline{\ell}$ pairs				
$\pi^0\pi^0\gamma$		$< 5.6 \times 10^{-6}$		209
$\pi^+\pi^-\gamma$	[y,ii]	$(4.17 \pm 0.15) \times 10^{-5}$		206
$\pi^0 2\gamma$	[ii]	$(1.49 \pm 0.08) \times 10^{-6}$	S=2.0	231
$\pi^0\gamma e^+ e^-$		$(2.3 \pm 0.4) \times 10^{-8}$		231
Other modes with photons or $\ell\overline{\ell}$ pairs				
2γ		$(5.48 \pm 0.05) \times 10^{-4}$	S=1.2	249
3γ		$< 2.4 \times 10^{-7}$	CL=90%	249
$e^+e^-\gamma$		$(10.0 \pm 0.5) \times 10^{-6}$	S=1.5	249
$\mu^+\mu^-\gamma$		$(3.59 \pm 0.11) \times 10^{-7}$	S=1.3	225
$e^+e^-\gamma\gamma$	[ii]	$(5.95 \pm 0.33) \times 10^{-7}$		249
$\mu^+\mu^-\gamma\gamma$	[ii]	$(1.0\,^{+0.8}_{-0.6}) \times 10^{-8}$		225

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

$\mu^+ \mu^-$	*S1*		$(6.87 \pm 0.11) \times 10^{-9}$		225
$e^+ e^-$	*S1*		$(9\ ^{+6}_{-4}) \times 10^{-12}$		249
$\pi^+ \pi^- e^+ e^-$	*S1*	[ii]	$(3.11 \pm 0.19) \times 10^{-7}$		206
$\pi^0 \pi^0 e^+ e^-$	*S1*		$< 6.6 \times 10^{-9}$	CL=90%	209
$\mu^+ \mu^- e^+ e^-$	*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*	[jj]	$< 3.8 \times 10^{-10}$	CL=90%	177
$\pi^0 e^+ e^-$	*CP,S1*	[jj]	$< 2.8 \times 10^{-10}$	CL=90%	231
$\pi^0 \nu \overline{\nu}$	*CP,S1*	[kk]	$< 5.9 \times 10^{-7}$	CL=90%	231
$e^\pm \mu^\mp$	*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]	$< 6.2 \times 10^{-9}$	CL=90%	217

$K^*(892)$

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

$K^*(892)^\pm$ mass $m = 891.66 \pm 0.26$ MeV
$K^*(892)^0$ mass $m = 896.00 \pm 0.25$ MeV (S = 1.4)
$K^*(892)^\pm$ full width $\Gamma = 50.8 \pm 0.9$ MeV
$K^*(892)^0$ full width $\Gamma = 50.3 \pm 0.6$ MeV (S = 1.1)

***K**(892) DECAY MODES**	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\pi$	~ 100 %		289
$K^0 \gamma$	$(2.31 \pm 0.20) \times 10^{-3}$		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 [n]
Full width $\Gamma = 90 \pm 20$ MeV [n]

***K*$_1$(1270) DECAY MODES**	Fraction (Γ_i/Γ)	p (MeV/c)
$K\rho$	(42 ± 6) %	45
$K_0^*(1430)\pi$	(28 ± 4) %	†
$K^*(892)\pi$	(16 ± 5) %	302
$K\omega$	(11.0 ± 2.0) %	†
$K f_0(1370)$	(3.0 ± 2.0) %	†
γK^0	seen	539

$K_1(1400)$

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

Mass $m = 1402 \pm 7$ 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) %	292
$K f_0(1370)$	(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

$K_0^*(1430)$ [ll]

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

Mass $m = 1414 \pm 6$ MeV
Full width $\Gamma = 290 \pm 21$ MeV

$K_0^*(1430)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(93 ± 10) %	613

$K_2^*(1430)$

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

$K_2^*(1430)^\pm$ 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
$K\rho$	$(\ 8.7\pm0.8)$ %	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	487
$K\omega\pi$	$<\ 7.2\quad\times10^{-4}$	CL=95%	100
$K^0\gamma$	$<\ 9\quad\times10^{-4}$	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
$K\rho$	$(31.4^{+4.7}_{-2.1})$ %	570
$K^*(892)\pi$	$(29.9^{+2.2}_{-4.7})$ %	618

$K_2(1770)$ [mm]

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

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
$K f_2(1270)$	seen	53
$K\phi$	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 $\pm$13) %		719
$K_2^*(1430)\pi$	$<$ 16 %	95%	291

$K_2(1820)$ [nn]

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

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
$K f_2(1270)$	seen	185
$K\omega$	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$\pm$1.2) %	958
$K^*(892)\pi\pi$	(9 $\pm$5) %	802
$K^*(892)\pi\pi\pi$	(7 $\pm$5) %	768
$\rho K\pi$	(5.7$\pm$3.2) %	741
$\omega K\pi$	(5.0$\pm$3.0) %	738
$\phi K\pi$	(2.8$\pm$1.4) %	594
$\phi K^*(892)$	(1.4$\pm$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 $m = 1869.3 \pm 0.4$ MeV (S = 1.1)
Mean life $\tau = (1040 \pm 7) \times 10^{-15}$ s
$c\tau = 311.8$ μm

c-quark decays

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

CP-violation decay-rate asymmetries

$A_{CP}(K^0_S \pi^{\pm}) = -0.016 \pm 0.017$
$A_{CP}(K^0_S K^{\pm}) = 0.07 \pm 0.06$
$A_{CP}(K^+ K^- \pi^{\pm}) = 0.007 \pm 0.008$
$A_{CP}(K^{\pm} K^{*0}) = 0.005 \pm 0.017$
$A_{CP}(\phi \pi^{\pm}) = -0.001 \pm 0.015$
$A_{CP}(\pi^+ \pi^- \pi^{\pm}) = -0.02 \pm 0.04$
$A_{CP}(K^0_S K^{\pm} \pi^+ \pi^-) = -0.04 \pm 0.07$

T-violation decay-rate asymmetry

$A_T(K^0_S K^{\pm} \pi^+ \pi^-) = 0.02 \pm 0.07$

$D^+ \to \ \overline{K}^*(892)^0 \ell^+ \nu_{\ell}$ form factors

$r_v = 1.62 \pm 0.08$ (S = 1.5)
$r_2 = 0.83 \pm 0.05$
$r_3 = 0.0 \pm 0.4$
$\Gamma_L/\Gamma_T = 1.13 \pm 0.08$
$\Gamma_+/\Gamma_- = 0.22 \pm 0.06$ (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^+ anything	(17.2 ± 1.9) %		–
K^- anything	(27.5 ± 2.4) %		–
$\overline{K}^0$ anything + K^0 anything	(61 ± 8) %		–
K^+ anything	(5.5 ± 1.6) %		–
$\overline{K}^*(892)^0$ anything	(23 ± 5) %		–
$K^*(892)^0$ anything	< 6.6 %	CL=90%	–
η anything	[pp] < 13 %	CL=90%	–
ϕ anything	< 1.8 %	CL=90%	–
ϕe^+ anything	< 1.6 %	CL=90%	–
Leptonic and semileptonic modes			
$e^+ \nu_e$	$< 2.4 \times 10^{-5}$	CL=90%	935
$\mu^+ \nu_\mu$	$(4.4 \pm 0.7) \times 10^{-4}$		932
$\overline{K}^0 e^+ \nu_e$	(8.6 ± 0.5) %		868
$\overline{K}^0 \mu^+ \nu_\mu$	(9.5 ± 0.8) %		865
$K^- \pi^+ e^+ \nu_e$	$(4.5 {}^{+1.0}_{-0.8})$ %	S=1.1	863
$\overline{K}^*(892)^0 e^+ \nu_e$, $\overline{K}^*(892)^0 \to K^- \pi^+$	(3.74 ± 0.21) %		722
$K^- \pi^+ e^+ \nu_e$ nonresonant	$< 7 \times 10^{-3}$	CL=90%	863
$K^- \pi^+ \mu^+ \nu_\mu$	(4.0 ± 0.5) %		851
$\overline{K}^*(892)^0 \mu^+ \nu_\mu$, $\overline{K}^*(892)^0 \to K^- \pi^+$	(3.7 ± 0.3) %		717
$K^- \pi^+ \mu^+ \nu_\mu$ nonresonant	$(2.1 \pm 0.6) \times 10^{-3}$		851
$(\overline{K}^*(892)\pi)^0 e^+ \nu_e$	< 1.2 %	CL=90%	712
$(\overline{K}\pi\pi)^0 e^+ \nu_e$ non-$\overline{K}^*(892)$	$< 9 \times 10^{-3}$	CL=90%	846
$K^- \pi^+ \pi^0 \mu^+ \nu_\mu$	$< 1.7 \times 10^{-3}$	CL=90%	825
$\pi^0 e^+ \nu_e$	$(4.4 \pm 0.7) \times 10^{-3}$		930

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

$\overline{K}^*(892)^0 e^+ \nu_e$	(5.61 ± 0.31) %	S=1.1	722
$\overline{K}^*(892)^0 \mu^+ \nu_\mu$	(5.5 ± 0.5) %	S=1.1	717
$\overline{K}_1(1270)^0 \mu^+ \nu_\mu$	< 4 %	CL=95%	493
$\overline{K}^*_0(1430)^0 \mu^+ \nu_\mu$	$< 2.5 \times 10^{-4}$		388
$\overline{K}^*_2(1430)^0 \mu^+ \nu_\mu$	< 1.1 %	CL=95%	380
$\overline{K}^*(1680)^0 \mu^+ \nu_\mu$	$< 1.6 \times 10^{-3}$		105

$\rho^0 e^+ \nu_e$		$(2.2 \pm 0.4) \times 10^{-3}$			774
$\rho^0 \mu^+ \nu_\mu$		$(3.4 \pm 0.8) \times 10^{-3}$			770
$\omega e^+ \nu_e$		$(1.6 \,{}^{+0.7}_{-0.6}) \times 10^{-3}$			771
$\phi e^+ \nu_e$		< 2.09 %	CL=90%		657
$\phi \mu^+ \nu_\mu$		< 3.72 %	CL=90%		651
$\eta \ell^+ \nu_\ell$		$< 7 \times 10^{-3}$	CL=90%		854
$\eta'(958) \mu^+ \nu_\mu$		< 1.1 %	CL=90%		684

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

$K^0_S \pi^+$		(1.47 ± 0.06) %	S=1.1	862
$K^- \pi^+ \pi^+$	[qq]	(9.51 ± 0.34) %	S=1.1	845
$\overline{K}^*(892)^0 \pi^+$, $\overline{K}^*(892)^0 \to K^- \pi^+$	[rr]	(1.33 ± 0.11) %		714
$\overline{K}^*_0(1430)^0 \pi^+$, $\overline{K}^*_0(1430)^0 \to K^- \pi^+$	[rr]	(2.41 ± 0.24) %		382
$\overline{K}^*(1680)^0 \pi^+$, $\overline{K}^*(1680)^0 \to K^- \pi^+$	[rr]	$(4.0 \pm 0.8) \times 10^{-3}$		58
$K^- \pi^+ \pi^+$ nonresonant	[rr]	(9.0 ± 0.7) %		845
$K^0_S \pi^+ \pi^0$	[qq]	(7.0 ± 0.5) %	S=1.2	845
$K^0_S \rho^+$		(4.8 ± 1.1) %		677
$\overline{K}^*(892)^0 \pi^+$, $\overline{K}^*(892)^0 \to K^0_S \pi^0$		(1.3 ± 0.6) %		714
$K^0_S \pi^+ \pi^0$ nonresonant		$(9 \pm 7) \times 10^{-3}$		845
$K^- \pi^+ \pi^+ \pi^0$	[qq]	(6.00 ± 0.28) %	S=1.1	816
$\overline{K}^*(892)^0 \rho^+$ total, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.3 ± 0.8) %		422
$\overline{K}_1(1400)^0 \pi^+$, $\overline{K}_1(1400)^0 \to K^- \pi^+ \pi^0$		(1.8 ± 0.7) %		390
$K^- \rho^+ \pi^+$ total		(2.6 ± 1.6) %		613
$K^- \rho^+ \pi^+$ 3-body		$(9 \pm 6) \times 10^{-3}$		613
$\overline{K}^*(892)^0 \pi^+ \pi^0$ total, $\overline{K}^*(892)^0 \to K^- \pi^+$		(4.2 ± 0.6) %		690
$\overline{K}^*(892)^0 \pi^+ \pi^0$ 3-body, $\overline{K}^*(892)^0 \to K^- \pi^+$		(2.7 ± 0.8) %		690
$K^*(892)^- \pi^+ \pi^+$ 3-body, $K^*(892)^- \to K^- \pi^0$		$(6 \pm 3) \times 10^{-3}$		688
$K^- \pi^+ \pi^+ \pi^0$ nonresonant	[ss]	(1.0 ± 0.7) %		816
$K^0_S \pi^+ \pi^+ \pi^-$	[qq]	(3.11 ± 0.21) %	S=1.1	814
$K^0_S a_1(1260)^+$, $a_1(1260)^+ \to \pi^+ \pi^+ \pi^-$		(1.8 ± 0.3) %		328
$\overline{K}_1(1400)^0 \pi^+$, $\overline{K}_1(1400)^0 \to K^0_S \pi^+ \pi^-$		(1.8 ± 0.7) %		390

$K^*(892)^-\pi^+\pi^+$ 3-body, $K^*(892)^- \to K^0_S\pi^-$		(1.3 ± 0.6) %		688
$K^0_S\rho^0\pi^+$ total		(1.86 ± 0.34) %	CL=90%	610
$K^0_S\rho^0\pi^+$ 3-body		$(2.2 \pm 2.2) \times 10^{-3}$		610
$K^0_S\pi^+\pi^+\pi^-$ nonresonant		$(3.7 \pm 1.9) \times 10^{-3}$		814
$K^-3\pi^+\pi^-$	[qq]	$(5.8 \pm 0.6) \times 10^{-3}$	S=1.1	772
$\overline{K}^*(892)^0\pi^+\pi^+\pi^-$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(1.2 \pm 0.4) \times 10^{-3}$		645
$\overline{K}^*(892)^0\rho^0\pi^+$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(2.3 \pm 0.4) \times 10^{-3}$		239
$K^-\rho^0\pi^+\pi^+$		$(1.75 \pm 0.29) \times 10^{-3}$		524
$K^-3\pi^+\pi^-$ nonresonant		$(4.1 \pm 3.0) \times 10^{-4}$		772
$K^+2K^0_S$		$(4.7 \pm 2.1) \times 10^{-3}$		545
$K^+K^-K^0_S\pi^+$		$(2.4 \pm 0.6) \times 10^{-4}$		435

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

$K^0_S a_1(1260)^+$		(3.6 ± 0.6) %		328
$K^0_S a_2(1320)^+$		$< 1.5 \times 10^{-3}$	CL=90%	199
$\overline{K}^*(892)^0\rho^+$ total	[ss]	(1.8 ± 1.4) %		422
$\overline{K}^*(892)^0\rho^+$ *S*-wave	[ss]	(1.4 ± 1.5) %		422
$\overline{K}^*(892)^0\rho^+$ *P*-wave		$< 1 \times 10^{-3}$	CL=90%	422
$\overline{K}^*(892)^0\rho^+$ *D*-wave		$(8 \pm 7) \times 10^{-3}$		422
$\overline{K}^*(892)^0\rho^+$ *D*-wave longitudinal		$< 7 \times 10^{-3}$	CL=90%	422
$\overline{K}_1(1270)^0\pi^+$		$< 7 \times 10^{-3}$	CL=90%	487
$\overline{K}_1(1400)^0\pi^+$		(4.3 ± 1.5) %	S=1.2	390
$\overline{K}^*(892)^0\pi^+\pi^0$ total		(5.8 ± 2.9) %		690
$\overline{K}^*(892)^0\pi^+\pi^0$ 3-body	[ss]	(3.6 ± 2.1) %		690
$K^*(892)^-\pi^+\pi^+$ total		—		688
$K^*(892)^-\pi^+\pi^+$ 3-body		$(1.8^{+1.1}_{-0.9})$ %	S=1.2	688
$\overline{K}^*(892)^0 a_1(1260)^+$		$(9.4 \pm 1.9) \times 10^{-3}$		†

Pionic modes

$\pi^+\pi^0$		$(1.28 \pm 0.09) \times 10^{-3}$		925
$\pi^+\pi^+\pi^-$		$(3.31 \pm 0.21) \times 10^{-3}$		908
$\rho^0\pi^+$		$(1.07 \pm 0.11) \times 10^{-3}$		766
$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$		$(1.86 \pm 0.18) \times 10^{-3}$		908
$\sigma\pi^+$, $\sigma \to \pi^+\pi^-$		$(1.53 \pm 0.32) \times 10^{-3}$		–
$f_0(980)\pi^+$, $f_0(980) \to \pi^+\pi^-$		$(2.1 \pm 0.5) \times 10^{-4}$		669
$f_0(1370)\pi^+$, $f_0(1370) \to \pi^+\pi^-$		$(8 \pm 6) \times 10^{-5}$		–

$f_2(1270)\pi^+$, $f_2(1270) \to \pi^+\pi^-$		$(4.8 \pm 1.3) \times 10^{-4}$		485
$\pi^+ 2\pi^0$		$(4.8 \pm 0.4) \times 10^{-3}$		910
$\pi^+\pi^+\pi^-\pi^0$		(1.18 ± 0.09) %		883
$\eta\pi^+$, $\eta \to \pi^+\pi^-\pi^0$		$(7.9 \pm 0.7) \times 10^{-4}$		848
$\omega\pi^+$, $\omega \to \pi^+\pi^-\pi^0$		$< 3 \times 10^{-4}$	CL=90%	763
$3\pi^+ 2\pi^-$		$(1.68 \pm 0.17) \times 10^{-3}$	S=1.1	845

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

$\eta\pi^+$		$(3.50 \pm 0.32) \times 10^{-3}$		848
$\omega\pi^+$		$< 3.4 \times 10^{-4}$	CL=90%	763
$\eta\rho^+$		$< 7 \times 10^{-3}$	CL=90%	655
$\eta'(958)\pi^+$		$(5.3 \pm 1.1) \times 10^{-3}$		680
$\eta'(958)\rho^+$		$< 6 \times 10^{-3}$	CL=90%	348

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

$K^+ K^0_S$		$(2.96 \pm 0.19) \times 10^{-3}$		792
$K^+ K^- \pi^+$	[qq]	(1.00 ± 0.04) %	S=1.2	744
$\phi\pi^+$, $\phi \to K^+ K^-$		$(3.2 \pm 0.4) \times 10^{-3}$		647
$K^+ \overline{K}^*(892)^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$(3.02 \pm 0.35) \times 10^{-3}$		613
$K^+ \overline{K}^*_0(1430)^0$, $\overline{K}^*_0(1430)^0 \to K^-\pi^+$		$(3.7 \pm 0.4) \times 10^{-3}$		–
$K^0_S K^0_S \pi^+$		—		741
$K^*(892)^+ K^0_S$, $K^*(892)^+ \to K^0_S \pi^+$		$(5.3 \pm 2.3) \times 10^{-3}$		611
$K^+ K^- \pi^+ \pi^0$		—		682
$\phi\pi^+\pi^0$, $\phi \to K^+ K^-$		(1.1 ± 0.5) %		619
$\phi\rho^+$, $\phi \to K^+ K^-$		$< 7 \times 10^{-3}$	CL=90%	258
$K^+ K^- \pi^+ \pi^0$ non-ϕ		$(1.5 \; ^{+0.7}_{-0.6})$ %		682
$K^+ K^0_S \pi^+ \pi^-$		$(1.75 \pm 0.21) \times 10^{-3}$		678
$K^0_S K^- \pi^+ \pi^+$		$(2.39 \pm 0.23) \times 10^{-3}$		678
$K^*(892)^+ \overline{K}^*(892)^0$, $K^{*+} \to K^0_S \pi^+$, $\overline{K}^{*0} \to K^-\pi^+$		$(5.8 \pm 2.4) \times 10^{-3}$		280
$K^0_S K^- \pi^+ \pi^+$ (non-$K^{*+}\overline{K}^{*0}$)		$< 4 \times 10^{-3}$	CL=90%	678
$K^+ K^- \pi^+ \pi^+ \pi^-$		$(2.3 \pm 1.2) \times 10^{-4}$		600

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

$\phi\pi^+$		$(6.5 \pm 0.7) \times 10^{-3}$		647
$\phi\pi^+\pi^0$		(2.3 ± 1.0) %		619

$\phi\rho^+$			$<$ 1.5	%	CL=90%	259
$K^*(892)^+ K^0_S$			(1.6 ±0.7)	%		611
$K^*(892)^+ \overline{K}^*(892)^0$			(2.6 ±1.1)	%		280

Doubly Cabibbo-suppressed modes

$K^+\pi^0$			$<$ 4.2	$\times 10^{-4}$	CL=90%	864
$K^+\pi^+\pi^-$			(6.4 ±0.8)	$\times 10^{-4}$		845
$K^+\rho^0$			(2.5 ±0.7)	$\times 10^{-4}$		678
$K^*(892)^0\pi^+$, $K^*(892)^0 \rightarrow K^+\pi^-$			(3.0 ±0.6)	$\times 10^{-4}$		714
$K^+ f_0(980)$, $f_0(980) \rightarrow \pi^+\pi^-$			(5.7 ±3.5)	$\times 10^{-5}$		–
$K^*_2(1430)^0\pi^+$, $K^*_2(1430)^0 \rightarrow K^+\pi^-$			(5.2 ±3.5)	$\times 10^{-5}$		–
$K^+K^+K^-$			(9.0 ±2.1)	$\times 10^{-5}$		550

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

$\pi^+e^+e^-$	C1		$<$ 7.4	$\times 10^{-6}$	CL=90%	929
$\pi^+\phi$, $\phi \rightarrow e^+e^-$		[tt]	($2.7^{+3.6}_{-1.8}$)	$\times 10^{-6}$		–
$\pi^+\mu^+\mu^-$	C1		$<$ 8.8	$\times 10^{-6}$	CL=90%	917
$\rho^+\mu^+\mu^-$	C1		$<$ 5.6	$\times 10^{-4}$	CL=90%	757
$K^+e^+e^-$		[uu]	$<$ 6.2	$\times 10^{-6}$	CL=90%	869
$K^+\mu^+\mu^-$		[uu]	$<$ 9.2	$\times 10^{-6}$	CL=90%	856
$\pi^+e^\pm\mu^\mp$	LF	[gg]	$<$ 3.4	$\times 10^{-5}$	CL=90%	926
$K^+e^\pm\mu^\mp$	LF	[gg]	$<$ 6.8	$\times 10^{-5}$	CL=90%	866
$\pi^-e^+e^+$	L		$<$ 3.6	$\times 10^{-6}$	CL=90%	929
$\pi^-\mu^+\mu^+$	L		$<$ 4.8	$\times 10^{-6}$	CL=90%	917
$\pi^-e^+\mu^+$	L		$<$ 5.0	$\times 10^{-5}$	CL=90%	926
$\rho^-\mu^+\mu^+$	L		$<$ 5.6	$\times 10^{-4}$	CL=90%	757
$K^-e^+e^+$	L		$<$ 4.5	$\times 10^{-6}$	CL=90%	869
$K^-\mu^+\mu^+$	L		$<$ 1.3	$\times 10^{-5}$	CL=90%	856
$K^-e^+\mu^+$	L		$<$ 1.3	$\times 10^{-4}$	CL=90%	866
$K^*(892)^-\mu^+\mu^+$	L		$<$ 8.5	$\times 10^{-4}$	CL=90%	703

D^0

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

Mass $m = 1864.5 \pm 0.4$ MeV (S = 1.1)

$m_{D^\pm} - m_{D^0} = 4.78 \pm 0.10$ MeV (S = 1.1)

Mean life $\tau = (410.1 \pm 1.5) \times 10^{-15}$ s

$c\tau = 122.9\ \mu$m

$\left|m_{D^0_1} - m_{D^0_2}\right| < 7 \times 10^{10}\ \hbar\ \mathrm{s}^{-1}$, CL = 95% [vv]

$(\Gamma_{D^0_1} - \Gamma_{D^0_2})/\Gamma = 2y = (1.4 \pm 1.0) \times 10^{-2}$

$\Gamma(K^+\ell^-\overline{\nu}_\ell \text{ (via } \overline{D}^0))/\Gamma(K^-\ell^+\nu_\ell) < 0.005$, CL = 90%

$\Gamma\big(K^+\pi^- (\text{via } \overline{D}^0)\big)/\Gamma\big(K^-\pi^+\big) < 4.0 \times 10^{-4}$, CL = 95%

$\Gamma\big(K^0_S\pi^+\pi^- (\text{in } D^0 \to \overline{D}^0)\big)/\Gamma\big(K^0_S\pi^+\pi^-\big)$ Γ_0/Γ_0
< 0.0063, CL = 95%

CP-violation decay-rate asymmetries

$A_{CP}(K^+K^-) = 0.014 \pm 0.010$
$A_{CP}(K^0_S K^0_S) = -0.23 \pm 0.19$
$A_{CP}(\pi^+\pi^-) = 0.013 \pm 0.012$
$A_{CP}(\pi^0\pi^0) = 0.00 \pm 0.05$
$A_{CP}(\pi^+\pi^-\pi^0) = 0.01^{+0.10}_{-0.09}$
$A_{CP}(K^0_S\phi) = -0.03 \pm 0.09$
$A_{CP}(K^0_S\pi^0) = 0.001 \pm 0.013$
$A_{CP}(K^\pm\pi^\mp) = 0.05 \pm 0.04$
$A_{CP}(K^\mp\pi^\pm\pi^0) = -0.03 \pm 0.09$
$A_{CP}(K^\pm\pi^\mp\pi^0) = 0.00 \pm 0.05$
$A_{CP}(K^0_S\pi^+\pi^-) = -0.009^{+0.026}_{-0.061}$
$A_{CP}(K^\pm\pi^\mp\pi^+\pi^-) = -0.02 \pm 0.04$
$A_{CP}(K^+K^-\pi^+\pi^-) = -0.08 \pm 0.07$

T-violation decay-rate asymmetry

$A_T(K^+K^-\pi^+\pi^-) = 0.01 \pm 0.07$

CPT-violation decay-rate asymmetry

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

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	[ww]	(19 ± 6) %		–
2-prongs		(67 ± 6) %		–
4-prongs	[xx]	(13.8 ± 0.5) %		–
6-prongs		$(1.2 {}^{+1.3}_{-0.7}) \times 10^{-3}$		–

Inclusive modes

e^+ anything	[yy]	(6.71 ± 0.29) %		–
μ^+ anything		(6.5 ± 0.7) %		–
K^- anything		(53 ± 4) %	S=1.3	–
$\overline{K}^0$ anything + K^0 anything		(42 ± 5) %		–
K^+ anything		$(3.4 {+0.6 \atop -0.4})$ %		–
$\overline{K}^*(892)^0$ anything		(9 ± 4) %		–
$K^*(892)^0$ anything		(2.8 ± 1.3) %		–
η anything	[pp]	< 13 %	CL=90%	–
ϕ anything		(1.7 ± 0.8) %		–

Semileptonic modes

$K^- e^+ \nu_e$		(3.51 ± 0.11) %		867
$K^- \mu^+ \nu_\mu$		(3.19 ± 0.16) %		863
$K^*(892)^- e^+ \nu_e$		(2.17 ± 0.16) %		719
$K^*(892)^- \mu^+ \nu_\mu$		(1.95 ± 0.25) %		714
$K^- \pi^+ \pi^- \mu^+ \nu_\mu$		$< 1.2 \times 10^{-3}$	CL=90%	821
$(\overline{K}^*(892)\pi)^- \mu^+ \nu_\mu$		$< 1.4 \times 10^{-3}$	CL=90%	692
$\pi^- e^+ \nu_e$		$(2.81 \pm 0.19) \times 10^{-3}$		927
$\pi^- \mu^+ \nu_\mu$		$(2.4 \pm 0.4) \times 10^{-3}$		924
$\rho^- e^+ \nu_e$		$(1.9 \pm 0.4) \times 10^{-3}$		771

Hadronic modes with one $\overline{K}$

$K^- \pi^+$		(3.80 ± 0.07) %	S=1.1	861
$K^0_S \pi^0$		(1.14 ± 0.12) %		860
$K^0_S \pi^+ \pi^-$	[qq]	(2.90 ± 0.19) %		842
$K^0_S \rho^0$		$(7.5 {+0.6 \atop -0.8}) \times 10^{-3}$		674
$K^0_S \omega$, $\omega \to \pi^+ \pi^-$		$(2.1 \pm 0.6) \times 10^{-4}$		670
$K^0_S f_0(980)$, $f_0(980) \to \pi^+ \pi^-$		$(1.36 {+0.30 \atop -0.22}) \times 10^{-3}$		549
$K^0_S f_2(1270)$, $f_2(1270) \to \pi^+ \pi^-$		$(1.3 {+1.1 \atop -0.7}) \times 10^{-4}$		262
$K^0_S f_0(1370)$, $f_0(1370) \to \pi^+ \pi^-$		$(2.5 \pm 0.6) \times 10^{-3}$		†
$K^*(892)^- \pi^+$, $K^*(892)^- \to K^0_S \pi^-$		(1.91 ± 0.14) %		711
$K^*(892)^+ \pi^-$, $K^*(892)^+ \to K^0_S \pi^+$	[zz]	$(10 {+12 \atop -4}) \times 10^{-5}$		711
$K^*_0(1430)^- \pi^+$, $K^*_0(1430)^- \to K^0_S \pi^-$		$(2.8 {+0.6 \atop -0.4}) \times 10^{-3}$		378

$K_2^*(1430)^- \pi^+$, $K_2^*(1430)^- \to K_S^0 \pi^-$		$(3.2 \ {}^{+2.1}_{-1.1}) \times 10^{-4}$		367
$K^*(1680)^- \pi^+$, $K^*(1680)^- \to K_S^0 \pi^-$		$(6 \pm 5) \times 10^{-4}$		46
$K_S^0 \pi^+ \pi^-$ nonresonant		$(2.6 \ {}^{+5.9}_{-1.6}) \times 10^{-4}$		842
$K^- \pi^+ \pi^0$	[qq]	(14.1 ± 0.5) %	S=1.2	844
$K^- \rho^+$		(11.0 ± 0.7) %		675
$K^- \rho(1700)^+$, $\rho(1700)^+ \to \pi^+ \pi^0$		$(8.0 \pm 1.7) \times 10^{-3}$		†
$K^*(892)^- \pi^+$, $K^*(892)^- \to K^- \pi^0$		$(2.25 \ {}^{+0.36}_{-0.20})$ %		711
$\overline{K}^*(892)^0 \pi^0$, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.91 ± 0.24) %		711
$K_0^*(1430)^- \pi^+$, $K_0^*(1430)^- \to K^- \pi^0$		$(4.6 \pm 2.2) \times 10^{-3}$		378
$\overline{K}_0^*(1430)^0 \pi^0$, $\overline{K}_0^*(1430)^0 \to K^- \pi^+$		$(5.8 \ {}^{+4.6}_{-1.5}) \times 10^{-3}$		379
$K^*(1680)^- \pi^+$, $K^*(1680)^- \to K^- \pi^0$		$(1.8 \pm 0.7) \times 10^{-3}$		46
$K^- \pi^+ \pi^0$ nonresonant		$(1.13 \ {}^{+0.54}_{-0.20})$ %		844
$K_S^0 \pi^0 \pi^0$		—		843
$\overline{K}^*(892)^0 \pi^0$, $\overline{K}^*(892)^0 \to K_S^0 \pi^0$		$(6.3 \ {}^{+1.8}_{-1.5}) \times 10^{-3}$		711
$K_S^0 \pi^0 \pi^0$ nonresonant		$(4.2 \pm 1.1) \times 10^{-3}$		843
$K^- \pi^+ \pi^+ \pi^-$	[qq]	(7.72 ± 0.28) %	S=1.3	812
$K^- \pi^+ \rho^0$ total		(6.4 ± 0.4) %		609
$K^- \pi^+ \rho^0$ 3-body		$(4.9 \pm 2.2) \times 10^{-3}$		609
$\overline{K}^*(892)^0 \rho^0$, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.00 ± 0.22) %		416
$K^- a_1(1260)^+$, $a_1(1260)^+ \to \pi^+ \pi^+ \pi^-$		(3.6 ± 0.6) %		327
$\overline{K}^*(892)^0 \pi^+ \pi^-$ total, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.5 ± 0.4) %		685
$\overline{K}^*(892)^0 \pi^+ \pi^-$ 3-body, $\overline{K}^*(892)^0 \to K^- \pi^+$		$(9.7 \pm 2.1) \times 10^{-3}$		685
$K_1(1270)^- \pi^+$, $K_1(1270)^- \to K^- \pi^+ \pi^-$	[ss]	$(2.9 \pm 0.3) \times 10^{-3}$		484
$K^- \pi^+ \pi^+ \pi^-$ nonresonant		(1.80 ± 0.25) %		812
$K_S^0 \pi^+ \pi^- \pi^0$	[qq]	(5.3 ± 0.6) %		812
$K_S^0 \eta$, $\eta \to \pi^+ \pi^- \pi^0$		$(8.6 \pm 1.4) \times 10^{-4}$		772
$K_S^0 \omega$, $\omega \to \pi^+ \pi^- \pi^0$		$(9.8 \pm 1.8) \times 10^{-3}$		670

$K^*(892)^- \rho^+$, $K^*(892)^- \to K^0_S \pi^-$		$(2.1 \pm 0.8)\%$		416
$K_1(1270)^- \pi^+$, $K_1(1270)^- \to K^0_S \pi^- \pi^0$	[ss]	$(2.2 \pm 0.6) \times 10^{-3}$		484
$\overline{K}^*(892)^0 \pi^+ \pi^-$ 3-body, $\overline{K}^*(892)^0 \to K^0_S \pi^0$		$(2.4 \pm 0.5) \times 10^{-3}$		685
$K^0_S \pi^+ \pi^- \pi^0$ nonresonant		$(1.1 \pm 1.1)\%$		812
$K^- \pi^+ \pi^+ \pi^- \pi^0$		$(4.1 \pm 0.4)\%$		771
$\overline{K}^*(892)^0 \pi^+ \pi^- \pi^0$, $\overline{K}^*(892)^0 \to K^- \pi^+$		$(1.2 \pm 0.6)\%$		643
$K^- \pi^+ \omega$, $\omega \to \pi^+ \pi^- \pi^0$		$(2.7 \pm 0.5)\%$		605
$\overline{K}^*(892)^0 \omega$, $\overline{K}^*(892)^0 \to K^- \pi^+$, $\omega \to \pi^+ \pi^- \pi^0$		$(6.5 \pm 2.4) \times 10^{-3}$		410
$K^0_S \eta \pi^0$		$(5.2 \pm 1.2) \times 10^{-3}$		721
$K^0_S a_0(980)$, $a_0(980) \to \eta \pi^0$		$(6.2 \pm 2.0) \times 10^{-3}$		–
$\overline{K}^*(892)^0 \eta$, $\overline{K}^*(892)^0 \to K^0_S \pi^0$		$(1.5 \pm 0.5) \times 10^{-3}$		–
$K^0_S 2\pi^+ 2\pi^-$		$(2.75 \pm 0.31) \times 10^{-3}$		768
$K^0_S \rho^0 \pi^+ \pi^-$, no $K^*(892)^-$		$(1.1 \pm 0.7) \times 10^{-3}$		–
$K^*(892)^- \pi^+ \pi^+ \pi^-$, $K^*(892)^- \to K^0_S \pi^-$, no ρ^0		$(5 \pm 8) \times 10^{-4}$		642
$K^*(892)^- \rho^0 \pi^+$, $K^*(892)^- \to K^0_S \pi^-$		$(1.7 \pm 0.7) \times 10^{-3}$		230
$K^0_S 2\pi^+ 2\pi^-$ nonresonant		$< 1.3 \times 10^{-3}$	CL=90%	768
$K^- 3\pi^+ 2\pi^-$		$(2.1 \pm 0.5) \times 10^{-4}$		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.)

$K^0_S \eta$	$(3.8 \pm 0.6) \times 10^{-3}$		772
$K^0_S \omega$	$(1.10 \pm 0.20)\%$		670
$K^0_S \eta'(958)$	$(9.1 \pm 1.4) \times 10^{-3}$		565
$K^- a_1(1260)^+$	$(7.5 \pm 1.1)\%$		327
$\overline{K}^0 a_1(1260)^0$	$< 1.9\%$	CL=90%	322
$K^- a_2(1320)^+$	$< 2 \times 10^{-3}$	CL=90%	197
$\overline{K}^*(892)^0 \pi^+ \pi^-$ total	$(2.3 \pm 0.5)\%$		685
$\overline{K}^*(892)^0 \pi^+ \pi^-$ 3-body	$(1.46 \pm 0.32)\%$		685
$\overline{K}^*(892)^0 \rho^0$	$(1.50 \pm 0.33)\%$		417
$\overline{K}^*(892)^0 \rho^0$ transverse	$(1.6 \pm 0.5)\%$		417
$\overline{K}^*(892)^0 \rho^0$ S-wave	$(2.9 \pm 0.6)\%$		417

$\overline{K}^*(892)^0\rho^0$ S-wave long.		<3	$\times 10^{-3}$	CL=90%	417
$\overline{K}^*(892)^0\rho^0$ P-wave		<3	$\times 10^{-3}$	CL=90%	417
$\overline{K}^*(892)^0\rho^0$ D-wave		(2.0 ± 0.6)	%		417
$K^*(892)^-\rho^+$		(6.4 ± 2.5)	%		417
$K^*(892)^-\rho^+$ longitudinal		(3.1 ± 1.2)	%		417
$K^*(892)^-\rho^+$ transverse		(3.4 ± 2.0)	%		417
$K^*(892)^-\rho^+$ P-wave		<1.5	%	CL=90%	417
$K_1(1270)^-\pi^+$	[ss]	(1.12 ± 0.31)	%		484
$K_1(1400)^-\pi^+$		<1.2	%	CL=90%	386
$\overline{K}_1(1400)^0\pi^0$		<3.7	%	CL=90%	387
$\overline{K}^*(892)^0\pi^+\pi^-\pi^0$		(1.8 ± 0.9)	%		643
$K^-\pi^+\omega$		(3.0 ± 0.6)	%		605
$\overline{K}^*(892)^0\omega$		(1.1 ± 0.4)	%		410
$K^-\pi^+\eta'(958)$		(7.2 ± 1.8)	$\times 10^{-3}$		479
$\overline{K}^*(892)^0\eta'(958)$		<1.1	$\times 10^{-3}$	CL=90%	118

Hadronic modes with three K's

$K^0_S K^+ K^-$		(4.58 ± 0.34)	$\times 10^{-3}$		544
$K^0_S a_0(980)^0$, $a^0_0 \to K^+ K^-$		(3.0 ± 0.4)	$\times 10^{-3}$		–
$K^- a_0(980)^+$, $a^+_0 \to K^+ K^0_S$		(6.1 ± 1.8)	$\times 10^{-4}$		–
$K^+ a_0(980)^-$, $a^-_0 \to K^- K^0_S$		<1.1	$\times 10^{-4}$	CL=95%	–
$K^0_S f_0(980)$, $f_0 \to K^+ K^-$		<1.0	$\times 10^{-4}$	CL=95%	–
$K^0_S \phi$, $\phi \to K^+ K^-$		(2.10 ± 0.16)	$\times 10^{-3}$		520
$K^0_S f_0(1400)$, $f_0 \to K^+ K^-$		(1.7 ± 1.1)	$\times 10^{-4}$		–
$3K^0_S$		(9.3 ± 1.3)	$\times 10^{-4}$		538
$K^+ K^- K^- \pi^+$		(2.11 ± 0.31)	$\times 10^{-4}$		434
$K^+ K^- \overline{K}^*(892)^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		(4.2 ± 1.7)	$\times 10^{-5}$		†
$K^-\pi^+\phi$, $\phi \to K^+ K^-$		(3.8 ± 1.6)	$\times 10^{-5}$		422
$\phi\overline{K}^*(892)^0$, $\phi \to K^+ K^-$, $\overline{K}^*(892)^0 \to K^-\pi^+$		(1.01 ± 0.20)	$\times 10^{-4}$		†
$K^+ K^- K^- \pi^+$ nonresonant		(3.2 ± 1.4)	$\times 10^{-5}$		434
$K^0_S K^0_S K^\pm \pi^\mp$		(6.1 ± 1.3)	$\times 10^{-4}$		427

Pionic modes

$\pi^+\pi^-$		(1.364 ± 0.032)	$\times 10^{-3}$		922
$\pi^0\pi^0$		(7.9 ± 0.8)	$\times 10^{-4}$		922
$\pi^+\pi^-\pi^0$		(1.31 ± 0.06)	%		907
$\rho^+\pi^-$		(10.0 ± 0.6)	$\times 10^{-3}$		764
$\rho^0\pi^0$		(3.2 ± 0.4)	$\times 10^{-3}$		764
$\rho^-\pi^+$		(4.5 ± 0.4)	$\times 10^{-3}$		764
$f_0(980)\pi^0$, $f_0(980) \to \pi^+\pi^-$		<3.4	$\times 10^{-6}$	CL=95%	–

$f_0(600)\pi^0$, $f_0(600) \to \pi^+\pi^-$		$< 2.7 \times 10^{-5}$	CL=95%	–
$(\pi^+\pi^-)_{S-\text{wave}}\pi^0$		$< 2.5 \times 10^{-4}$	CL=95%	907
$3\pi^0$		$< 3.5 \times 10^{-4}$	CL=90%	908
$2\pi^+2\pi^-$		$(7.31 \pm 0.27) \times 10^{-3}$		879
$\pi^+\pi^-2\pi^0$		$(9.8 \pm 0.9) \times 10^{-3}$		882
$\eta\pi^0$	[aaa]	$(5.6 \pm 1.4) \times 10^{-4}$		846
$\omega\pi^0$	[aaa]	$< 2.6 \times 10^{-4}$	CL=90%	761
$2\pi^+2\pi^-\pi^0$		$(4.1 \pm 0.5) \times 10^{-3}$		844
$\eta\pi^+\pi^-$	[aaa]	$< 1.9 \times 10^{-3}$	CL=90%	827
$\omega\pi^+\pi^-$	[aaa]	$(1.6 \pm 0.5) \times 10^{-3}$		738
$3\pi^+3\pi^-$		$(4.0 \pm 1.1) \times 10^{-4}$		795

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

K^+K^-		$(3.84 \pm 0.10) \times 10^{-3}$		791
$2K^0_S$		$(3.7 \pm 0.7) \times 10^{-4}$		788
$K^0_S K^-\pi^+$		$(3.4 \pm 0.5) \times 10^{-3}$	S=1.1	739
$\overline{K}^*(892)^0 K^0_S$, $\overline{K}^*(892)^0 \to K^-\pi^+$		$< 6 \times 10^{-4}$	CL=90%	608
$K^*(892)^+ K^-$, $K^*(892)^+ \to K^0_S\pi^+$		$(1.2 \pm 0.3) \times 10^{-3}$		610
$K^0_S K^-\pi^+$ nonresonant		$(1.1 \pm 1.1) \times 10^{-3}$		739
$K^0_S K^+\pi^-$		$(2.6 \pm 0.5) \times 10^{-3}$		739
$K^*(892)^0 K^0_S$, $K^*(892)^0 \to K^+\pi^-$		$< 3 \times 10^{-4}$	CL=90%	608
$K^*(892)^- K^+$, $K^*(892)^- \to K^0_S\pi^-$		$(7 \pm 4) \times 10^{-4}$		610
$K^0_S K^+\pi^-$ nonresonant		$(1.9\,^{+1.1}_{-0.8}) \times 10^{-3}$		739
$K^+K^-\pi^0$		$(1.3 \pm 0.4) \times 10^{-3}$		743
$K^0_S K^0_S \pi^0$		$< 5.9 \times 10^{-4}$		740
$K^+K^-\pi^+\pi^-$	[bbb]	$(2.32 \pm 0.13) \times 10^{-3}$		676
$\phi\pi^+\pi^-$ 3-body, $\phi \to K^+K^-$		$(2.3 \pm 2.3) \times 10^{-5}$		614
$\phi\rho^0$, $\phi \to K^+K^-$		$(6.7 \pm 0.6) \times 10^{-4}$		250
$K^+K^-\rho^0$ 3-body		$(5 \pm 7) \times 10^{-5}$		302
$f_0(980)\pi^+\pi^-$, $f_0 \to K^+K^-$		$(3.5 \pm 0.9) \times 10^{-4}$		–
$K^*(892)^0 K^\mp\pi^\pm$ 3-body, $K^{*0} \to K^\pm\pi^\mp$	[ccc]	$(2.5 \pm 0.5) \times 10^{-4}$		531
$K^*(892)^0 \overline{K}^*(892)^0$, $K^{*0} \to K^\pm\pi^\mp$		$(7 \pm 5) \times 10^{-5}$		272
$K_1(1270)^\pm K^\mp$, $K_1(1270)^\pm \to K^\pm\pi^+\pi^-$		$(7.6 \pm 1.7) \times 10^{-4}$		–
$K_1(1400)^\pm K^\mp$, $K_1(1400)^\pm \to K^\pm\pi^+\pi^-$		$(5.1 \pm 1.2) \times 10^{-4}$		–

$K^0_S K^0_S \pi^+ \pi^-$		$(1.26 \pm 0.24) \times 10^{-3}$		673
$K^0_S K^- \pi^+ \pi^+ \pi^-$		$< 1.5 \times 10^{-4}$	CL=90%	595
$K^+ K^- \pi^+ \pi^- \pi^0$		$(3.1 \pm 2.0) \times 10^{-3}$		600

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

$\overline{K}^*(892)^0 K^0_S$		$< 8 \times 10^{-4}$	CL=90%	608
$K^*(892)^+ K^-$		$(3.7 \pm 0.8) \times 10^{-3}$		610
$K^*(892)^0 K^0_S$		$< 4 \times 10^{-4}$	CL=90%	608
$K^*(892)^- K^+$		$(2.0 \pm 1.1) \times 10^{-3}$		610
$\phi \pi^0$		$(7.4 \pm 0.5) \times 10^{-4}$		644
$\phi \eta$		$(1.4 \pm 0.4) \times 10^{-4}$		489
$\phi \omega$		$< 2.1 \times 10^{-3}$	CL=90%	237

Radiative modes

$\rho^0 \gamma$		$< 2.4 \times 10^{-4}$	CL=90%	771
$\omega \gamma$		$< 2.4 \times 10^{-4}$	CL=90%	768
$\phi \gamma$		$(2.4 {}^{+0.7}_{-0.6}) \times 10^{-5}$		654
$\overline{K}^*(892)^0 \gamma$		$< 7.6 \times 10^{-4}$	CL=90%	719

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

$K^+ \ell^- \overline{\nu}_\ell$ (via $\overline{D}^0$)	*C2M*	$< 1.8 \times 10^{-4}$	CL=90%	–
K^+ or $K^*(892)^+ e^- \overline{\nu}_e$ (via $\overline{D}^0$)	*C2M*	$< 6 \times 10^{-5}$	CL=90%	–
$K^+ \pi^-$	*DC*	$(1.43 \pm 0.04) \times 10^{-4}$		861
$K^+ \pi^-$ (via $\overline{D}^0$)	*C2M*	$< 1.5 \times 10^{-5}$	CL=95%	861
$K^0_S \pi^+ \pi^-$ (in $D^0 \to \overline{D}^0$)	*C2M*	$< 1.8 \times 10^{-4}$	CL=95%	–
$K^*(892)^+ \pi^-$, $K^*(892)^+ \to K^0_S \pi^+$	*DC*	$(10 {}^{+12}_{-4}) \times 10^{-5}$		711
$K^+ \pi^- \pi^0$	*DC*	$(3.29 {}^{+0.30}_{-0.27}) \times 10^{-4}$		844
$K^+ \pi^- \pi^+ \pi^-$	*DC*	$(2.49 {}^{+0.21}_{-0.19}) \times 10^{-4}$		812
$K^+ \pi^- \pi^+ \pi^-$ (via $\overline{D}^0$)	*C2M*	$< 4 \times 10^{-4}$	CL=90%	812
μ^- anything (via $\overline{D}^0$)	*C2M*	$< 4 \times 10^{-4}$	CL=90%	–

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

$\gamma \gamma$	*C1*	$< 2.6 \times 10^{-5}$	CL=90%	932
$e^+ e^-$	*C1*	$< 1.2 \times 10^{-6}$	CL=90%	932
$\mu^+ \mu^-$	*C1*	$< 1.3 \times 10^{-6}$	CL=90%	926
$\pi^0 e^+ e^-$	*C1*	$< 4.5 \times 10^{-5}$	CL=90%	927
$\pi^0 \mu^+ \mu^-$	*C1*	$< 1.8 \times 10^{-4}$	CL=90%	915

$\eta e^+ e^-$	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		$<$	3.0	$\times 10^{-5}$ CL=90%	894
$\rho^0 \mu^+ \mu^-$	C1		$<$	2.2	$\times 10^{-5}$ CL=90%	754
$\omega e^+ e^-$	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
$\phi e^+ e^-$	C1		$<$	5.2	$\times 10^{-5}$ CL=90%	654
$K^- K^+ \mu^+ \mu^-$	C1		$<$	3.3	$\times 10^{-5}$ CL=90%	709
$\phi \mu^+ \mu^-$	C1		$<$	3.1	$\times 10^{-5}$ CL=90%	631
$\overline{K}^0 e^+ e^-$		[uu]	$<$	1.1	$\times 10^{-4}$ CL=90%	866
$\overline{K}^0 \mu^+ \mu^-$		[uu]	$<$	2.6	$\times 10^{-4}$ CL=90%	852
$K^- \pi^+ e^+ e^-$	C1		$<$	3.85	$\times 10^{-4}$ CL=90%	861
$\overline{K}^*(892)^0 e^+ e^-$		[uu]	$<$	4.7	$\times 10^{-5}$ CL=90%	719
$K^- \pi^+ \mu^+ \mu^-$	C1		$<$	3.59	$\times 10^{-4}$ CL=90%	829
$\overline{K}^*(892)^0 \mu^+ \mu^-$		[uu]	$<$	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]	$<$	8.1	$\times 10^{-7}$ 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%	862
$K^- \pi^+ e^\pm \mu^\mp$	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
$\pi^- \pi^- e^+ e^+ +$ c.c.	L		$<$	1.12	$\times 10^{-4}$ CL=90%	922
$\pi^- \pi^- \mu^+ \mu^+ +$ c.c.	L		$<$	2.9	$\times 10^{-5}$ CL=90%	894
$K^- \pi^- e^+ e^+ +$ c.c.	L		$<$	2.06	$\times 10^{-4}$ CL=90%	861
$K^- \pi^- \mu^+ \mu^+ +$ c.c.	L		$<$	3.9	$\times 10^{-4}$ CL=90%	829
$K^- K^- e^+ e^+ +$ c.c.	L		$<$	1.52	$\times 10^{-4}$ CL=90%	791
$K^- K^- \mu^+ \mu^+ +$ c.c.	L		$<$	9.4	$\times 10^{-5}$ CL=90%	709
$\pi^- \pi^- e^+ \mu^+ +$ 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
$K^- K^- e^+ \mu^+ +$ c.c.	L		$<$	5.7	$\times 10^{-5}$ CL=90%	754

$D^*(2007)^0$

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

Mass $m = 2006.7 \pm 0.4$ MeV (S = 1.1)
$m_{D^{*0}} - m_{D^0} = 142.12 \pm 0.07$ 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 $m = 2010.0 \pm 0.4$ MeV (S = 1.1)
$m_{D^*(2010)^+} - m_{D^+} = 140.64 \pm 0.10$ MeV (S = 1.1)
$m_{D^*(2010)^+} - m_{D^0} = 145.421 \pm 0.010$ MeV (S = 1.1)
Full width $\Gamma = 96 \pm 22$ 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
$D^+\gamma$	$(\ 1.6\pm0.4)$ %	136

$D_1(2420)^0$

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

Mass $m = 2422.3 \pm 1.3$ MeV (S = 1.2)
$m_{D_1^0} - m_{D^{*+}} = 411.7 \pm 0.8$
Full width $\Gamma = 20.4 \pm 1.7$ MeV

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

$D_1(2420)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+\pi^-$	seen	355
$D^0\pi^+\pi^-$	seen	426
$D^+\pi^-$	not seen	474
$D^{*0}\pi^+\pi^-$	not seen	281

$D_2^*(2460)^0$

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

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

Mass $m = 2461.1 \pm 1.6$ MeV (S = 1.3)
$m_{D_2^{*0}} - m_{D^+} = 593.9 \pm 0.8$
Full width $\Gamma = 43 \pm 4$ MeV (S = 1.8)

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

$D_2^*(2460)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+\pi^-$	seen	506
$D^*(2010)^+\pi^-$	seen	389
$D^0\pi^+\pi^-$	not seen	462
$D^{*0}\pi^+\pi^-$	not seen	325

$D_2^*(2460)^\pm$

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

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

Mass $m = 2459 \pm 4$ MeV (S = 1.7)
$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0} = 2.4 \pm 1.7$ MeV
Full width $\Gamma = 29 \pm 5$ MeV

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

$D_2^*(2460)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0\pi^+$	seen	507
$D^{*0}\pi^+$	seen	390
$D^+\pi^+\pi^-$	not seen	456
$D^{*+}\pi^+\pi^-$	not seen	319

CHARMED, STRANGE MESONS ($C = S = \pm1$)

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

$D_s^\pm$ was $F^\pm$

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

Mass $m = 1968.2 \pm 0.5$ MeV (S = 1.1)

$m_{D_s^\pm} - m_{D^\pm} = 98.85 \pm 0.30$ MeV (S = 1.4)

Mean life $\tau = (500 \pm 7) \times 10^{-15}$ s (S = 1.3)

$c\tau = 149.9$ μm

T-violation decay-rate asymmetry

$A_T(K_S^0 K^\pm \pi^+ \pi^-) = -0.04 \pm 0.07$

D_s^+ form factors

$r_2 = 1.32 \pm 0.24$ (S = 1.2)

$r_v = 1.72 \pm 0.21$

$\Gamma_L/\Gamma_T = 0.72 \pm 0.18$

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			
K^- anything	$(13 \ {}^{+14}_{-12})$ %		–
$\overline{K}^0$ anything + K^0 anything	(39 ± 28) %		–
K^+ anything	$(20 \ {}^{+18}_{-14})$ %		–
(non-$K\overline{K}$) anything	(64 ± 17) %		–
e^+ anything	$(8 \ {}^{+6}_{-5})$ %		–
ϕ anything	$(18 \ {}^{+15}_{-10})$ %		–

Leptonic and semileptonic modes

$\mu^+ \nu_\mu$		$(6.1 \pm 1.9) \times 10^{-3}$	S=1.4	981
$\tau^+ \nu_\tau$		(6.4 ± 1.5) %		182
$\phi \ell^+ \nu_\ell$	[*ddd*]	(2.4 ± 0.4) %	S=1.1	720
$\eta \ell^+ \nu_\ell + \eta'(958) \ell^+ \nu_\ell$	[*ddd*]	(4.2 ± 0.8) %		–
$\eta \ell^+ \nu_\ell$	[*ddd*]	(3.1 ± 0.6) %		908
$\eta'(958) \ell^+ \nu_\ell$	[*ddd*]	(1.08 ± 0.35) %		751

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

$K^+ \overline{K}^0$		(4.4 ± 0.9) %		850
$K^+ K^- \pi^+$	[*qq*]	(5.2 ± 0.9) %	S=1.1	805
$\phi \pi^+$	[*eee*]	(4.4 ± 0.6) %	S=1.1	711
$\phi \pi^+$, $\phi \to K^+ K^-$		(2.16 ± 0.28) %	S=1.1	712
$K^+ \overline{K}^*(892)^0$, $\overline{K}^{*0} \to K^- \pi^+$		(2.5 ± 0.5) %		416
$f_0(980) \pi^+$, $f_0 \to K^+ K^-$		$(5.7 \pm 2.5) \times 10^{-3}$		732
$K^+ \overline{K}^*_0(1430)^0$, $\overline{K}^*_0 \to K^- \pi^+$		$(4.8 \pm 2.5) \times 10^{-3}$		218
$K^0 \overline{K}^0 \pi^+$		—		802
$K^*(892)^+ \overline{K}^0$	[*eee*]	(5.3 ± 1.3) %		683
$K^+ K^- \pi^+ \pi^0$		—		748
$\phi \pi^+ \pi^0$	[*eee*]	(11 ± 5) %		686
$\phi \rho^+$	[*eee*]	$(8.2 {}^{+2.0}_{-2.4})$ %		401
$\phi \pi^+ \pi^0$ 3-body	[*eee*]	< 3.1 %	CL=90%	686
$K^+ K^- \pi^+ \pi^0$ non-ϕ		< 11 %	CL=90%	748
$K^+ \overline{K}^0 \pi^+ \pi^-$		(3.1 ± 0.9) %		744
$K^0 K^- \pi^+ \pi^+$		(5.3 ± 1.4) %		744
$K^*(892)^+ \overline{K}^*(892)^0$	[*eee*]	(7.0 ± 2.7) %		416
$K^0 K^- \pi^+ \pi^+$ (non-$K^{*+} \overline{K}^{*0}$)		< 3.5 %	CL=90%	744
$K^+ K^- \pi^+ \pi^+ \pi^-$		$(8.3 \pm 2.0) \times 10^{-3}$		673
$\phi \pi^+ \pi^+ \pi^-$	[*eee*]	(1.18 ± 0.20) %		640
$K^+ K^- \rho^0 \pi^+$ non-ϕ		$< 2.5 \times 10^{-4}$	CL=90%	248
$\phi \rho^0 \pi^+$	[*eee*]	(1.24 ± 0.33) %		181
$\phi a_1(1260)^+$	[*eee*]	(2.9 ± 0.7) %		†
$K^+ K^- \pi^+ \pi^+ \pi^-$ nonresonant		$(8 \pm 7) \times 10^{-4}$		673
$K^0_S K^0_S \pi^+ \pi^+ \pi^-$		$(2.7 \pm 1.3) \times 10^{-3}$		669

Hadronic modes without K's

$\pi^+ \pi^+ \pi^-$		(1.22 ± 0.23) %	S=1.2	959
$\pi^+ (\pi^+ \pi^-)_{S-\text{wave}}$	[*fff*]	(1.06 ± 0.22) %		959
$f_2(1270) \pi^+$, $f_2 \to \pi^+ \pi^-$		$(1.2 \pm 0.7) \times 10^{-3}$		559
$\rho(1450)^0 \pi^+$, $\rho^0 \to \pi^+ \pi^-$		$(8 \pm 7) \times 10^{-4}$		421
$\pi^+ \pi^+ \pi^- \pi^0$		< 15 %	CL=90%	935
$\eta \pi^+$	[*eee*]	(2.11 ± 0.35) %		902
$\omega \pi^+$	[*eee*]	$(3.4 \pm 1.2) \times 10^{-3}$		822

$3\pi^+ 2\pi^-$			$(7.6 \pm 1.6) \times 10^{-3}$		899
$\pi^+\pi^+\pi^-\pi^0\pi^0$			—		902
$\eta\rho^+$		[eee]	(13.1 ± 2.6) %		724
$\eta\pi^+\pi^0$ 3-body		[eee]	< 5 %	CL=90%	885
$3\pi^+ 2\pi^- \pi^0$			(4.9 ± 3.2) %		856
$\eta'(958)\pi^+$		[eee]	(4.7 ± 0.7) %		743
$3\pi^+ 2\pi^- 2\pi^0$			—		803
$\eta'(958)\rho^+$		[eee]	(12.2 ± 2.4) %		464
$\eta'(958)\pi^+\pi^0$ 3-body		[eee]	< 1.8 %	CL=90%	720

Modes with one or three K's

$K^0\pi^+$			$< 9 \times 10^{-3}$	CL=90%	916
$K^+\pi^+\pi^-$			$(6.6 \pm 1.4) \times 10^{-3}$		900
$K^+\rho^0$			$(2.6 \pm 0.7) \times 10^{-3}$		744
$K^+\rho(1450)^0$, $\rho^0 \to \pi^+\pi^-$			$(7.0 \pm 2.9) \times 10^{-4}$		–
$K^*(892)^0\pi^+$, $K^{*0} \to K^+\pi^-$			$(1.4 \pm 0.4) \times 10^{-3}$		775
$K^*(1410)^0\pi^+$, $K^{*0} \to K^+\pi^-$			$(1.2 \pm 0.4) \times 10^{-3}$		–
$K^*(1430)^0\pi^+$, $K^{*0} \to K^+\pi^-$			$(5 \pm 4) \times 10^{-4}$		–
$K^+\pi^+\pi^-$ nonresonant			$(1.0 \pm 0.4) \times 10^{-3}$		900
$K^+K^+K^-$			$(4.6 \pm 1.8) \times 10^{-4}$		627
ϕK^+		[eee]	$< 6 \times 10^{-4}$	CL=90%	606

Doubly Cabibbo-suppressed modes

$K^+K^+\pi^-$			$(2.7 \pm 1.2) \times 10^{-4}$		805

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

$\pi^+ e^+ e^-$		[uu]	$< 2.7 \times 10^{-4}$	CL=90%	979
$\pi^+\mu^+\mu^-$		[uu]	$< 2.6 \times 10^{-5}$	CL=90%	968
$K^+ e^+ e^-$	C1		$< 1.6 \times 10^{-3}$	CL=90%	922
$K^+\mu^+\mu^-$	C1		$< 3.6 \times 10^{-5}$	CL=90%	909
$K^*(892)^+\mu^+\mu^-$	C1		$< 1.4 \times 10^{-3}$	CL=90%	765
$\pi^+ e^\pm \mu^\mp$	LF	[gg]	$< 6.1 \times 10^{-4}$	CL=90%	976
$K^+ e^\pm \mu^\mp$	LF	[gg]	$< 6.3 \times 10^{-4}$	CL=90%	919
$\pi^- e^+ e^+$	L		$< 6.9 \times 10^{-4}$	CL=90%	979
$\pi^-\mu^+\mu^+$	L		$< 2.9 \times 10^{-5}$	CL=90%	968
$\pi^- e^+\mu^+$	L		$< 7.3 \times 10^{-4}$	CL=90%	976
$K^- e^+ e^+$	L		$< 6.3 \times 10^{-4}$	CL=90%	922
$K^-\mu^+\mu^+$	L		$< 1.3 \times 10^{-5}$	CL=90%	909
$K^- e^+\mu^+$	L		$< 6.8 \times 10^{-4}$	CL=90%	919
$K^*(892)^-\mu^+\mu^+$	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 $m = 2112.0 \pm 0.6$ MeV   (S = 1.1)
$m_{D_s^{*\pm}} - m_{D_s^\pm} = 143.8 \pm 0.4$ 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 $m = 2317.3 \pm 0.6$ MeV
$m_{D_{s0}^*(2317)^\pm} - m_{D_s^\pm} = 349.1 \pm 0.6$ MeV
Full width $\Gamma < 4.6$ MeV, CL = 90%

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

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

Mass $m = 2458.9 \pm 0.9$ MeV   (S = 1.1)
$m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}} = 346.9 \pm 1.0$ MeV   (S = 1.2)
$m_{D_{s1}(2460)^\pm} - m_{D_s^\pm} = 490.7 \pm 0.9$ MeV   (S = 1.2)
Full width $\Gamma < 5.5$ MeV, CL = 90%

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

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

Mass $m = 2535.35 \pm 0.34 \pm 0.5$ MeV
Full width $\Gamma < 2.3$ MeV, CL = 90%

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

$D_{s1}(2536)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+ K^0$	seen	150
$D^*(2007)^0 K^+$	seen	168
$D^+ K^0$	not seen	382
$D^0 K^+$	not seen	392
$D_s^{*+}\gamma$	possibly seen	388

$D_{s2}(2573)^{\pm}$

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

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

Mass $m = 2573.5 \pm 1.7$ MeV
Full width $\Gamma = 15^{+5}_{-4}$ MeV

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

$D_{s2}(2573)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 K^+$	seen	436
$D^*(2007)^0 K^+$	not seen	246

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, branching fractions *CP* violation
- B^0

  mass, mean life, branching fractions

  polarization in B^0 decay, B^0-$\overline{B}^0$ mixing, *CP* violation
- $B^{\pm}$ B^0 Admixtures

  branching fractions, *CP* violation
- $B^{\pm}/B^0/B_s^0/b$-baryon Admixtures

  mean life, production fractions, branching fractions

  χ_b at high energy, V_{cb} measurements
- B^*

  mass
- B_s^0

  mass, mean life, branching fractions

  polarization in B_s^0 decay, B_s^0-$\overline{B}_s^0$ mixing
- $B_c^{\pm}$

  mass, mean life, branching fractions

At end of Baryon Listings:

- Λ_b

  mass, mean life, 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 $m_{B^{\pm}} = 5279.0 \pm 0.5$ MeV
Mean life $\tau_{B^{\pm}} = (1.638 \pm 0.011) \times 10^{-12}$ s
$c\tau = 491.1\ \mu$m

CP violation

$A_{CP}(B^+ \to J/\psi(1S) K^+) = -0.024 \pm 0.014$
$A_{CP}(B^+ \to J/\psi(1S) \pi^+) = 0.09 \pm 0.08$
$A_{CP}(B^+ \to J/\psi K^*(892)^+) = 0.048 \pm 0.033$
$A_{CP}(B^+ \to \psi(2S) K^+) = -0.025 \pm 0.024$
$A_{CP}(B^+ \to \psi(2S) K^*(892)^+) = -0.08 \pm 0.21$
$A_{CP}(B^+ \to \chi_{c1} K^+) = 0.00 \pm 0.08$
$A_{CP}(B^+ \to \chi_{c1} K^*(892)^+) = -0.5 \pm 0.5$
$A_{CP}(B^+ \to \overline{D}^0 \pi^+) = -0.008 \pm 0.008$
$A_{CP}(B^+ \to D_{CP(+1)} \pi^+) = 0.035 \pm 0.024$
$A_{CP}(B^+ \to D_{CP(-1)} \pi^+) = 0.017 \pm 0.026$
$A_{CP}(B^+ \to \overline{D}^0 K^+) = 0.07 \pm 0.04$
$r_B(B^+ \to D^0 K^+) = 0.12 \pm 0.09$
$\delta_B(B^+ \to D^0 K^+) = 104 \pm 50$ degrees
$A_{CP}(B^+ \to [K^- \pi^+]_D K^+) = 0.9^{+0.8}_{-0.6}$
$A_{CP}(B^+ \to [K^- \pi^+]_{\overline{D}} K^*(892)^+) = -0.2 \pm 0.6$
$A_{CP}(B^+ \to [K^- \pi^+]_D \pi^+) = 0.30^{+0.30}_{-0.26}$
$A_{CP}(B^+ \to [\pi^+ \pi^- \pi^0]_D K^+) = -0.02 \pm 0.16$
$A_{CP}(B^+ \to D_{CP(+1)} K^+) = 0.22 \pm 0.14$ (S = 1.4)
$A_{CP}(B^+ \to D_{CP(-1)} K^+) = -0.09 \pm 0.10$
$A_{CP}(B^+ \to \overline{D}^{*0} \pi^+) = -0.014 \pm 0.015$
$A_{CP}(B^+ \to (D^*_{CP(+1)})^0 \pi^+) = -0.02 \pm 0.05$
$A_{CP}(B^+ \to (D^*_{CP(-1)})^0 \pi^+) = -0.09 \pm 0.05$
$A_{CP}(B^+ \to D^{*0} K^+) = -0.09 \pm 0.09$
$r^*_B(B^+ \to D^{*0} K^+) = 0.17 \pm 0.11$
$\delta^*_B(B^+ \to D^{*0} K^+) = -64 \pm 50$ degrees
$A_{CP}(B^+ \to D^{*0}_{CP(+1)} K^+) = -0.15 \pm 0.16$
$A_{CP}(B^+ \to D^*_{CP(-1)} K^+) = 0.13 \pm 0.31$
$A_{CP}(B^+ \to D_{CP(+1)} K^*(892)^+) = -0.08 \pm 0.21$
$A_{CP}(B^+ \to D_{CP(-1)} K^*(892)^+) = -0.3 \pm 0.4$
$A_{CP}(B^+ \to K^0_S \pi^+) = -0.02 \pm 0.07$ (S = 1.9)
$A_{CP}(B^+ \to K^+ \pi^0) = 0.04 \pm 0.04$
$A_{CP}(B^+ \to K^+ \eta') = 0.020 \pm 0.025$
$A_{CP}(B^+ \to \eta K^+) = -0.25 \pm 0.14$
$A_{CP}(B^+ \to \eta K^*(892)^+) = 0.13 \pm 0.14$
$A_{CP}(B^+ \to \omega K^+) = -0.02 \pm 0.13$
$A_{CP}(B^+ \to K^{*0} \pi^+) = 0.07 \pm 0.10$
$A_{CP}(B^+ \to K^+ \pi^- \pi^+) = -0.01 \pm 0.04$

$A_{CP}(B^+ \to\ f_0(980)K^+) = 0.09^{+0.14}_{-0.11}$
$A_{CP}(B^+ \to\ \rho^0 K^+) = 0.32 \pm 0.16$
$A_{CP}(B^+ \to\ K_0^*(1430)^0 \pi^+) = -0.06 \pm 0.04$
$A_{CP}(B^+ \to\ K^*(892)^+ \pi^0) = 0.04 \pm 0.29$
$A_{CP}(B^+ \to\ \rho^0 K^*(892)^+) = 0.20 \pm 0.31$
$A_{CP}(B^+ \to\ K^0 K^+) = 0.15 \pm 0.33$
$A_{CP}(B^+ \to\ K^+ K_S^0 K_S^0) = -0.04 \pm 0.11$
$A_{CP}(B^+ \to\ K^+ K^- K^+) = 0.02 \pm 0.08$
$A_{CP}(B^+ \to\ \phi K^+) = 0.01 \pm 0.07$
$A_{CP}(B^+ \to\ \phi K^*(892)^+) = 0.05 \pm 0.11$
$A_{CP}(B^+ \to\ \eta K^+ \gamma) = -0.16 \pm 0.11$
$A_{CP}(B^+ \to\ \pi^+ \pi^0) = -0.02 \pm 0.07$
$A_{CP}(B^+ \to\ \pi^+ \pi^- \pi^+) = -0.01 \pm 0.08$
$A_{CP}(B^+ \to\ \rho^0 \pi^+) = -0.07 \pm 0.13$
$A_{CP}(B^+ \to\ f_2(1270)\pi^+) = 0.00 \pm 0.25$
$A_{CP}(B^+ \to\ \rho^+ \pi^0) = 0.15 \pm 0.12$
$A_{CP}(B^+ \to\ \rho^+ \rho^0) = -0.09 \pm 0.16$
$A_{CP}(B^+ \to\ \omega \pi^+) = 0.10 \pm 0.22 \quad (S = 1.9)$
$A_{CP}(B^+ \to\ \omega \rho^+) = 0.05 \pm 0.26$
$A_{CP}(B^+ \to\ \eta \pi^+) = -0.05 \pm 0.10$
$A_{CP}(B^+ \to\ \eta' \pi^+) = 0.14 \pm 0.16$
$A_{CP}(B^+ \to\ \eta \rho^+) = 0.02 \pm 0.18$
$A_{CP}(B^+ \to\ p \overline{p} \pi^+) = -0.16 \pm 0.22$
$A_{CP}(B^+ \to\ p \overline{p} K^+) = -0.05 \pm 0.11$
$\gamma(B^+ \to\ D^{(*)} K^+) = (75 \pm 20)^\circ$

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	[ggg]	(10.9 ± 0.4) %		–
$\overline{D}^0 \ell^+ \nu_\ell$	[ggg]	(2.15 ± 0.22) %		2310
$\overline{D}^*(2007)^0 \ell^+ \nu_\ell$	[ggg]	(6.5 ± 0.5) %		2258
$\overline{D}_1(2420)^0 \ell^+ \nu_\ell$		(5.6 ± 1.6) $\times 10^{-3}$		2084
$\overline{D}_2^*(2460)^0 \ell^+ \nu_\ell$		< 8 $\times 10^{-3}$	CL=90%	2066
$D^- \pi^+ \ell^+ \nu_\ell$		(5.3 ± 1.0) $\times 10^{-3}$		2306
$D^{*-} \pi^+ \ell^+ \nu_\ell$		(6.4 ± 1.5) $\times 10^{-3}$		2254
$\pi^0 \ell^+ \nu_\ell$		(7.4 ± 1.1) $\times 10^{-5}$		2638
$\eta \ell^+ \nu_\ell$		(8 ± 4) $\times 10^{-5}$		2611
$\omega \ell^+ \nu_\ell$	[ggg]	(1.3 ± 0.6) $\times 10^{-4}$		2582
$\rho^0 \ell^+ \nu_\ell$	[ggg]	(1.24 ± 0.23) $\times 10^{-4}$		2583
$p \overline{p} e^+ \nu_e$		< 5.2 $\times 10^{-3}$	CL=90%	2467
$e^+ \nu_e$		< 1.5 $\times 10^{-5}$	CL=90%	2640
$\mu^+ \nu_\mu$		< 6.6 $\times 10^{-6}$	CL=90%	2638
$\tau^+ \nu_\tau$		< 2.6 $\times 10^{-4}$	CL=90%	2340
$e^+ \nu_e \gamma$		< 2.0 $\times 10^{-4}$	CL=90%	2640
$\mu^+ \nu_\mu \gamma$		< 5.2 $\times 10^{-5}$	CL=90%	2638
Inclusive modes				
$D^0 X$		(9.8 ± 1.1) %		–
$\overline{D}^0 X$		(79 ± 5) %		–
$D^+ X$		(3.8 ± 1.0) %		–
$D^- X$		(9.8 ± 1.8) %		–
$D_s^+ X$		(14 $^{+5}_{-4}$) %		–
$D_s^- X$		< 2.2 %	CL=90%	–
$\Lambda_c^+ X$		(2.9 $^{+1.4}_{-1.1}$) %		–
$\overline{\Lambda}_c^- X$		(3.5 $^{+1.5}_{-1.2}$) %		–
$\overline{c} X$		(98 ± 6) %		–
$c X$		(33 $^{+6}_{-4}$) %		–
$\overline{c} c X$		(131 $^{+10}_{-8}$) %		–
D, D^*, or D_s modes				
$\overline{D}^0 \pi^+$		(4.92 ± 0.20) $\times 10^{-3}$		2308
$D_{CP(+1)} \pi^+$	[hhh]	(4.0 ± 0.8) $\times 10^{-3}$		–
$D_{CP(-1)} \pi^+$	[hhh]	(3.6 ± 0.8) $\times 10^{-3}$		–
$\overline{D}^0 \rho^+$		(1.34 ± 0.18) %		2237
$\overline{D}^0 K^+$		(4.08 ± 0.24) $\times 10^{-4}$		2281

$D_{CP(+1)} K^+$	[hhh]	$(3.7 \pm 0.6) \times 10^{-4}$		–
$D_{CP(-1)} K^+$	[hhh]	$(3.5 \pm 0.5) \times 10^{-4}$		–
$[K^- \pi^+]_D \pi^+$	[iii]	$(1.7 \pm 0.5) \times 10^{-5}$		–
$[\pi^+ \pi^- \pi^0]_D K^-$		$(5.5 \pm 1.2) \times 10^{-6}$		–
$\overline{D}^0 K^*(892)^+$		$(6.3 \pm 0.8) \times 10^{-4}$		2213
$D_{CP(-1)} K^*(892)^+$	[hhh]	$(2.0 \pm 0.9) \times 10^{-4}$		–
$D_{CP(+1)} K^*(892)^+$	[hhh]	$(6.2 \pm 1.5) \times 10^{-4}$		–
$\overline{D}^0 K^+ \overline{K}^0$		$(5.5 \pm 1.6) \times 10^{-4}$		2189
$\overline{D}^0 K^+ \overline{K}^*(892)^0$		$(7.5 \pm 1.7) \times 10^{-4}$		2071
$\overline{D}^0 \pi^+ \pi^+ \pi^-$		(1.1 ± 0.4) %		2289
$\overline{D}^0 \pi^+ \pi^+ \pi^-$ nonresonant		$(5 \pm 4) \times 10^{-3}$		2289
$\overline{D}^0 \pi^+ \rho^0$		$(4.2 \pm 3.0) \times 10^{-3}$		2207
$\overline{D}^0 a_1(1260)^+$		$(4 \pm 4) \times 10^{-3}$		2123
$\overline{D}^0 \omega \pi^+$		$(4.1 \pm 0.9) \times 10^{-3}$		2206
$D^*(2010)^- \pi^+ \pi^+$		$(1.35 \pm 0.22) \times 10^{-3}$		2247
$D^- \pi^+ \pi^+$		$(1.02 \pm 0.16) \times 10^{-3}$		2299
$D^+ K^0$		$< 5.0 \times 10^{-6}$	CL=90%	2278
$\overline{D}^*(2007)^0 \pi^+$		$(4.6 \pm 0.4) \times 10^{-3}$		2256
$\overline{D}^*(2007)^0 \omega \pi^+$		$(4.5 \pm 1.2) \times 10^{-3}$		2149
$\overline{D}^*(2007)^0 \rho^+$		$(9.8 \pm 1.7) \times 10^{-3}$		2181
$\overline{D}^*(2007)^0 K^+$		$(3.7 \pm 0.4) \times 10^{-4}$		2227
$\overline{D}^*(2007)^0 K^*(892)^+$		$(8.1 \pm 1.4) \times 10^{-4}$		2156
$\overline{D}^*(2007)^0 K^+ \overline{K}^0$		$< 1.06 \times 10^{-3}$	CL=90%	2132
$\overline{D}^*(2007)^0 K^+ K^*(892)^0$		$(1.5 \pm 0.4) \times 10^{-3}$		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
$\overline{D}^{*0} 3\pi^+ 2\pi^-$		$(5.7 \pm 1.2) \times 10^{-3}$		2196
$D^*(2010)^+ \pi^0$		$< 1.7 \times 10^{-4}$	CL=90%	2255
$D^*(2010)^+ K^0$		$< 9.0 \times 10^{-6}$	CL=90%	2225
$D^*(2010)^- \pi^+ \pi^+ \pi^0$		(1.5 ± 0.7) %		2235
$D^*(2010)^- \pi^+ \pi^+ \pi^+ \pi^-$		$(2.6 \pm 0.4) \times 10^{-3}$		2217
$\overline{D}_1^*(2420)^0 \pi^+$		$(1.5 \pm 0.6) \times 10^{-3}$	S=1.3	2081
$\overline{D}_1(2420)^0 \pi^+ \times B(\overline{D}_1^0 \to \overline{D}^0 \pi^+ \pi^-)$		$(1.9 {}^{+0.5}_{-0.6}) \times 10^{-4}$		2081
$\overline{D}_2^*(2462)^0 \pi^+ \times B(\overline{D}_2^*(2462)^0 \to D^- \pi^+)$		$(3.4 \pm 0.8) \times 10^{-4}$		–
$\overline{D}_0^*(2308)^0 \pi^+ \times B(\overline{D}_0^*(2308)^0 \to D^- \pi^+)$		$(6.1 \pm 1.9) \times 10^{-4}$		–
$\overline{D}_1(2421)^0 \pi^+ \times B(\overline{D}_1(2421)^0 \to D^{*-} \pi^+)$		$(6.8 \pm 1.5) \times 10^{-4}$		–

$\overline{D}_2^*(2462)^0\pi^+ \times$ B$(\overline{D}_2^*(2462)^0 \to D^{*-}\pi^+)$	$(1.8 \pm 0.5) \times 10^{-4}$			–
$\overline{D}_1'(2427)^0\pi^+ \times$ B$(\overline{D}_1'(2427)^0 \to D^{*-}\pi^+)$	$(5.0 \pm 1.2) \times 10^{-4}$			–
$\overline{D}_1(2420)^0\pi^+ \times$B$(\overline{D}_1^0 \to \overline{D}^{*0}\pi^+\pi^-)$	$< 6 \times 10^{-6}$	CL=90%		2081
$\overline{D}_1^*(2420)^0\rho^+$	$< 1.4 \times 10^{-3}$	CL=90%		1995
$\overline{D}_2^*(2460)^0\pi^+$	$< 1.3 \times 10^{-3}$	CL=90%		2063
$\overline{D}_2^*(2460)^0\pi^+ \times$B$(\overline{D}_2^{*0} \to \overline{D}^{*0}\pi^+\pi^-)$	$< 2.2 \times 10^{-5}$	CL=90%		2063
$\overline{D}_2^*(2460)^0\rho^+$	$< 4.7 \times 10^{-3}$	CL=90%		1976
$\overline{D}^0 D_s^+$	(1.09 ± 0.27) %			1815
$D_{s0}(2317)^+\overline{D}^0 \times$ B$(D_{s0}(2317)^+ \to D_s^+\pi^0)$	$(7.4 {}^{+2.3}_{-1.9}) \times 10^{-4}$			1605
$D_{s0}(2317)^+\overline{D}^0 \times$ B$(D_{s0}(2317)^+ \to D_s^{*+}\gamma)$	$< 7.6 \times 10^{-4}$	CL=90%		1605
$D_{s0}(2317)^+\overline{D}^*(2010)^0 \times$ B$(D_{s0}(2317)^+ \to D_s^+\pi^0)$	$(9 \pm 7) \times 10^{-4}$			–
$D_{sJ}(2457)^+\overline{D}^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^{*+}\pi^0)$	$(1.4 {}^{+0.6}_{-0.5}) \times 10^{-3}$		S=1.3	–
$D_{sJ}(2457)^+\overline{D}^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^+\gamma)$	$(4.7 {}^{+1.4}_{-1.2}) \times 10^{-4}$			–
$D_{sJ}(2457)^+\overline{D}^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^+\pi^+\pi^-)$	$< 2.2 \times 10^{-4}$	CL=90%		–
$D_{sJ}(2457)^+\overline{D}^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^+\pi^0)$	$< 2.7 \times 10^{-4}$	CL=90%		–
$D_{sJ}(2457)^+\overline{D}^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^{*+}\gamma)$	$< 9.8 \times 10^{-4}$	CL=90%		–
$D_{sJ}(2457)^+\overline{D}^*(2010)^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^{*+}\pi^0)$	$(7.6 {}^{+3.6}_{-2.9}) \times 10^{-3}$			–
$D_{sJ}(2457)^+\overline{D}^*(2010)^0 \times$ B$(D_{sJ}(2457)^+ \to D_s^+\gamma)$	$(1.4 {}^{+0.7}_{-0.6}) \times 10^{-3}$			–
$\overline{D}^0 D_{sJ}(2536)^+ \times$ B$(D_{sJ}(2536)^+ \to D^*(2007)^0 K^+)$	$< 2 \times 10^{-4}$	CL=90%		1447
$\overline{D}^*(2007)^0 D_{sJ}(2536)^+ \times$ B$(D_{sJ}(2536)^+ \to D^*(2007)^0 K^+)$	$< 7 \times 10^{-4}$	CL=90%		1338

$\overline{D}^0 D_{sJ}(2573)^+ \times$ B$(D_{sJ}(2573)^+ \to D^0 K^+)$	$<$ 2	$\times 10^{-4}$	CL=90%	1416
$\overline{D}^*(2007)^0 D_{sJ}(2573)^+ \times$ B$(D_{sJ}(2573)^+ \to D^0 K^+)$	$<$ 5	$\times 10^{-4}$	CL=90%	1305
$\overline{D}^0 D_s^{*+}$	(7.2 $\pm$ 2.6)	$\times 10^{-3}$		1734
$\overline{D}^*(2007)^0 D_s^+$	(10 $\pm$ 4)	$\times 10^{-3}$		1737
$\overline{D}^*(2007)^0 D_s^{*+}$	(2.2 $\pm$ 0.7)	%		1651
$D_s^{(*)+} \overline{D}^{**0}$	(2.7 $\pm$ 1.2)	%		–
$\overline{D}^*(2007)^0 D^*(2010)^+$	$<$ 1.1	%	CL=90%	1713
$\overline{D}^0 D^*(2010)^+ + \overline{D}^*(2007)^0 D^+$	$<$ 1.3	%	CL=90%	1792
$\overline{D}^0 D^*(2010)^+$	(4.6 $\pm$ 0.9)	$\times 10^{-4}$		1792
$\overline{D}^0 D^+$	(4.8 $\pm$ 1.0)	$\times 10^{-4}$		1866
$\overline{D}^0 D^+ K^0$	$<$ 2.8	$\times 10^{-3}$	CL=90%	1571
$\overline{D}^*(2007)^0 D^+ K^0$	$<$ 6.1	$\times 10^{-3}$	CL=90%	1475
$\overline{D}^0 \overline{D}^*(2010)^+ K^0$	(5.2 $\pm$ 1.2)	$\times 10^{-3}$		1476
$\overline{D}^*(2007)^0 D^*(2010)^+ K^0$	(7.8 $\pm$ 2.6)	$\times 10^{-3}$		1362
$\overline{D}^0 D^0 K^+$	(1.37 $\pm$ 0.32)	$\times 10^{-3}$	S=1.5	1577
$\overline{D}^*(2010)^0 D^0 K^+$	$<$ 3.8	$\times 10^{-3}$	CL=90%	–
$\overline{D}^0 D^*(2007)^0 K^+$	(4.7 $\pm$ 1.0)	$\times 10^{-3}$		1481
$\overline{D}^*(2007)^0 D^*(2007)^0 K^+$	(5.3 $\pm$ 1.6)	$\times 10^{-3}$		1368
$D^- D^+ K^+$	$<$ 4	$\times 10^{-4}$	CL=90%	1571
$D^- D^*(2010)^+ K^+$	$<$ 7	$\times 10^{-4}$	CL=90%	1475
$D^*(2010)^- D^+ K^+$	(1.5 $\pm$ 0.4)	$\times 10^{-3}$		1475
$D^*(2010)^- D^*(2010)^+ K^+$	$<$ 1.8	$\times 10^{-3}$	CL=90%	1363
$(\overline{D}+\overline{D}^*)(D+D^*)K$	(3.5 $\pm$ 0.6)	%		–
$D_s^+ \pi^0$	$<$ 1.7	$\times 10^{-4}$	CL=90%	2270
$D_s^{*+} \pi^0$	$<$ 2.7	$\times 10^{-4}$	CL=90%	2215
$D_s^+ \eta$	$<$ 4	$\times 10^{-4}$	CL=90%	2235
$D_s^{*+} \eta$	$<$ 6	$\times 10^{-4}$	CL=90%	2178
$D_s^+ \rho^0$	$<$ 3.1	$\times 10^{-4}$	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
$D_s^+ \phi$	$<$ 1.9	$\times 10^{-6}$	CL=90%	2141
$D_s^{*+} \phi$	$<$ 1.2	$\times 10^{-5}$	CL=90%	2079
$D_s^+ \overline{K}^0$	$<$ 9	$\times 10^{-4}$	CL=90%	2242
$D_s^{*+} \overline{K}^0$	$<$ 9	$\times 10^{-4}$	CL=90%	2185
$D_s^+ \overline{K}^*(892)^0$	$<$ 4	$\times 10^{-4}$	CL=90%	2172
$D_s^{*+} \overline{K}^*(892)^0$	$<$ 4	$\times 10^{-4}$	CL=90%	2112

$D_s^- \pi^+ K^+$		< 7	$\times 10^{-4}$	CL=90%	2222
$D_s^{*-} \pi^+ K^+$		< 9.8	$\times 10^{-4}$	CL=90%	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

Charmonium modes

$\eta_c K^+$		$(9.1 \pm 1.3) \times 10^{-4}$			1753
$\eta_c' K^+$		$(3.4 \pm 1.8) \times 10^{-4}$			–
$J/\psi(1S) K^+$		$(1.008 \pm 0.035) \times 10^{-3}$			1683
$J/\psi(1S) K^+ \pi^+ \pi^-$		$(1.07 \pm 0.19) \times 10^{-3}$		S=1.9	1612
$h_c(1P) K^+ \times$ B$(h_c(1P) \to J/\psi \pi^+ \pi^-)$		< 3.4	$\times 10^{-6}$	CL=90%	1401
$X(3872) K^+$		< 3.2	$\times 10^{-4}$	CL=90%	1141
$X(3872) K^+ \times$ B$(X \to J/\psi \pi^+ \pi^-)$		$(1.14 \pm 0.20) \times 10^{-5}$			1141
$X(3872) K^+ \times$ B$(X(3872) \to D^0 \overline{D}{}^0)$		< 6.0	$\times 10^{-5}$	CL=90%	1141
$X(3872) K^+ \times$ B$(X(3872) \to D^+ D^-)$		< 4.0	$\times 10^{-5}$	CL=90%	1141
$X(3872) K^+ \times$ B$(X(3872) \to D^0 \overline{D}{}^0 \pi^0)$		< 6.0	$\times 10^{-5}$	CL=90%	1141
$X(3872) K^+ \times$ B$(X(3872) \to J/\psi(1S) \eta)$		< 7.7	$\times 10^{-6}$	CL=90%	1141
$X(3872)^+ K^0 \times$ B$(X(3872)^+ \to J/\psi(1S) \pi^+ \pi^0)$	[jjj]	< 2.2	$\times 10^{-5}$	CL=90%	–
$Y(4260)^0 K^+ \times$ B$(Y^0 \to J/\psi \pi^+ \pi^-)$		< 2.9	$\times 10^{-5}$	CL=95%	–
$J/\psi(1S) K^*(892)^+$		$(1.41 \pm 0.08) \times 10^{-3}$			1571
$J/\psi(1S) K(1270)^+$		$(1.8 \pm 0.5) \times 10^{-3}$			1390
$J/\psi(1S) K(1400)^+$		< 5	$\times 10^{-4}$	CL=90%	1308
$J/\psi(1S) \eta K^+$		$(1.08 \pm 0.33) \times 10^{-4}$			1510
$J/\psi(1S) \phi K^+$		$(5.2 \pm 1.7) \times 10^{-5}$		S=1.2	1227
$J/\psi(1S) \pi^+$		$(4.9 \pm 0.6) \times 10^{-5}$		S=1.5	1727
$J/\psi(1S) \rho^+$		< 7.7	$\times 10^{-4}$	CL=90%	1611
$J/\psi(1S) a_1(1260)^+$		< 1.2	$\times 10^{-3}$	CL=90%	1414
$J/\psi(1S) p \overline{\Lambda}$		$(1.18 \pm 0.31) \times 10^{-5}$			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%	871
$J/\psi(1S) \overline{D}{}^0 \pi^+$		< 2.5	$\times 10^{-5}$	CL=90%	665
$\psi(2S) K^+$		$(6.48 \pm 0.35) \times 10^{-4}$			1284
$\psi(2S) K^*(892)^+$		$(6.7 \pm 1.4) \times 10^{-4}$		S=1.3	1115
$\psi(2S) K^+ \pi^+ \pi^-$		$(1.9 \pm 1.2) \times 10^{-3}$			1178
$\psi(3770) K^+$		$(4.9 \pm 1.3) \times 10^{-4}$			1220

$\psi(3770)K^+ \times B(\psi(3770) \to D^0\overline{D}^0)$	$(3.4 \pm 0.9) \times 10^{-4}$			1220
$\psi(3770)K^+ \times B(\psi(3770) \to D^+D^-K^+)$	$(1.4 \pm 0.8) \times 10^{-4}$			1220
$\chi_{c0}\pi^+ \times B(\chi_{c0} \to \pi^+\pi^-)$	$< 3 \times 10^{-7}$	CL=90%		–
$\chi_{c0}(1P)K^+$	$(1.6 {+0.5 \atop -0.4}) \times 10^{-4}$			1478
$\chi_{c0}K^*(892)^+$	$< 2.86 \times 10^{-3}$	CL=90%		–
$\chi_{c2}K^+$	$< 2.9 \times 10^{-5}$	CL=90%		–
$\chi_{c2}K^*(892)^+$	$< 1.2 \times 10^{-5}$	CL=90%		–
$\chi_{c1}(1P)K^+$	$(5.3 \pm 0.7) \times 10^{-4}$		S=1.7	1411
$\chi_{c1}(1P)K^*(892)^+$	$(3.6 \pm 0.9) \times 10^{-4}$			1265

K or K^* modes

$K^0\pi^+$	$(2.41 \pm 0.17) \times 10^{-5}$		S=1.4	2614
$K^+\pi^0$	$(1.21 \pm 0.08) \times 10^{-5}$			2615
$\eta' K^+$	$(7.05 \pm 0.35) \times 10^{-5}$			2528
$\eta' K^*(892)^+$	$< 1.4 \times 10^{-5}$	CL=90%		2472
ηK^+	$(2.6 \pm 0.6) \times 10^{-6}$		S=1.3	2588
$\eta K^*(892)^+$	$(2.6 \pm 0.4) \times 10^{-5}$			2534
ωK^+	$(5.1 \pm 0.7) \times 10^{-6}$			2557
$\omega K^*(892)^+$	$< 7.4 \times 10^{-6}$	CL=90%		2503
$a_0^+ K^0$	$< 3.9 \times 10^{-6}$	CL=90%		–
$a_0^0 K^+$	$< 2.5 \times 10^{-6}$	CL=90%		–
$K^*(892)^0\pi^+$	$(1.16 \pm 0.19) \times 10^{-5}$		S=1.8	2562
$K^*(892)^+\pi^0$	$(6.9 \pm 2.4) \times 10^{-6}$			2562
$K^+\pi^-\pi^+$	$(5.6 \pm 0.9) \times 10^{-5}$		S=2.6	2609
$K^+\pi^-\pi^+$ nonresonant	$(3.1 {+1.0 \atop -0.8}) \times 10^{-6}$			2609
$K^+ f_0(980) \times B(f_0 \to \pi^+\pi^-)$	$(8.9 \pm 1.0) \times 10^{-6}$			2524
$f_2(1270)^0 K^+$	$< 2.3 \times 10^{-6}$	CL=90%		–
$f_0^*(1370)^0 K^+ \times B(f_0^*(1370)^0 \to \pi^+\pi^-)$	$< 1.07 \times 10^{-5}$	CL=90%		–
$\rho^0(1450)K^+ \times B(\rho^0(1450) \to \pi^+\pi^-)$	$< 1.17 \times 10^{-5}$	CL=90%		–
$f_0(1500)K^+ \times B(f_0(1500) \to \pi^+\pi^-)$	$< 4.4 \times 10^{-6}$	CL=90%		2397
$f_2'(1525)K^+ \times B(f_2'(1525) \to \pi^+\pi^-)$	$< 3.4 \times 10^{-6}$	CL=90%		2392
$K^+\rho^0$	$(5.0 {+0.7 \atop -0.8}) \times 10^{-6}$			2558
$K_0^*(1430)^0\pi^+$	$(3.8 \pm 0.5) \times 10^{-5}$			2448
$K_2^*(1430)^0\pi^+$	$< 6.9 \times 10^{-6}$	CL=90%		2445
$K^*(1410)^0\pi^+$	$< 4.5 \times 10^{-5}$	CL=90%		2448

$K^*(1680)^0\pi^+$	$<\ 1.2$	$\times 10^{-5}$	CL=90%	2358
$K^-\pi^+\pi^+$	$<\ 1.8$	$\times 10^{-6}$	CL=90%	2609
$K^-\pi^+\pi^+$ nonresonant	$<\ 5.6$	$\times 10^{-5}$	CL=90%	2609
$K_1(1400)^0\pi^+$	$<\ 2.6$	$\times 10^{-3}$	CL=90%	2451
$K^0\pi^+\pi^0$	$<\ 6.6$	$\times 10^{-5}$	CL=90%	2609
$K^0\rho^+$	$<\ 4.8$	$\times 10^{-5}$	CL=90%	2558
$K^*(892)^+\pi^+\pi^-$	$<\ 1.1$	$\times 10^{-3}$	CL=90%	2556
$K^*(892)^+\rho^0$	$(\ 1.1\ \pm\ 0.4\ )$	$\times 10^{-5}$		2504
$K^*(892)^0\rho^+$	$(\ 8.9\ \pm\ 2.1\ )$	$\times 10^{-6}$		2504
$K^*(892)^+K^*(892)^0$	$<\ 7.1$	$\times 10^{-5}$	CL=90%	2484
$K_1(1400)^+\rho^0$	$<\ 7.8$	$\times 10^{-4}$	CL=90%	2387
$K_2^*(1430)^+\rho^0$	$<\ 1.5$	$\times 10^{-3}$	CL=90%	2381
$K^+\overline{K}^0$	$(\ 1.20\ \pm\ 0.32\ )$	$\times 10^{-6}$		2593
$\overline{K}^0K^+\pi^0$	$<\ 2.4$	$\times 10^{-5}$	CL=90%	2578
$K^+K_S^0K_S^0$	$(\ 1.15\ \pm\ 0.13\ )$	$\times 10^{-5}$		2521
$K_S^0K_S^0\pi^+$	$<\ 3.2$	$\times 10^{-6}$	CL=90%	2577
$K^+K^-\pi^+$	$<\ 6.3$	$\times 10^{-6}$	CL=90%	2578
$K^+K^-\pi^+$ nonresonant	$<\ 7.5$	$\times 10^{-5}$	CL=90%	2578
$K^+K^+\pi^-$	$<\ 1.3$	$\times 10^{-6}$	CL=90%	2578
$K^+K^+\pi^-$ nonresonant	$<\ 8.79$	$\times 10^{-5}$	CL=90%	2578
$K^+K^*(892)^0$	$<\ 5.3$	$\times 10^{-6}$	CL=90%	2540
$K^+K^-K^+$	$(\ 3.01\ \pm\ 0.19\ )$	$\times 10^{-5}$		2522
$K^+\phi$	$(\ 9.0\ \pm\ 0.8\ )$	$\times 10^{-6}$	S=1.3	2516
$f_0(980)K^+\times$ B$(f_0(980)\to K^+K^-)$	$<\ 2.9$	$\times 10^{-6}$	CL=90%	2524
$a_2(1320)K^+\times$ B$(a_2(1320)\to K^+K^-)$	$<\ 1.1$	$\times 10^{-6}$	CL=90%	2449
$f_2'(1525)K^+\times$ B$(f_2'(1525)\to K^+K^-)$	$<\ 4.9$	$\times 10^{-6}$	CL=90%	2392
$\phi(1680)K^+\times$ B$(\phi(1680)\to K^+K^-)$	$<\ 8$	$\times 10^{-7}$	CL=90%	2344
$K^+K^-K^+$ nonresonant	$(\ 2.40\ ^{+\ 0.30}_{-\ 0.62}\ )$	$\times 10^{-5}$		2522
$K^*(892)^+K^+K^-$	$<\ 1.6$	$\times 10^{-3}$	CL=90%	2466
$K^*(892)^+\phi$	$(\ 9.6\ \pm\ 3.0\ )$	$\times 10^{-6}$	S=1.9	2460
$K_1(1400)^+\phi$	$<\ 1.1$	$\times 10^{-3}$	CL=90%	2339
$K_2^*(1430)^+\phi$	$<\ 3.4$	$\times 10^{-3}$	CL=90%	2332
$K^+\phi\phi$	$(\ 2.6\ ^{+\ 1.1}_{-\ 0.9}\ )$	$\times 10^{-6}$		2306
$K^*(892)^+\gamma$	$(\ 4.03\ \pm\ 0.26\ )$	$\times 10^{-5}$		2564
$K_1(1270)^+\gamma$	$(\ 4.3\ \pm\ 1.3\ )$	$\times 10^{-5}$		2486
$\eta K^+\gamma$	$(\ 8.4\ \pm\ 1.8\ )$	$\times 10^{-6}$		2588
$\phi K^+\gamma$	$(\ 3.4\ \pm\ 1.0\ )$	$\times 10^{-6}$		2516
$K^+\pi^-\pi^+\gamma$	$(\ 2.50\ \pm\ 0.28\ )$	$\times 10^{-5}$		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%	2558
$K^+ \pi^- \pi^+ \gamma$ nonresonant	$< 9.2 \times 10^{-6}$	CL=90%	2609
$K_1(1400)^+ \gamma$	$< 1.5 \times 10^{-5}$		2453
$K_2^*(1430)^+ \gamma$	$(1.4 \pm 0.4) \times 10^{-5}$		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%	2243

Light unflavored meson modes

$\rho^+ \gamma$	$< 1.8 \times 10^{-6}$	CL=90%	2583
$\pi^+ \pi^0$	$(5.5 \pm 0.6) \times 10^{-6}$		2636
$\pi^+ \pi^+ \pi^-$	$(1.62 \pm 0.15) \times 10^{-5}$		2630
$\rho^0 \pi^+$	$(8.7 \pm 1.1) \times 10^{-6}$		2581
$\pi^+ f_0(980) \times$ B($f_0(980) \to \pi^+ \pi^-$)	$< 3.0 \times 10^{-6}$	CL=90%	2547
$\pi^+ f_2(1270)$	$(8.2 \pm 2.5) \times 10^{-6}$		2483
$\rho(1450)^0 \pi^+$	$< 2.3 \times 10^{-6}$	CL=90%	2436
$f_0(1370) \pi^+ \times$B($f_0(1370) \to \pi^+ \pi^-$)	$< 3.0 \times 10^{-6}$	CL=90%	2460
$f_0(600) \pi^+ \times$B($f_0(600) \to \pi^+ \pi^-$)	$< 4.1 \times 10^{-6}$	CL=90%	–
$\pi^+ \pi^- \pi^+$ nonresonant	$< 4.6 \times 10^{-6}$	CL=90%	2630
$\pi^+ \pi^0 \pi^0$	$< 8.9 \times 10^{-4}$	CL=90%	2631
$\rho^+ \pi^0$	$(1.20 \pm 0.19) \times 10^{-5}$		2581
$\pi^+ \pi^- \pi^+ \pi^0$	$< 4.0 \times 10^{-3}$	CL=90%	2621
$\rho^+ \rho^0$	$(2.6 \pm 0.6) \times 10^{-5}$		2523
$a_1(1260)^+ \pi^0$	$< 1.7 \times 10^{-3}$	CL=90%	2494
$a_1(1260)^0 \pi^+$	$< 9.0 \times 10^{-4}$	CL=90%	2494
$\omega \pi^+$	$(5.9 \pm 1.0) \times 10^{-6}$	S=1.2	2580
$\omega \rho^+$	$(1.3 \pm 0.4) \times 10^{-5}$		2522
$\eta \pi^+$	$(4.9 \pm 0.5) \times 10^{-6}$		2609
$\eta' \pi^+$	$(4.0 \pm 0.9) \times 10^{-6}$		2551
$\eta' \rho^+$	$< 2.2 \times 10^{-5}$	CL=90%	2492
$\eta \rho^+$	$(8.4 \pm 2.2) \times 10^{-6}$		2553
$\phi \pi^+$	$< 4.1 \times 10^{-7}$	CL=90%	2539
$\phi \rho^+$	$< 1.6 \times 10^{-5}$		2480
$a_0^0 \pi^+$	$< 5.8 \times 10^{-6}$	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
$\pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^0$	$< 6.3 \times 10^{-3}$	CL=90%	2592
$a_1(1260)^+ a_1(1260)^0$	< 1.3 %	CL=90%	2335

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

$p\overline{p}\pi^+$		($3.1\ ^{+0.8}_{-0.7}$) $\times 10^{-6}$			2439
$p\overline{p}\pi^+$ nonresonant		$<$ 5.3 $\times 10^{-5}$	CL=90%		2439
$p\overline{p}\pi^+\pi^+\pi^-$		$<$ 5.2 $\times 10^{-4}$	CL=90%		2369
$p\overline{p}K^+$		(5.6 $\pm$ 1.0) $\times 10^{-6}$	S=2.4		2348
$\Theta(1710)^{++}\overline{p} \times$ B($\Theta(1710)^{++} \to pK^+$)	[kkk]	$<$ 9.1 $\times 10^{-8}$	CL=90%		–
$f_J(2220)K^+ \times$ B($f_J(2220) \to p\overline{p}$)	[kkk]	$<$ 4.1 $\times 10^{-7}$	CL=90%		2135
$p\overline{\Lambda}(1520)$		$<$ 1.5 $\times 10^{-6}$	CL=90%		2322
$p\overline{p}K^+$ nonresonant		$<$ 8.9 $\times 10^{-5}$	CL=90%		2348
$p\overline{p}K^*(892)^+$		($1.03\ ^{+0.38}_{-0.33}$) $\times 10^{-5}$			2215
$p\overline{\Lambda}$		$<$ 4.9 $\times 10^{-7}$	CL=90%		2430
$p\overline{\Lambda}\gamma$		(2.2 $\pm$ 0.6) $\times 10^{-6}$			2430
$p\overline{\Sigma}\gamma$		$<$ 4.6 $\times 10^{-6}$	CL=90%		2413
$p\overline{\Lambda}\pi^+\pi^-$		$<$ 2.0 $\times 10^{-4}$	CL=90%		2367
$\Lambda\overline{\Lambda}\pi^+$		$<$ 2.8 $\times 10^{-6}$	CL=90%		2358
$\Lambda\overline{\Lambda}K^+$		($2.9\ ^{+1.0}_{-0.8}$) $\times 10^{-6}$			2251
$\overline{\Delta}^0 p$		$<$ 3.8 $\times 10^{-4}$	CL=90%		2402
$\Delta^{++}\overline{p}$		$<$ 1.5 $\times 10^{-4}$	CL=90%		2402
$D^+ p\overline{p}$		$<$ 1.5 $\times 10^{-5}$	CL=90%		1860
$D^*(2010)^+ p\overline{p}$		$<$ 1.5 $\times 10^{-5}$	CL=90%		1786
$\overline{\Lambda}_c^- p\pi^+$		(2.1 $\pm$ 0.7) $\times 10^{-4}$			1980
$\overline{\Lambda}_c^- p\pi^+\pi^0$		(1.8 $\pm$ 0.6) $\times 10^{-3}$			1935
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-$		(2.3 $\pm$ 0.7) $\times 10^{-3}$			1880
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-\pi^0$		$<$ 1.34 %	CL=90%		1822
$\overline{\Sigma}_c(2455)^0 p$		$<$ 8 $\times 10^{-5}$	CL=90%		1938
$\overline{\Sigma}_c(2520)^0 p$		$<$ 4.6 $\times 10^{-5}$	CL=90%		1904
$\overline{\Sigma}_c(2455)^0 p\pi^0$		(4.4 $\pm$ 1.8) $\times 10^{-4}$			1896
$\overline{\Sigma}_c(2455)^0 p\pi^-\pi^+$		(4.4 $\pm$ 1.7) $\times 10^{-4}$			1845
$\overline{\Sigma}_c(2455)^{--} p\pi^+\pi^+$		(2.8 $\pm$ 1.2) $\times 10^{-4}$			1845
$\overline{\Lambda}_c(2593)^- / \overline{\Lambda}_c(2625)^- p\pi^+$		$<$ 1.9 $\times 10^{-4}$	CL=90%		–

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

$\pi^+ e^+ e^-$	*B1*		< 3.9		$\times 10^{-3}$	CL=90%	2638
$\pi^+ \mu^+ \mu^-$	*B1*		< 9.1		$\times 10^{-3}$	CL=90%	2633
$\pi^+ \nu \overline{\nu}$	*B1*		< 1.0		$\times 10^{-4}$	CL=90%	2638
$K^+ e^+ e^-$	*B1*		(8.0	$^{+2.2}_{-1.9}$	) $\times 10^{-7}$	S=1.4	2616
$K^+ \mu^+ \mu^-$	*B1*		(3.4	$^{+1.9}_{-1.4}$	) $\times 10^{-7}$	S=1.7	2612
$K^+ \ell^+ \ell^-$	*B1*	[ggg]	(5.3	$\pm$ 1.1	) $\times 10^{-7}$		2616
$K^+ \overline{\nu} \nu$	*B1*		< 5.2		$\times 10^{-5}$	CL=90%	2616
$K^*(892)^+ e^+ e^-$	*B1*		< 4.6		$\times 10^{-6}$	CL=90%	2564
$K^*(892)^+ \mu^+ \mu^-$	*B1*		< 2.2		$\times 10^{-6}$	CL=90%	2560
$K^*(892)^+ \ell^+ \ell^-$	*B1*	[ggg]	< 2.2		$\times 10^{-6}$	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
$K^+ e^+ \mu^-$	*LF*		< 8		$\times 10^{-7}$	CL=90%	2615
$K^+ e^- \mu^+$	*LF*		< 6.4		$\times 10^{-3}$	CL=90%	2615
$K^*(892)^+ e^\pm \mu^\mp$	*LF*		< 7.9		$\times 10^{-6}$	CL=90%	2563
$\pi^- e^+ e^+$	*L*		< 1.6		$\times 10^{-6}$	CL=90%	2638
$\pi^- \mu^+ \mu^+$	*L*		< 1.4		$\times 10^{-6}$	CL=90%	2633
$\pi^- e^+ \mu^+$	*L*		< 1.3		$\times 10^{-6}$	CL=90%	2637
$\rho^- e^+ e^+$	*L*		< 2.6		$\times 10^{-6}$	CL=90%	2583
$\rho^- \mu^+ \mu^+$	*L*		< 5.0		$\times 10^{-6}$	CL=90%	2578
$\rho^- e^+ \mu^+$	*L*		< 3.3		$\times 10^{-6}$	CL=90%	2581
$K^- e^+ e^+$	*L*		< 1.0		$\times 10^{-6}$	CL=90%	2616
$K^- \mu^+ \mu^+$	*L*		< 1.8		$\times 10^{-6}$	CL=90%	2612
$K^- e^+ \mu^+$	*L*		< 2.0		$\times 10^{-6}$	CL=90%	2615
$K^*(892)^- e^+ e^+$	*L*		< 2.8		$\times 10^{-6}$	CL=90%	2564
$K^*(892)^- \mu^+ \mu^+$	*L*		< 8.3		$\times 10^{-6}$	CL=90%	2560
$K^*(892)^- e^+ \mu^+$	*L*		< 4.4		$\times 10^{-6}$	CL=90%	2563

B^0

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

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

Mass $m_{B^0} = 5279.4 \pm 0.5$ MeV

$m_{B^0} - m_{B^\pm} = 0.33 \pm 0.28$ MeV (S = 1.1)

Mean life $\tau_{B^0} = (1.530 \pm 0.009) \times 10^{-12}$ s

$c\tau = 458.7\ \mu$m

$\tau_{B^+}/\tau_{B^0} = 1.071 \pm 0.009$ (direct measurements)

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

$\chi_d = 0.188 \pm 0.003$
$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L} = (0.507 \pm 0.005) \times 10^{12}\ \hbar\ \mathrm{s}^{-1}$
$= (3.337 \pm 0.033) \times 10^{-10}$ MeV
$x_d = \Delta m_{B^0}/\Gamma_{B^0} = 0.776 \pm 0.008$
$\mathrm{Re}\big(\lambda_{CP}\ /\ \big|\lambda_{CP}\big|\big)\ \mathrm{Re}(z) = 0.01 \pm 0.05$
$\mathrm{Re}(z) = 0.00 \pm 0.12$
$\mathrm{Im}(z) = -0.002 \pm 0.033$ (S = 1.4)

CP violation parameters

$\mathrm{Re}(\epsilon_{B^0})/(1+|\epsilon_{B^0}|^2) = (-1.3 \pm 2.9) \times 10^{-3}$
$A_{T/CP} = 0.005 \pm 0.018$
$A_{CP}(B^0 \to D^*(2010)^+ D^-) = 0.03 \pm 0.07$
$A_{CP}(B^0 \to K^*(892)^0 \phi) = 0.01 \pm 0.07$
$A_{CP}\ (B^0 \to K^+ \pi^-) = -0.113 \pm 0.020$
$A_{CP}(B^0 \to K^0_S \pi^0) = 0.16 \pm 0.29$
$A_{CP}(B^0 \to \eta K^*(892)^0) = 0.02 \pm 0.11$
$A_{CP}(B^0 \to \rho^+ K^-) = 0.26 \pm 0.15$
$A_{CP}(B^0 \to K^+ \pi^- \pi^0) = 0.07 \pm 0.11$
$A_{CP}(B^0 \to K^*(892)^+ \pi^-) = -0.05 \pm 0.14$
$A_{CP}(B^0 \to \rho^+ \pi^-) = -0.15 \pm 0.08$
$A_{CP}(B^0 \to \rho^- \pi^+) = -0.53 \pm 0.30$
$A_{CP}(B^0 \to K^*(1430) \gamma) = -0.08 \pm 0.15$
$C_{D^*(2010)^- D^+}\ (B^0 \to D^*(2010)^- D^+) = 0.20 \pm 0.18$
$S_{D^*(2010)^- D^+}\ (B^0 \to D^*(2010)^- D^+) = -0.53 \pm 0.32$ (S = 1.2)
$C_{D^*(2010)^+ D^-}\ (B^0 \to D^*(2010)^+ D^-) = -0.17 \pm 0.23$ (S = 1.3)
$S_{D^*(2010)^+ D^-}\ (B^0 \to D^*(2010)^+ D^-) = -0.54 \pm 0.27$
$C_{D^{*+} D^{*-}}\ (B^0 \to D^{*+} D^{*-}) = 0.27 \pm 0.17$
$S_{D^{*+} D^{*-}}\ (B^0 \to D^{*+} D^{*-}) = -0.2 \pm 0.4$ (S = 1.2)
$C_+\ (B^0 \to D^{*+} D^{*-}) = 0.06 \pm 0.17$
$S_+\ (B^0 \to D^{*+} D^{*-}) = -0.75 \pm 0.25$
$C_-\ (B^0 \to D^{*+} D^{*-}) = -0.2 \pm 1.0$
$S_-\ (B^0 \to D^{*+} D^{*-}) = -1.8 \pm 1.8$
$C_{D^+ D^-}\ (B^0 \to D^+ D^-) = 0.1 \pm 0.4$
$S_{D^+ D^-}\ (B^0 \to D^+ D^-) = -0.3 \pm 0.6$
$C_{J/\psi(1S) \pi^0}\ (B^0 \to J/\psi(1S) \pi^0) = 0.13 \pm 0.24$
$S_{J/\psi(1S) \pi^0}\ (B^0 \to J/\psi(1S) \pi^0) = -0.4 \pm 0.4$ (S = 1.1)

$C_{\omega K^0_S}$ $(B^0 \rightarrow\ \omega K^0_S) = -0.3 \pm 0.5$
$S_{\omega K^0_S}$ $(B^0 \rightarrow\ \omega K^0_S) = 0.8 \pm 0.7$
$C_{\eta'(958) K}$ $(B^0 \rightarrow\ \eta'(958) K^0_S) = -0.04 \pm 0.20$ (S = 2.5)
$S_{\eta'(958) K}$ $(B^0 \rightarrow\ \eta'(958) K^0_S) = 0.43 \pm 0.17$ (S = 1.5)
$C_{f_0(980) K^0_S}$ $(B^0 \rightarrow\ f_0(980) K^0_S) = 0.39 \pm 0.28$
$S_{f_0(980) K^0_S}$ $(B^0 \rightarrow\ f_0(980) K^0_S) = 0.5 \pm 0.4$
$C_{K_S K_S K_S}(B^0 \rightarrow\ K_S K_S K_S) = -0.41 \pm 0.21$
$S_{K_S K_S K_S}(B^0 \rightarrow\ K_S K_S K_S) = -0.3^{+0.8}_{-0.7}$ (S = 2.4)
$C_{K^+ K^- K^0_S}$ $(B^0 \rightarrow\ K^+ K^- K^0_S) = 0.09 \pm 0.10$
$S_{K^+ K^- K^0_S}$ $(B^0 \rightarrow\ K^+ K^- K^0_S) = -0.45 \pm 0.13$
$C_{\phi K^0_S}$ $(B^0 \rightarrow\ \phi K^0_S) = -0.04 \pm 0.17$
$S_{\phi K^0_S}$ $(B^0 \rightarrow\ \phi K^0_S) = 0.35 \pm 0.21$
$C_{K^0_S \pi^0}$ $(B^0 \rightarrow\ K^0_S \pi^0) = 0.08 \pm 0.14$
$S_{K^0_S \pi^0}$ $(B^0 \rightarrow\ K^0_S \pi^0) = 0.34 \pm 0.28$
$C_{K^0_S \pi^0 \gamma}(B^0 \rightarrow\ K^0_S \pi^0 \gamma) = -0.3 \pm 0.4$ (S = 1.5)
$S_{K^0_S \pi^0 \gamma}(B^0 \rightarrow\ K^0_S \pi^0 \gamma) = -0.3^{+0.6}_{-0.5}$ (S = 1.3)
$C_{K^*(892)^0 \gamma}$ $(B^0 \rightarrow\ K^*(892)^0 \gamma) = -0.40 \pm 0.23$
$S_{K^*(892)^0 \gamma}$ $(B^0 \rightarrow\ K^*(892)^0 \gamma) = -0.39 \pm 0.33$
$C_{\pi\pi}$ $(B^0 \rightarrow\ \pi^+ \pi^-) = -0.36 \pm 0.23$ (S = 2.3)
$S_{\pi\pi}$ $(B^0 \rightarrow\ \pi^+ \pi^-) = -0.49 \pm 0.18$ (S = 1.5)
$C_{\pi^0 \pi^0}(B^0 \rightarrow\ \pi^0 \pi^0) = -0.3 \pm 0.4$
$C_{\rho\pi}$ $(B^0 \rightarrow\ \rho^+ \pi^-) = 0.30 \pm 0.13$
$S_{\rho\pi}$ $(B^0 \rightarrow\ \rho^+ \pi^-) = -0.04 \pm 0.23$ (S = 1.3)
$\Delta C_{\rho\pi}$ $(B^0 \rightarrow\ \rho^+ \pi^-) = 0.33 \pm 0.13$
$\Delta S_{\rho\pi}$ $(B^0 \rightarrow\ \rho^+ \pi^-) = -0.07 \pm 0.22$ (S = 1.3)
$C_{\rho\rho}$ $(B^0 \rightarrow\ \rho^+ \rho^-) = -0.02 \pm 0.17$
$S_{\rho\rho}$ $(B^0 \rightarrow\ \rho^+ \rho^-) = -0.22 \pm 0.22$
$\left|\lambda\right|$ $(B^0 \rightarrow\ c\overline{c} K^0) = 0.969 \pm 0.028$
$\left|\lambda\right|$ $(B^0 \rightarrow\ J/\psi K^*(892)^0) <$ 0.25, CL = 95%
$\cos 2\beta$ $(B^0 \rightarrow\ J/\psi K^*(892)^0) = 1.7^{+0.7}_{-0.9}$ (S = 1.6)
$(S_+ + S_-)/2$ $(B^0 \rightarrow\ D^{*-} \pi^+) = -0.028 \pm 0.017$ (S = 1.3)
$(S_- - S_+)/2$ $(B^0 \rightarrow\ D^{*-} \pi^+) = -0.001 \pm 0.018$
$(S_+ + S_-)/2$ $(B^0 \rightarrow\ D^- \pi^+) = -0.043 \pm 0.030$
$(S_- - S_+)/2$ $(B^0 \rightarrow\ D^- \pi^+) = -0.01 \pm 0.04$
$\sin(2\beta) = 0.725 \pm 0.037$
$\sin(2\beta_{\text{eff}})(B^0 \rightarrow\ \phi K^0) = 0.50 \pm 0.26$
$\sin(2\beta_{\text{eff}})(B^0 \rightarrow\ K^+ K^- K^0_S) = 0.55 \pm 0.25$
$\left|\sin(2\beta + \gamma)\right| >$ 0.35, CL = 90%
$\alpha = (96 \pm 10)^\circ$

$\overline{B}^0$ 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.*, $B \to D^{\pm}$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	[ggg]	(10.4 ± 0.4) %		–
$D^-\ell^+\nu_\ell$	[ggg]	(2.12 ± 0.20) %		2309
$D^*(2010)^-\ell^+\nu_\ell$	[ggg]	(5.35 ± 0.20) %		2257
$\overline{D}^0\pi^+\ell^+\nu_\ell$		$(3.2 \pm 1.0) \times 10^{-3}$		2308
$\overline{D}^{*0}\pi^+\ell^+\nu_\ell$		$(6.5 \pm 1.5) \times 10^{-3}$		2256
$\rho^-\ell^+\nu_\ell$	[ggg]	$(2.3 \pm 0.4) \times 10^{-4}$		2583
$\pi^-\ell^+\nu_\ell$	[ggg]	$(1.36 \pm 0.15) \times 10^{-4}$		2638
		Inclusive modes		
$K^{\pm}$ anything		(78 ± 8) %		–
$D^0 X$		(6.3 ± 2.0) %		–
$\overline{D}^0 X$		(51 ± 4) %		–
$D^+ X$		< 5.1 %	CL=90%	–
$D^- X$		(40 ± 5) %		–
$D_s^+ X$		$(10.9 {}^{+4.4}_{-3.2})$ %		–
$D_s^- X$		< 8.7 %	CL=90%	–
$\Lambda_c^+ X$		< 3.8 %	CL=90%	–
$\overline{\Lambda}_c^- X$		$(4.9 {}^{+2.5}_{-2.0})$ %		–
$\overline{c} X$		(104 ± 8) %		–
$c X$		(24 ± 5) %		–
$\overline{c} c X$		$(128 {}^{+11}_{-10})$ %		–

D, D^*, or D_s modes

$D^- \pi^+$	$(2.83 \pm 0.17) \times 10^{-3}$		2306
$D^- \rho^+$	$(7.5 \pm 1.2) \times 10^{-3}$		2235
$D^- K^0 \pi^+$	$(4.9 \pm 0.9) \times 10^{-4}$		2259
$D^- K^*(892)^+$	$(4.5 \pm 0.7) \times 10^{-4}$		2211
$D^- \omega \pi^+$	$(2.8 \pm 0.6) \times 10^{-3}$		2204
$D^- K^+$	$(2.0 \pm 0.6) \times 10^{-4}$		2279
$D^- K^+ \overline{K}^0$	$< 3.1 \times 10^{-4}$	CL=90%	2188
$D^- K^+ \overline{K}^*(892)^0$	$(8.8 \pm 1.9) \times 10^{-4}$		2070
$\overline{D}^0 \pi^+ \pi^-$	$(8.0 \pm 1.6) \times 10^{-4}$		2301
$D^*(2010)^- \pi^+$	$(2.76 \pm 0.21) \times 10^{-3}$		2255
$D^- \pi^+ \pi^+ \pi^-$	$(8.0 \pm 2.5) \times 10^{-3}$		2287
$(D^- \pi^+ \pi^+ \pi^-)$ nonresonant	$(3.9 \pm 1.9) \times 10^{-3}$		2287
$D^- \pi^+ \rho^0$	$(1.1 \pm 1.0) \times 10^{-3}$		2206
$D^- a_1(1260)^+$	$(6.0 \pm 3.3) \times 10^{-3}$		2121
$D^*(2010)^- \pi^+ \pi^0$	(1.5 ± 0.5) %		2248
$D^*(2010)^- \rho^+$	$(6.8 \pm 0.9) \times 10^{-3}$		2180
$D^*(2010)^- K^+$	$(2.14 \pm 0.20) \times 10^{-4}$		2226
$D^*(2010)^- K^0 \pi^+$	$(3.0 \pm 0.8) \times 10^{-4}$		2205
$D^*(2010)^- K^*(892)^+$	$(3.3 \pm 0.6) \times 10^{-4}$		2155
$D^*(2010)^- K^+ \overline{K}^0$	$< 4.7 \times 10^{-4}$	CL=90%	2131
$D^*(2010)^- K^+ \overline{K}^*(892)^0$	$(1.29 \pm 0.33) \times 10^{-3}$		2007
$D^*(2010)^- \pi^+ \pi^+ \pi^-$	$(7.0 \pm 0.8) \times 10^{-3}$	S=1.3	2235
$(D^*(2010)^- \pi^+ \pi^+ \pi^-)$ non-resonant	$(0.0 \pm 2.5) \times 10^{-3}$		2235
$D^*(2010)^- \pi^+ \rho^0$	$(5.7 \pm 3.2) \times 10^{-3}$		2150
$D^*(2010)^- a_1(1260)^+$	(1.30 ± 0.27) %		2061
$D^*(2010)^- \pi^+ \pi^+ \pi^- \pi^0$	(1.76 ± 0.27) %		2218
$D^{*-} 3\pi^+ 2\pi^-$	$(4.7 \pm 0.9) \times 10^{-3}$		2195
$D^*(2010)^- p \overline{p} \pi^+$	$(6.5 \pm 1.6) \times 10^{-4}$		1708
$D^*(2010)^- p \overline{n}$	$(1.5 \pm 0.4) \times 10^{-3}$		1785
$\overline{D}^*(2010)^- \omega \pi^+$	$(2.9 \pm 0.5) \times 10^{-3}$		2148
$D_1(2420)^- \pi^+ \times B(D_1^- \to D^- \pi^+ \pi^-)$	$(8.9 {}^{+2.3}_{-3.5}) \times 10^{-5}$		–
$D_1(2420)^- \pi^+ \times B(D_1^- \to D^{*-} \pi^+ \pi^-)$	$< 3.3 \times 10^{-5}$	CL=90%	–
$\overline{D}_2^*(2460)^- \pi^+$	$< 2.2 \times 10^{-3}$	CL=90%	2064
$D_2^*(2460)^- \pi^+ \times B((D_2^*)^- \to D^{*-} \pi^+ \pi^-)$	$< 2.4 \times 10^{-5}$	CL=90%	–
$\overline{D}_2^*(2460)^- \rho^+$	$< 4.9 \times 10^{-3}$	CL=90%	1977
$D^- D^+$	$(1.9 \pm 0.6) \times 10^{-4}$		1864
$D^- D_s^+$	$(6.5 \pm 2.1) \times 10^{-3}$		1813
$D^*(2010)^- D_s^+$	$(8.8 \pm 1.6) \times 10^{-3}$		1735

$D^- D_s^{*+}$	$(8.6 \pm 3.4) \times 10^{-3}$		1732
$D^*(2010)^- D_s^{*+}$	(1.79 ± 0.16) %		1649
$D_{s0}(2317)^+ K^- \times$ B($D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0$)	$(4.3 \pm 1.5) \times 10^{-5}$		2097
$D_{s0}(2317)^+ \pi^- \times$ B($D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0$)	$< 2.5 \times 10^{-5}$	CL=90%	2128
$D_{sJ}(2457)^+ K^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \pi^0$)	$< 9.4 \times 10^{-6}$	CL=90%	–
$D_{sJ}(2457)^+ \pi^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \pi^0$)	$< 4.0 \times 10^{-6}$	CL=90%	–
$D_s^- D_s^+$	$< 1.0 \times 10^{-4}$	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%	1584
$D_{s0}(2317)^+ D^- \times$ B($D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0$)	$(9.7 {}^{+4.1}_{-3.4}) \times 10^{-4}$	S=1.4	1602
$D_{s0}(2317)^+ D^- \times$ B($D_{s0}(2317)^+ \rightarrow D_s^{*+} \gamma$)	$< 9.5 \times 10^{-4}$	CL=90%	–
$D_{s0}(2317)^+ D^*(2010)^- \times$ B($D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0$)	$(1.5 \pm 0.6) \times 10^{-3}$		1510
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^{*+} \pi^0$)	$(2.0 {}^{+0.6}_{-0.5}) \times 10^{-3}$		–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \gamma$)	$(6.6 {}^{+1.8}_{-1.5}) \times 10^{-4}$		–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^{*+} \gamma$)	$< 6.0 \times 10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \pi^+ \pi^-$)	$< 2.0 \times 10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+ D^- \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \pi^0$)	$< 3.6 \times 10^{-4}$	CL=90%	–
$D_{sJ}(2457)^+ D^*(2010) \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^{*+} \pi^0$)	$(5.5 {}^{+2.5}_{-2.0}) \times 10^{-3}$		–
$D_{sJ}(2457)^+ D^*(2010) \times$ B($D_{sJ}(2457)^+ \rightarrow D_s^+ \gamma$)	$(2.3 {}^{+0.9}_{-0.7}) \times 10^{-3}$		–
$D^- D_{sJ}(2536)^+ \times$ B($D_{sJ}(2536)^+ \rightarrow D^*(2007)^0 K^+$)	$< 5 \times 10^{-4}$	CL=90%	1444

$D^*(2010)^- D_{sJ}(2536)^+ \times$ B$(D_{sJ}(2536)^+ \to D^*(2007)^0 K^+)$	$<$ 7	$\times 10^{-4}$	CL=90%	1336
$D^- D_{sJ}(2573)^+ \times$ B$(D_{sJ}(2573)^+ \to D^0 K^+)$	$<$ 1	$\times 10^{-4}$	CL=90%	1413
$D^*(2010)^- D_{sJ}(2573)^+ \times$ B$(D_{sJ}(2573)^+ \to D^0 K^+)$	$<$ 2	$\times 10^{-4}$	CL=90%	1302
$D_s^+ \pi^-$	(2.2 ± 0.7)	$\times 10^{-5}$		2270
$D_s^{*+} \pi^-$	$<$ 4.1	$\times 10^{-5}$	CL=90%	2215
$D_s^+ \rho^-$	$<$ 6	$\times 10^{-4}$	CL=90%	2197
$D_s^{*+} \rho^-$	$<$ 6	$\times 10^{-4}$	CL=90%	2138
$D_s^+ a_1(1260)^-$	$<$ 2.1	$\times 10^{-3}$	CL=90%	2080
$D_s^{*+} a_1(1260)^-$	$<$ 1.8	$\times 10^{-3}$	CL=90%	2015
$D_s^- K^+$	(3.1 ± 0.8)	$\times 10^{-5}$		2242
$D_s^{*-} K^+$	$<$ 2.5	$\times 10^{-5}$	CL=90%	2185
$D_s^- K^*(892)^+$	$<$ 8	$\times 10^{-4}$	CL=90%	2172
$D_s^{*-} K^*(892)^+$	$<$ 9	$\times 10^{-4}$	CL=90%	2112
$D_s^- \pi^+ K^0$	$<$ 4	$\times 10^{-3}$	CL=90%	2222
$D_s^{*-} \pi^+ K^0$	$<$ 2.6	$\times 10^{-3}$	CL=90%	2164
$D_s^- \pi^+ K^*(892)^0$	$<$ 3.1	$\times 10^{-3}$	CL=90%	2138
$D_s^{*-} \pi^+ K^*(892)^0$	$<$ 1.7	$\times 10^{-3}$	CL=90%	2076
$\overline{D}^0 K^0$	(5.0 ± 1.4)	$\times 10^{-5}$		2280
$\overline{D}^0 K^+ \pi^-$	(8.8 ± 1.7)	$\times 10^{-5}$		2261
$\quad \overline{D}^0 K^*(892)^0$	(5.3 ± 0.8)	$\times 10^{-5}$		2213
$\quad D_2^*(2460)^- K^+ \times$ B$(D_2^*(2460)^- \to \overline{D}^0 \pi^-)$	(1.8 ± 0.5)	$\times 10^{-5}$		2031
$\quad \overline{D}^0 K^+ \pi^-$ non-resonant	$<$ 3.7	$\times 10^{-5}$	CL=90%	–
$\overline{D}^0 \pi^0$	(2.91 ± 0.28)	$\times 10^{-4}$		2308
$\overline{D}^0 \rho^0$	(2.9 ± 1.1)	$\times 10^{-4}$		2237
$\overline{D}^0 \eta$	(2.2 ± 0.5)	$\times 10^{-4}$	S=1.6	2274
$\overline{D}^0 \eta'$	(1.25 ± 0.23)	$\times 10^{-4}$	S=1.1	2198
$\overline{D}^0 \omega$	(2.5 ± 0.6)	$\times 10^{-4}$	S=1.5	2235
$D^0 K^+ \pi^-$	$<$ 1.9	$\times 10^{-5}$	CL=90%	2261
$\quad D^0 K^*(892)^0$	$<$ 1.8	$\times 10^{-5}$	CL=90%	2213
$\overline{D}^{*0} \gamma$	$<$ 2.5	$\times 10^{-5}$	CL=90%	2258
$\overline{D}^*(2007)^0 \pi^0$	(2.7 ± 0.5)	$\times 10^{-4}$		2256
$\overline{D}^*(2007)^0 \rho^0$	$<$ 5.1	$\times 10^{-4}$	CL=90%	2182
$\overline{D}^*(2007)^0 \eta$	(2.6 ± 0.6)	$\times 10^{-4}$		2220
$\overline{D}^*(2007)^0 \eta'$	(1.23 ± 0.35)	$\times 10^{-4}$		2141
$\overline{D}^*(2007)^0 \pi^+ \pi^-$	(6.2 ± 2.2)	$\times 10^{-4}$		2248
$\overline{D}^*(2007)^0 K^0$	$<$ 6.6	$\times 10^{-5}$	CL=90%	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 $\pm$ 0.5)	$\times 10^{-3}$		2219
$D^*(2010)^+ D^*(2010)^-$	(	8.3 $\pm$ 1.1)	$\times 10^{-4}$		1711
$\overline{D}^*(2007)^0 \omega$	(	4.2 $\pm$ 1.1)	$\times 10^{-4}$		2180
$D^*(2010)^+ D^-$	<	6.3	$\times 10^{-4}$	CL=90%	1790
$D^*(2010)^- D^+ + D^*(2010)^+ D^-$	(	9.3 $\pm$ 1.5)	$\times 10^{-4}$		1790
$D^*(2007)^0 \overline{D}^*(2007)^0$	<	2.7	%	CL=90%	1715
$D^- D^0 K^+$	(	1.7 $\pm$ 0.4)	$\times 10^{-3}$		1574
$D^- D^*(2007)^0 K^+$	(	4.6 $\pm$ 1.0)	$\times 10^{-3}$		1478
$D^*(2010)^- D^0 K^+$	(	$3.1 \, {}^{+0.6}_{-0.5}$)	$\times 10^{-3}$		1479
$D^*(2010)^- D^*(2007)^0 K^+$	(	1.18 $\pm$ 0.20)	%		1366
$D^- D^+ K^0$	<	1.7	$\times 10^{-3}$	CL=90%	1568
$D^*(2010)^- D^+ K^0 + D^- D^*(2010)^+ K^0$	(	6.5 $\pm$ 1.6)	$\times 10^{-3}$		1473
$D^*(2010)^- D^*(2010)^+ K^0$	(	8.8 $\pm$ 1.9)	$\times 10^{-3}$		1360
$\overline{D}^0 D^0 K^0$	<	1.4	$\times 10^{-3}$	CL=90%	1575
$\overline{D}^0 D^*(2007)^0 K^0 + \overline{D}^*(2007)^0 D^0 K^0$	<	3.7	$\times 10^{-3}$	CL=90%	1478
$\overline{D}^*(2007)^0 D^*(2007)^0 K^0$	<	6.6	$\times 10^{-3}$	CL=90%	1365
$(\overline{D}+\overline{D}^*)(D+D^*)K$	(	4.3 $\pm$ 0.7)	%		–

Charmonium modes

$\eta_c K^0$	(	9.9 $\pm$ 1.9)	$\times 10^{-4}$		1753
$\eta_c K^*(892)^0$	(	1.6 $\pm$ 0.7)	$\times 10^{-3}$		1648
$J/\psi(1S) K^0$	(	8.72 $\pm$ 0.33)	$\times 10^{-4}$		1683
$J/\psi(1S) K^+ \pi^-$	(	1.2 $\pm$ 0.6)	$\times 10^{-3}$		1652
$J/\psi(1S) K^*(892)^0$	(	1.33 $\pm$ 0.06)	$\times 10^{-3}$		1571
$J/\psi(1S) \eta K^0_S$	(	8 $\pm$ 4)	$\times 10^{-5}$		1508
$J/\psi(1S) \phi K^0$	(	9.4 $\pm$ 2.6)	$\times 10^{-5}$		1224
$J/\psi(1S) K(1270)^0$	(	1.3 $\pm$ 0.5)	$\times 10^{-3}$		1390
$J/\psi(1S) \pi^0$	(	2.2 $\pm$ 0.4)	$\times 10^{-5}$		1728
$J/\psi(1S) \eta$	<	2.7	$\times 10^{-5}$	CL=90%	1672
$J/\psi(1S) \pi^+ \pi^-$	(	4.6 $\pm$ 0.9)	$\times 10^{-5}$		1716
$J/\psi(1S) \rho^0$	(	1.6 $\pm$ 0.7)	$\times 10^{-5}$		1611
$J/\psi(1S) \omega$	<	2.7	$\times 10^{-4}$	CL=90%	1609
$J/\psi(1S) \phi$	<	9.2	$\times 10^{-6}$	CL=90%	1519
$J/\psi(1S) \eta'(958)$	<	6.3	$\times 10^{-5}$	CL=90%	1546
$J/\psi(1S) K^0 \pi^+ \pi^-$	(	1.0 $\pm$ 0.4)	$\times 10^{-3}$		1611
$J/\psi(1S) K^0 \rho^0$	(	5.4 $\pm$ 3.0)	$\times 10^{-4}$		1390
$J/\psi(1S) K^*(892)^+ \pi^-$	(	8 $\pm$ 4)	$\times 10^{-4}$		1514
$J/\psi(1S) K^*(892)^0 \pi^+ \pi^-$	(	6.6 $\pm$ 2.2)	$\times 10^{-4}$		1447
$X(3872)^- K^+$	<	5	$\times 10^{-4}$	CL=90%	–

$X(3872)^- K^+ \times$ B$(X(3872)^- \to J/\psi(1S)\pi^-\pi^0)$	[jjj]	$< 5.4 \times 10^{-6}$	CL=90%	–
$X(3872) K^0 \times$ B$(X \to J/\psi \pi^+\pi^-)$		$< 1.03 \times 10^{-5}$	CL=90%	1140
$J/\psi(1S) p\overline{p}$		$< 8.3 \times 10^{-7}$	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
$\psi(2S) K^0$		$(6.2 \pm 0.6) \times 10^{-4}$		1283
$\psi(2S) K^+\pi^-$		$< 1 \times 10^{-3}$	CL=90%	1238
$\psi(2S) K^*(892)^0$		$(7.2 \pm 0.8) \times 10^{-4}$		1116
$\chi_{c0}(1P) K^0$		$< 5.0 \times 10^{-4}$	CL=90%	1477
$\chi_{c0} K^*(892)^0$		$< 7.7 \times 10^{-4}$	CL=90%	–
$\chi_{c2} K^0$		$< 2.6 \times 10^{-5}$	CL=90%	–
$\chi_{c2} K^*(892)^0$		$< 3.6 \times 10^{-5}$	CL=90%	–
$\chi_{c1}(1P) K^0$		$(3.9 \pm 0.4) \times 10^{-4}$		1411
$\chi_{c1}(1P) K^*(892)^0$		$(3.2 \pm 0.6) \times 10^{-4}$		1265
K or K^* modes				
$K^+\pi^-$		$(1.82 \pm 0.08) \times 10^{-5}$		2615
$K^0\pi^0$		$(1.15 \pm 0.10) \times 10^{-5}$		2614
$\eta' K^0$		$(6.8 \pm 0.4) \times 10^{-5}$		2528
$\eta' K^*(892)^0$		$< 7.6 \times 10^{-6}$	CL=90%	2472
$\eta K^*(892)^0$		$(1.77 \pm 0.23) \times 10^{-5}$		2534
ηK^0		$< 2.0 \times 10^{-6}$	CL=90%	2587
ωK^0		$(5.5 {+1.2 \atop -1.0}) \times 10^{-6}$		2557
$a_0^0 K^0$		$< 7.8 \times 10^{-6}$	CL=90%	–
$a_0^- K^+$		$< 2.1 \times 10^{-6}$	CL=90%	–
$K_S^0 X^0$ (Familon)		$< 5.3 \times 10^{-5}$	CL=90%	–
$\omega K^*(892)^0$		$< 6.0 \times 10^{-6}$	CL=90%	2503
$K^+ K^-$		$< 3.7 \times 10^{-7}$	CL=90%	2593
$K^0\overline{K}^0$		$(1.13 {+0.38 \atop -0.35}) \times 10^{-6}$		2592
$K_S^0 K_S^0 K_S^0$		$(6.2 {+1.2 \atop -1.1}) \times 10^{-6}$	S=1.3	2521
$K^+\pi^-\pi^0$		$(3.7 \pm 0.5) \times 10^{-5}$		2609
$K^+\rho^-$		$(8.5 \pm 2.8) \times 10^{-6}$	S=1.7	2559
$(K^+\pi^-\pi^0)$ non-resonant		$< 9.4 \times 10^{-6}$	CL=90%	–
$K_x^{*0}\pi^0$	[lll]	$(6.1 \pm 1.6) \times 10^{-6}$		–
$K^0\pi^+\pi^-$		$(4.38 \pm 0.29) \times 10^{-5}$		2609
$K^0\rho^0$		$< 3.9 \times 10^{-5}$	CL=90%	2558
$K^0 f_0(980)$		$(5.5 \pm 0.9) \times 10^{-6}$		2524
$K^*(892)^+\pi^-$		$(1.18 \pm 0.15) \times 10^{-5}$		2562
$K_x^{*+}\pi^-$	[lll]	$(5.1 \pm 1.6) \times 10^{-6}$		–

$K^*(892)^0 \pi^0$		$<$ 3.5	$\times 10^{-6}$	CL=90%	2563
$K_2^*(1430)^+ \pi^-$		$<$ 1.8	$\times 10^{-5}$	CL=90%	2445
$K^0 K^- \pi^+$		$<$ 2.1	$\times 10^{-5}$	CL=90%	2578
$K^+ K^- \pi^0$		$<$ 1.9	$\times 10^{-5}$	CL=90%	2579
$K^0 K^+ K^-$		(2.47 $\pm$ 0.23)	$\times 10^{-5}$		2522
$K^0 \phi$		(8.6 $^{+1.3}_{-1.1}$)	$\times 10^{-6}$		2516
$K^+ \pi^- \pi^+ \pi^-$	[mmm]	$<$ 2.3	$\times 10^{-4}$	CL=90%	2600
$K^*(892)^0 \pi^+ \pi^-$		$<$ 1.4	$\times 10^{-3}$	CL=90%	2557
$K^*(892)^0 \rho^0$		$<$ 3.4	$\times 10^{-5}$	CL=90%	2504
$K^*(892)^0 f_0(980)$		$<$ 1.7	$\times 10^{-4}$	CL=90%	2468
$K_1(1400)^+ \pi^-$		$<$ 1.1	$\times 10^{-3}$	CL=90%	2451
$K^+ a_1(1260)^-$	[mmm]	$<$ 2.3	$\times 10^{-4}$	CL=90%	2471
$K^*(892)^0 K^+ K^-$		$<$ 6.1	$\times 10^{-4}$	CL=90%	2466
$K^*(892)^0 \phi$		(9.5 $\pm$ 0.9)	$\times 10^{-6}$		2460
$\overline{K}^*(892)^0 K^*(892)^0$		$<$ 2.2	$\times 10^{-5}$	CL=90%	2485
$K^*(892)^0 K^*(892)^0$		$<$ 3.7	$\times 10^{-5}$	CL=90%	2485
$K^*(892)^+ K^*(892)^-$		$<$ 1.41	$\times 10^{-4}$	CL=90%	2485
$K_1(1400)^0 \rho^0$		$<$ 3.0	$\times 10^{-3}$	CL=90%	2388
$K_1(1400)^0 \phi$		$<$ 5.0	$\times 10^{-3}$	CL=90%	2339
$K_0^*(1430)^0 \phi$		seen			2336
$K_2^*(1430)^0 \rho^0$		$<$ 1.1	$\times 10^{-3}$	CL=90%	2381
$K_2^*(1430)^0 \phi$		seen			2333
$K^*(892)^0 \gamma$		(4.01 $\pm$ 0.20)	$\times 10^{-5}$		2564
$\eta K^0 \gamma$		(8.7 $^{+3.6}_{-3.1}$)	$\times 10^{-6}$		2587
$K^0 \phi \gamma$		$<$ 8.3	$\times 10^{-6}$	CL=90%	2516
$K^+ \pi^- \gamma$		(4.6 $\pm$ 1.4)	$\times 10^{-6}$		2615
$K^*(1410) \gamma$		$<$ 1.3	$\times 10^{-4}$	CL=90%	2450
$K^+ \pi^- \gamma$ nonresonant		$<$ 2.6	$\times 10^{-6}$	CL=90%	2615
$K^0 \pi^+ \pi^- \gamma$		(2.4 $\pm$ 0.5)	$\times 10^{-5}$		2609
$K_1(1270)^0 \gamma$		$<$ 5.8	$\times 10^{-5}$		2486
$K_1(1400)^0 \gamma$		$<$ 1.5	$\times 10^{-5}$		2453
$K_2^*(1430)^0 \gamma$		(1.24 $\pm$ 0.24)	$\times 10^{-5}$		2447
$K^*(1680)^0 \gamma$		$<$ 2.0	$\times 10^{-3}$	CL=90%	2360
$K_3^*(1780)^0 \gamma$		$<$ 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

$\rho^0 \gamma$	$<$ 4	$\times 10^{-7}$	CL=90%	2583
$\omega \gamma$	$<$ 8	$\times 10^{-7}$	CL=90%	2582
$\phi \gamma$	$<$ 8.5	$\times 10^{-7}$	CL=90%	2541
$\pi^+ \pi^-$	(4.6 $\pm$ 0.4)	$\times 10^{-6}$		2636
$\pi^0 \pi^0$	(1.5 $\pm$ 0.5)	$\times 10^{-6}$	S=1.7	2636
$\eta \pi^0$	$<$ 2.5	$\times 10^{-6}$	CL=90%	2610

$\eta\eta$		$<$ 2.0	$\times 10^{-6}$	CL=90%	2582
$\eta'\pi^0$		$<$ 3.7	$\times 10^{-6}$	CL=90%	2551
$\eta'\eta'$		$<$ 1.0	$\times 10^{-5}$	CL=90%	2460
$\eta'\eta$		$<$ 4.6	$\times 10^{-6}$	CL=90%	2522
$\eta'\rho^0$		$<$ 4.3	$\times 10^{-6}$	CL=90%	2492
$\eta\rho^0$		$<$ 1.5	$\times 10^{-6}$	CL=90%	2553
$\omega\eta$		$<$ 1.9	$\times 10^{-6}$	CL=90%	2552
$\omega\eta'$		$<$ 2.8	$\times 10^{-6}$	CL=90%	2491
$\omega\rho^0$		$<$ 3.3	$\times 10^{-6}$	CL=90%	2522
$\omega\omega$		$<$ 1.9	$\times 10^{-5}$	CL=90%	2521
$\phi\pi^0$		$<$ 1.0	$\times 10^{-6}$	CL=90%	2539
$\phi\eta$		$<$ 1.0	$\times 10^{-6}$	CL=90%	2511
$\phi\eta'$		$<$ 4.5	$\times 10^{-6}$	CL=90%	2447
$\phi\rho^0$		$<$ 1.3	$\times 10^{-5}$	CL=90%	2480
$\phi\omega$		$<$ 2.1	$\times 10^{-5}$	CL=90%	2479
$\phi\phi$		$<$ 1.5	$\times 10^{-6}$	CL=90%	2435
$a_0^{\mp}\pi^{\pm}$		$<$ 5.1	$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^-\pi^0$		$<$ 7.2	$\times 10^{-4}$	CL=90%	2631
$\rho^0\pi^0$		(1.8 $\pm$ 0.8)	$\times 10^{-6}$	S=1.3	2581
$\rho^{\mp}\pi^{\pm}$	[gg]	(2.28 $\pm$ 0.25)	$\times 10^{-5}$		2581
$\pi^+\pi^-\pi^+\pi^-$		$<$ 2.3	$\times 10^{-4}$	CL=90%	2621
$\rho^0\rho^0$		$<$ 1.1	$\times 10^{-6}$	CL=90%	2523
$a_1(1260)^{\mp}\pi^{\pm}$	[gg]	$<$ 4.9	$\times 10^{-4}$	CL=90%	2494
$a_2(1320)^{\mp}\pi^{\pm}$	[gg]	$<$ 3.0	$\times 10^{-4}$	CL=90%	2473
$\pi^+\pi^-\pi^0\pi^0$		$<$ 3.1	$\times 10^{-3}$	CL=90%	2622
$\rho^+\rho^-$		(2.5 $\pm$ 0.4)	$\times 10^{-5}$		2523
$a_1(1260)^0\pi^0$		$<$ 1.1	$\times 10^{-3}$	CL=90%	2494
$\omega\pi^0$		$<$ 1.2	$\times 10^{-6}$	CL=90%	2580
$\pi^+\pi^+\pi^-\pi^-\pi^0$		$<$ 9.0	$\times 10^{-3}$	CL=90%	2609
$a_1(1260)^+\rho^-$		$<$ 3.4	$\times 10^{-3}$	CL=90%	2433
$a_1(1260)^0\rho^0$		$<$ 2.4	$\times 10^{-3}$	CL=90%	2433
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$		$<$ 3.0	$\times 10^{-3}$	CL=90%	2592
$a_1(1260)^+a_1(1260)^-$		$<$ 2.8	$\times 10^{-3}$	CL=90%	2336
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\pi^0$		$<$ 1.1	%	CL=90%	2572

Baryon modes

$p\overline{p}$		$<$ 2.7	$\times 10^{-7}$	CL=90%	2467
$p\overline{p}\pi^+\pi^-$		$<$ 2.5	$\times 10^{-4}$	CL=90%	2406
$p\overline{p}K^0$		($2.1^{+0.6}_{-0.4}$)	$\times 10^{-6}$		2347
$\Theta(1540)^+\overline{p}\times$ B$(\Theta(1540)^+ \to pK_S^0)$	[nnn]	$<$ 2.3	$\times 10^{-7}$	CL=90%	2318
$p\overline{p}K^*(892)^0$		$<$ 7.6	$\times 10^{-6}$	CL=90%	2215
$p\overline{\Lambda}\pi^-$		(2.6 $\pm$ 0.5)	$\times 10^{-6}$		2401
$p\overline{\Lambda}K^-$		$<$ 8.2	$\times 10^{-7}$	CL=90%	2308

$p\overline{\Sigma}^0\pi^-$		$<$ 3.8	$\times 10^{-6}$	CL=90%	2383
$\overline{\Lambda}\Lambda$		$<$ 6.9	$\times 10^{-7}$	CL=90%	2392
$\Delta^0\overline{\Delta}^0$		$<$ 1.5	$\times 10^{-3}$	CL=90%	2335
$\Delta^{++}\overline{\Delta}^{--}$		$<$ 1.1	$\times 10^{-4}$	CL=90%	2335
$\overline{D}^0 p\overline{p}$		(1.18± 0.22)	$\times 10^{-4}$		1863
$\overline{D}^*(2007)^0 p\overline{p}$		(1.2 ± 0.4)	$\times 10^{-4}$		1788
$\overline{\Sigma}_c^{--}\Delta^{++}$		$<$ 1.0	$\times 10^{-3}$	CL=90%	1839
$\overline{\Lambda}_c^- p\pi^+\pi^-$		(1.3 ± 0.4)	$\times 10^{-3}$		1934
$\overline{\Lambda}_c^- p$		(2.2 ± 0.8)	$\times 10^{-5}$		2021
$\overline{\Lambda}_c^- p\pi^0$		$<$ 5.9	$\times 10^{-4}$	CL=90%	1982
$\overline{\Lambda}_c^- p\pi^+\pi^-\pi^0$		$<$ 5.07	$\times 10^{-3}$	CL=90%	1882
$\overline{\Lambda}_c^- p\pi^+\pi^-\pi^+\pi^-$		$<$ 2.74	$\times 10^{-3}$	CL=90%	1821
$\overline{\Sigma}_c(2520)^{--} p\pi^+$		(1.6 ± 0.7)	$\times 10^{-4}$		1860
$\overline{\Sigma}_c(2520)^0 p\pi^-$		$<$ 1.21	$\times 10^{-4}$	CL=90%	1860
$\overline{\Sigma}_c(2455)^0 p\pi^-$		(10 ± 8)	$\times 10^{-5}$	S=1.7	1895
$\overline{\Sigma}_c(2455)^{--} p\pi^+$		(2.8 ± 0.9)	$\times 10^{-4}$		1895
$\overline{\Lambda}_c(2593)^-$ / $\overline{\Lambda}_c(2625)^- p$		$<$ 1.1	$\times 10^{-4}$	CL=90%	–

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

$\gamma\gamma$	$B1$		$<$ 6.2	$\times 10^{-7}$	CL=90%	2640
e^+e^-	$B1$		$<$ 6.1	$\times 10^{-8}$	CL=90%	2640
$\mu^+\mu^-$	$B1$		$<$ 3.9	$\times 10^{-8}$	CL=90%	2638
$K^0 e^+e^-$	$B1$		$<$ 5.4	$\times 10^{-7}$	CL=90%	2616
$K^0\mu^+\mu^-$	$B1$		($2.0^{+1.3}_{-1.0}$)	$\times 10^{-7}$	S=1.6	2612
$K^0\ell^+\ell^-$	$B1$	[ggg]	$<$ 6.8	$\times 10^{-7}$	CL=90%	2616
$K^*(892)^0 e^+e^-$	$B1$		$<$ 2.4	$\times 10^{-6}$	CL=90%	2564
$K^*(892)^0\mu^+\mu^-$	$B1$		($1.22^{+0.38}_{-0.32}$)	$\times 10^{-6}$		2560
$K^*(892)^0\nu\overline{\nu}$	$B1$		$<$ 1.0	$\times 10^{-3}$	CL=90%	2564
$K^*(892)^0\ell^+\ell^-$	$B1$	[ggg]	(1.17± 0.30)	$\times 10^{-6}$		2564
$e^\pm\mu^\mp$	LF	[gg]	$<$ 1.7	$\times 10^{-7}$	CL=90%	2639
$K^0 e^\pm\mu^\mp$	LF		$<$ 4.0	$\times 10^{-6}$	CL=90%	2615
$K^*(892)^0 e^\pm\mu^\mp$	LF		$<$ 3.4	$\times 10^{-6}$	CL=90%	2563
$e^\pm\tau^\mp$	LF	[gg]	$<$ 1.1	$\times 10^{-4}$	CL=90%	2341
$\mu^\pm\tau^\mp$	LF	[gg]	$<$ 3.8	$\times 10^{-5}$	CL=90%	2339
invisible	$B1$		$<$ 2.2	$\times 10^{-4}$	CL=90%	–
$\nu\overline{\nu}\gamma$	$B1$		$<$ 4.7	$\times 10^{-5}$	CL=90%	2640

$B^{\pm}/B^0$ ADMIXTURE

CP violation

$A_{CP}(B \rightarrow K^*(892)\gamma) = -0.010 \pm 0.028$
$A_{CP}(B \rightarrow s\gamma) = 0.00 \pm 0.04$
$A_{CP}(b \rightarrow X_s \ell^+ \ell^-) = -0.22 \pm 0.26$

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

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.

$\overline{B}$ 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				
$B \rightarrow e^+ \nu_e$ anything	[ooo]	$(10.78 \pm 0.18)\ \%$		–
$B \rightarrow \overline{p} e^+ \nu_e$ anything		$< 5.9 \times 10^{-4}$	CL=90%	–
$B \rightarrow \mu^+ \nu_\mu$ anything	[ooo]	$(10.78 \pm 0.18)\ \%$		–
$B \rightarrow \ell^+ \nu_\ell$ anything	[ggg,ooo]	$(10.78 \pm 0.18)\ \%$		–
$B \rightarrow D^- \ell^+ \nu_\ell$ anything	[ggg]	$(2.8 \pm 0.9)\ \%$		–
$B \rightarrow \overline{D}^0 \ell^+ \nu_\ell$ anything	[ggg]	$(7.2 \pm 1.5)\ \%$		–
$B \rightarrow D^{*-} \ell^+ \nu_\ell$ anything	[ppp]	$(6.7 \pm 1.3) \times 10^{-3}$		–
$B \rightarrow \overline{D}^{**} \ell^+ \nu_\ell$	[ggg,qqq]	$(2.7 \pm 0.7)\ \%$		–
$B \rightarrow \overline{D}_1(2420) \ell^+ \nu_\ell$ anything		$(3.8 \pm 1.3) \times 10^{-3}$	S=2.4	–
$B \rightarrow D \pi \ell^+ \nu_\ell$ anything + $D^* \pi \ell^+ \nu_\ell$ anything		$(2.6 \pm 0.5)\ \%$	S=1.5	–
$B \rightarrow D \pi \ell^+ \nu_\ell$ anything		$(1.5 \pm 0.6)\ \%$		–
$B \rightarrow D^* \pi \ell^+ \nu_\ell$ anything		$(1.9 \pm 0.4)\ \%$		–
$B \rightarrow \overline{D}_2^*(2460) \ell^+ \nu_\ell$ anything		$(4.4 \pm 1.6) \times 10^{-3}$		–
$B \rightarrow D^{*-} \pi^+ \ell^+ \nu_\ell$ anything		$(1.00 \pm 0.34)\ \%$		–
$B \rightarrow D_s^- \ell^+ \nu_\ell$ anything	[ggg]	$< 7 \times 10^{-3}$	CL=90%	–
$B \rightarrow D_s^- \ell^+ \nu_\ell K^+$ anything	[ggg]	$< 5 \times 10^{-3}$	CL=90%	–

$B \to D_s^- \ell^+ \nu_\ell K^0$ anything	[ggg]	<	7	$\times 10^{-3}$	CL=90%	–
$B \to \ell^+ \nu_\ell$ charm			(10.61 ± 0.17)	%		–
$B \to X_u \ell^+ \nu_\ell$			(2.33 ± 0.22)	$\times 10^{-3}$		–
$B \to K^+ \ell^+ \nu_\ell$ anything	[ggg]		(6.2 ± 0.6)	%		–
$B \to K^- \ell^+ \nu_\ell$ anything	[ggg]		(10 ± 4)	$\times 10^{-3}$		–
$B \to K^0 / \overline{K}^0 \ell^+ \nu_\ell$ anything	[ggg]		(4.6 ± 0.5)	%		–

D, D^*, or D_s modes

$B \to D^\pm$ anything			(22.8 ± 1.4)	%		–
$B \to D^0 / \overline{D}^0$ anything			(64.0 ± 3.0)	%	S=1.2	–
$B \to D^*(2010)^\pm$ anything			(22.5 ± 1.5)	%		–
$B \to D^*(2007)^0$ anything			(26.0 ± 2.7)	%		–
$B \to D_s^\pm$ anything	[gg]		(8.6 ± 1.2)	%		–
$B \to D_s^{*\pm}$ anything			(6.5 ± 1.2)	%		–
$B \to D_s^{*\pm} \overline{D}^{(*)}$			(3.4 ± 0.7)	%		–
$B \to D^{(*)} \overline{D}^{(*)} K^0 + D^{(*)} \overline{D}^{(*)} K^\pm$	[gg,rrr]		($7.1 {}^{+2.7}_{-1.7}$)	%		–
$b \to c \overline{c} s$			(22 ± 4)	%		–
$B \to D_s{}^{(*)} \overline{D}^{(*)}$	[gg,rrr]		(4.0 ± 0.6)	%		–
$B \to D^* D^*(2010)^\pm$	[gg]	<	5.9	$\times 10^{-3}$	CL=90%	1711
$B \to D D^*(2010)^\pm + D^* D^\pm$	[gg]	<	5.5	$\times 10^{-3}$	CL=90%	–
$B \to D D^\pm$	[gg]	<	3.1	$\times 10^{-3}$	CL=90%	1866
$B \to D_s{}^{(*)\pm} \overline{D}^{(*)} X(n\pi^\pm)$	[gg,rrr]		($9 {}^{+5}_{-4}$)	%		–
$B \to D^*(2010)\gamma$		<	1.1	$\times 10^{-3}$	CL=90%	2257
$B \to D_s^+ \pi^-$, $D_s^{*+} \pi^-$, $D_s^+ \rho^-$, $D_s^{*+} \rho^-$, $D_s^+ \pi^0$, $D_s^{*+} \pi^0$, $D_s^+ \eta$, $D_s^{*+} \eta$, $D_s^+ \rho^0$, $D_s^{*+} \rho^0$, $D_s^+ \omega$, $D_s^{*+} \omega$	[gg]	<	4	$\times 10^{-4}$	CL=90%	–
$B \to D_{s1}(2536)^+$ anything		<	9.5	$\times 10^{-3}$	CL=90%	–

Charmonium modes

$B \to J/\psi(1S)$ anything			(1.094 ± 0.032)	%	S=1.1	–
$B \to J/\psi(1S)$(direct) anything			(7.8 ± 0.4)	$\times 10^{-3}$	S=1.1	–
$B \to \psi(2S)$ anything			(3.07 ± 0.21)	$\times 10^{-3}$		–
$B \to \chi_{c1}(1P)$ anything			(3.86 ± 0.27)	$\times 10^{-3}$		–
$B \to \chi_{c1}(1P)$(direct) anything			(3.18 ± 0.25)	$\times 10^{-3}$		–

$B \to \chi_{c2}(1P)$anything		$(1.3 \pm 0.4) \times 10^{-3}$	S=1.9	–
$B \to \chi_{c2}(1P)$(direct) anything		$(1.65 \pm 0.31) \times 10^{-3}$		–
$B \to \eta_c(1S)$anything		$< 9 \times 10^{-3}$	CL=90%	–
$B \to K\,Y(3940) \times$ B$(Y(3940) \to \omega J/\psi)$	[sss]	$(7.1 \pm 3.4) \times 10^{-5}$		1083

K or K^* modes

$B \to K^{\pm}$anything	[gg]	(78.9 ± 2.5) %		–
$B \to K^{+}$anything		(66 ± 5) %		–
$B \to K^{-}$anything		(13 ± 4) %		–
$B \to K^0/\overline{K}^0$anything	[gg]	(64 ± 4) %		–
$B \to K^*(892)^{\pm}$anything		(18 ± 6) %		–
$B \to K^*(892)^0/\overline{K}^*(892)^0$anything	[gg]	(14.6 ± 2.6) %		–
$B \to K^*(892)\gamma$		$(4.2 \pm 0.6) \times 10^{-5}$		2564
$B \to \eta K \gamma$		$(8.5 {}^{+1.8}_{-1.6}) \times 10^{-6}$		2588
$B \to K_1(1400)\gamma$		$< 1.27 \times 10^{-4}$	CL=90%	2453
$B \to K_2^*(1430)\gamma$		$(1.7 {}^{+0.6}_{-0.5}) \times 10^{-5}$		2447
$B \to K_2(1770)\gamma$		$< 1.2 \times 10^{-3}$	CL=90%	2342
$B \to K_3^*(1780)\gamma$		$< 3.7 \times 10^{-5}$	CL=90%	2341
$B \to K_4^*(2045)\gamma$		$< 1.0 \times 10^{-3}$	CL=90%	2244
$B \to K\eta'(958)$		$(8.3 \pm 1.1) \times 10^{-5}$		2528
$B \to K^*(892)\eta'(958)$		$< 2.2 \times 10^{-5}$	CL=90%	2472
$B \to K\eta$		$< 5.2 \times 10^{-6}$	CL=90%	2588
$B \to K^*(892)\eta$		$(1.8 \pm 0.5) \times 10^{-5}$		2534
$B \to K\phi\phi$		$(2.3 \pm 0.9) \times 10^{-6}$		2306
$B \to \overline{b} \to \overline{s}\gamma$		$(3.43 \pm 0.29) \times 10^{-4}$		–
$B \to \overline{b} \to \overline{s}$gluon		< 6.8 %	CL=90%	–
$B \to \eta$anything		$< 4.4 \times 10^{-4}$	CL=90%	–
$B \to \eta'$anything		$(4.2 \pm 0.9) \times 10^{-4}$		–

Light unflavored meson modes

$B \to \rho\gamma$		$< 1.9 \times 10^{-6}$	CL=90%	2583
$B \to \rho/\omega\gamma$		$< 1.2 \times 10^{-6}$	CL=90%	–
$B \to \pi^{\pm}$ anything	[gg,ttt]	(358 ± 7) %		–
$B \to \pi^0$ anything		(235 ± 11) %		–
$B \to \eta$ anything		(17.6 ± 1.6) %		–
$B \to \rho^0$ anything		(21 ± 5) %		–
$B \to \omega$ anything		< 81 %	CL=90%	–
$B \to \phi$ anything		(3.42 ± 0.13) %		–
$B \to \phi K^*(892)$		$< 2.2 \times 10^{-5}$	CL=90%	2460

Baryon modes

$B \to \Lambda_c^+ / \overline{\Lambda}_c^-$ anything			(6.4 ± 1.1) %			–
$B \to \overline{\Lambda}_c^- e^+$ anything			$< 3.2 \times 10^{-3}$	CL=90%		–
$B \to \overline{\Lambda}_c^- p$ anything			(3.6 ± 0.7) %			–
$B \to \overline{\Lambda}_c^- p e^+ \nu_e$			$< 1.5 \times 10^{-3}$	CL=90%		2021
$B \to \overline{\Sigma}_c^{--}$ anything			$(4.2 \pm 2.4) \times 10^{-3}$			–
$B \to \overline{\Sigma}_c^-$ anything			$< 9.6 \times 10^{-3}$	CL=90%		–
$B \to \overline{\Sigma}_c^0$ anything			$(4.6 \pm 2.4) \times 10^{-3}$			–
$B \to \overline{\Sigma}_c^0 N (N = p$ or $n)$			$< 1.5 \times 10^{-3}$	CL=90%		1938
$B \to \Xi_c^0$ anything $\times$ B$(\Xi_c^0 \to \Xi^- \pi^+)$			$(1.93 \pm 0.30) \times 10^{-4}$	S=1.1		–
$B \to \Xi_c^+$ anything $\times$ B$(\Xi_c^+ \to \Xi^- \pi^+ \pi^+)$			$(4.5 {}^{+1.3}_{-1.2}) \times 10^{-4}$			–
$B \to p / \overline{p}$ anything		[gg]	(8.0 ± 0.4) %			–
$B \to p / \overline{p}$(direct) anything		[gg]	(5.5 ± 0.5) %			–
$B \to \Lambda / \overline{\Lambda}$ anything		[gg]	(4.0 ± 0.5) %			–
$B \to \Xi^- / \overline{\Xi}^+$ anything		[gg]	$(2.7 \pm 0.6) \times 10^{-3}$			–
$B \to$ baryons anything			(6.8 ± 0.6) %			–
$B \to p \overline{p}$ anything			(2.47 ± 0.23) %			–
$B \to \Lambda \overline{p} / \overline{\Lambda} p$ anything		[gg]	(2.5 ± 0.4) %			–
$B \to \Lambda \overline{\Lambda}$ anything			$< 5 \times 10^{-3}$	CL=90%		–

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

$B \to s e^+ e^-$	*B1*		$(4.7 \pm 1.3) \times 10^{-6}$			–
$B \to s \mu^+ \mu^-$	*B1*		$(4.3 \pm 1.2) \times 10^{-6}$			–
$B \to s \ell^+ \ell^-$	*B1*	[ggg]	$(4.5 \pm 1.0) \times 10^{-6}$			–
$B \to K e^+ e^-$	*B1*		$(6.0 {}^{+1.4}_{-1.2}) \times 10^{-7}$	S=1.1		2617
$B \to K^*(892) e^+ e^-$	*B1*		$(1.24 {}^{+0.37}_{-0.32}) \times 10^{-6}$			2564
$B \to K \mu^+ \mu^-$	*B1*		$(4.7 {}^{+1.1}_{-1.0}) \times 10^{-7}$			2612
$B \to K^*(892) \mu^+ \mu^-$	*B1*		$(1.19 {}^{+0.34}_{-0.29}) \times 10^{-6}$			2560
$B \to K \ell^+ \ell^-$	*B1*		$(5.4 \pm 0.8) \times 10^{-7}$			2617
$B \to K^*(892) \ell^+ \ell^-$	*B1*		$(1.05 \pm 0.20) \times 10^{-6}$			2564
$B \to e^\pm \mu^\mp s$	*LF*	[gg]	$< 2.2 \times 10^{-5}$	CL=90%		–
$B \to \pi e^\pm \mu^\mp$	*LF*		$< 1.6 \times 10^{-6}$	CL=90%		2637
$B \to \rho e^\pm \mu^\mp$	*LF*		$< 3.2 \times 10^{-6}$	CL=90%		2582
$B \to K e^\pm \mu^\mp$	*LF*		$< 1.6 \times 10^{-6}$	CL=90%		2616
$B \to K^*(892) e^\pm \mu^\mp$	*LF*		$< 6.2 \times 10^{-6}$	CL=90%		2563

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

These measurements are for an admixture of bottom particles at high energy (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

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

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

The branching fraction measurements are for an admixture of B mesons and baryons at energies above the $\Upsilon(4S)$. Only the highest energy results (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 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. Values assume

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

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

B^+	(39.8 ± 1.2) %		–
B^0	(39.8 ± 1.2) %		–
B^0_s	(10.3 ± 1.4) %		–
b-baryon	(10.0 ± 2.0) %		–
B_c	—		–

DECAY MODES

Semileptonic and leptonic modes

ν anything		(23.1 ± 1.5) %		–
$\ell^+ \nu_\ell$ anything	[ggg]	(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	[ggg]	(2.2 ± 0.4) %	S=1.9	–
$D^- \pi^+ \ell^+ \nu_\ell$ anything		$(4.9 \pm 1.9) \times 10^{-3}$		–
$D^- \pi^- \ell^+ \nu_\ell$ anything		$(2.6 \pm 1.6) \times 10^{-3}$		–
$\overline{D}^0 \ell^+ \nu_\ell$ anything	[ggg]	(6.90 ± 0.35) %		–
$\overline{D}^0 \pi^- \ell^+ \nu_\ell$ anything		(1.07 ± 0.27) %		–
$\overline{D}^0 \pi^+ \ell^+ \nu_\ell$ anything		$(2.3 \pm 1.6) \times 10^{-3}$		–
$D^{*-} \ell^+ \nu_\ell$ anything	[ggg]	(2.75 ± 0.19) %		–
$D^{*-} \pi^+ \ell^+ \nu_\ell$ anything		$(4.8 \pm 1.0) \times 10^{-3}$		–
$D^{*-} \pi^- \ell^+ \nu_\ell$ anything		$(6 \pm 7) \times 10^{-4}$		–
$\overline{D}^0_j \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}^0_j \to D^{*+} \pi^-$)	[ggg,uuu]	$(2.6 \pm 0.9) \times 10^{-3}$		–
$D^-_j \ell^+ \nu_\ell$ anything $\times$ B($D^-_j \to D^0 \pi^-$)	[ggg,uuu]	$(7.0 \pm 1.9) \times 10^{-3}$		–
$\overline{D}^*_2(2460)^0 \ell^+ \nu_\ell$ 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($\overline{D}^*_2(2460)^0 \to D^- \pi^+$)		(160 ± 80) %		–
charmless $\ell \overline{\nu}_\ell$	[ggg]	$(1.7 \pm 0.5) \times 10^{-3}$		–
$\tau^+ \nu_\tau$ anything		(2.48 ± 0.26) %		–
$D^{*-} \tau \nu_\tau$ anything		$(9 \pm 4) \times 10^{-3}$		–
$\overline{c} \to \ell^- \overline{\nu}_\ell$ anything	[ggg]	(8.02 ± 0.19) %		–
$c \to \ell^+ \nu$ anything		$(1.6^{+0.4}_{-0.5})$ %		–

Charmed meson and baryon modes

$\overline{D}^0$ anything		(61.0 ± 3.1) %		–
$D^0 D^\pm_s$ anything	[gg]	$(9.1^{+3.9}_{-2.8})$ %		–
$D^\mp D^\pm_s$ 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]	$(2.7 \begin{array}{l} +1.8 \\ -1.6 \end{array}) \%$		–
$D^{\pm} D^{\mp}$ anything	[gg]	$< 9 \times 10^{-3}$	CL=90%	–
D^- anything		$(22.4 \pm 1.8) \%$		–
$D^*(2010)^+$ anything		$(17.3 \pm 2.0) \%$		–
$D_1(2420)^0$ anything		$(5.0 \pm 1.5) \%$		–
$D^*(2010)^{\mp} D_s^{\pm}$ anything	[gg]	$(3.3 \begin{array}{l} +1.6 \\ -1.3 \end{array}) \%$		–
$D^0 D^*(2010)^{\pm}$ anything	[gg]	$(3.0 \begin{array}{l} +1.1 \\ -0.9 \end{array}) \%$		–
$D^*(2010)^{\pm} D^{\mp}$ anything	[gg]	$(2.5 \begin{array}{l} +1.2 \\ -1.0 \end{array}) \%$		–
$D^*(2010)^{\pm} D^*(2010)^{\mp}$ anything	[gg]	$(1.2 \pm 0.4) \%$		–
$\overline{D} D$ anything		$(10 \begin{array}{l} +11 \\ -10 \end{array}) \%$		–
$D_2^*(2460)^0$ anything		$(4.7 \pm 2.7) \%$		–
D_s^- anything		$(15.0 \pm 2.6) \%$		–
D_s^+ anything		$(10.1 \pm 3.1) \%$		–
Λ_c^+ anything		$(9.7 \pm 2.9) \%$		–
$\overline{c} / c$ anything	[ttt]	$(116.2 \pm 3.2) \%$		–
Charmonium modes				
$J/\psi(1S)$ anything		$(1.16 \pm 0.10) \%$		–
$\psi(2S)$ anything		$(4.8 \pm 2.4) \times 10^{-3}$		–
$\chi_{c1}(1P)$ anything		$(1.4 \pm 0.4) \%$		–
***K* or *K** modes**				
$\overline{s} \gamma$		$(3.1 \pm 1.1) \times 10^{-4}$		–
$\overline{s} \overline{\nu} \nu$		$< 6.4 \times 10^{-4}$	CL=90%	–
$K^{\pm}$ anything		$(74 \pm 6) \%$		–
K_S^0 anything		$(29.0 \pm 2.9) \%$		–
Pion modes				
$\pi^{\pm}$ anything		$(397 \pm 21) \%$		–
π^0 anything	[ttt]	$(278 \pm 60) \%$		–
ϕ anything		$(2.82 \pm 0.23) \%$		–
Baryon modes				
$p / \overline{p}$ anything		$(13.1 \pm 1.1) \%$		–
Other modes				
charged anything	[ttt]	$(497 \pm 7) \%$		–
hadron$^+$ hadron$^-$		$(1.7 \begin{array}{l} +1.0 \\ -0.7 \end{array}) \times 10^{-5}$		–
charmless		$(7 \pm 21) \times 10^{-3}$		–
Baryon modes				
$\Lambda / \overline{\Lambda}$ anything		$(5.9 \pm 0.6) \%$		–
b-baryon anything		$(10.2 \pm 2.8) \%$		–

$\Delta B = 1$ 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 $m_{B^*} = 5325.0 \pm 0.6$ MeV

$m_{B^*} - m_B = 45.78 \pm 0.35$ MeV

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

BOTTOM, STRANGE MESONS ($B = \pm1$, $S = \mp1$)

$B_s^0 = s\overline{b}$, $\overline{B}_s^0 = \overline{s}\,b$, 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 $m_{B_s^0} = 5367.5 \pm 1.8$ MeV (S = 1.1)

Mean life $\tau = (1.466 \pm 0.059) \times 10^{-12}$ s

$c\tau = 439$ μm

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

$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0} > 14.4 \times 10^{12}\ \hbar\ \mathrm{s}^{-1}$, CL = 95%

$> 94.8 \times 10^{-10}$ MeV, CL = 95%

$x_s = \Delta m_{B_s^0}/\Gamma_{B_s^0} > 19.9$, CL = 95%

$\chi_s > 0.49878$, CL = 95%

These branching fractions all scale with B($\overline{b} \rightarrow B_s^0$), the LEP B_s^0 production fraction. The first four were evaluated using B($\overline{b} \rightarrow B_s^0$) = (10.7 $\pm$ 1.4)% and the rest assume B($\overline{b} \rightarrow B_s^0$) = 12%.

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

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_s^0 DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
D_s^- anything		(94 $\pm$30) %		–
$D_s^- \ell^+ \nu_\ell$ anything	[*vvv*]	(7.9 $\pm$ 2.4) %		–
$D_s^- \pi^+$		< 13 %		2321
$D_s^{(*)+} D_s^{(*)-}$		(23 $^{+21}_{-13}$) %		–
$J/\psi(1S)\phi$		(9.3 $\pm$ 3.3) $\times 10^{-4}$		1588
$J/\psi(1S)\pi^0$		< 1.2 $\times 10^{-3}$	90%	1787
$J/\psi(1S)\eta$		< 3.8 $\times 10^{-3}$	90%	1734
$\psi(2S)\phi$		seen		1121
$\pi^+\pi^-$		< 1.7 $\times 10^{-4}$	90%	2680
$\pi^0\pi^0$		< 2.1 $\times 10^{-4}$	90%	2680
$\eta\pi^0$		< 1.0 $\times 10^{-3}$	90%	2654
$\eta\eta$		< 1.5 $\times 10^{-3}$	90%	2627
$\rho^0\rho^0$		< 3.20 $\times 10^{-4}$	90%	2569
$\phi\rho^0$		< 6.17 $\times 10^{-4}$	90%	2527
$\phi\phi$		(1.4 $\pm$ 0.8) $\times 10^{-5}$		2483
$\pi^+ K^-$		< 2.1 $\times 10^{-4}$	90%	2659
$K^+ K^-$		< 5.9 $\times 10^{-5}$	90%	2638
$\overline{K}^*(892)^0 \rho^0$		< 7.67 $\times 10^{-4}$	90%	2550
$\overline{K}^*(892)^0 K^*(892)^0$		< 1.681 $\times 10^{-3}$	90%	2531
$\phi K^*(892)^0$		< 1.013 $\times 10^{-3}$	90%	2507
$p\overline{p}$		< 5.9 $\times 10^{-5}$	90%	2514
$\gamma\gamma$	*B1*	< 1.48 $\times 10^{-4}$	90%	2684
$\phi\gamma$		< 1.2 $\times 10^{-4}$	90%	2587

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

$\mu^+\mu^-$	*B1*	< 1.5 $\times 10^{-7}$	90%	2682
$e^+ e^-$	*B1*	< 5.4 $\times 10^{-5}$	90%	2684

$e^{\pm}\mu^{\mp}$	*LF*	[gg]	$<$ 6.1	$\times 10^{-6}$	90%	2683
$\phi(1020)\mu^+\mu^-$	*B1*		$<$ 4.7	$\times 10^{-5}$	90%	2582
$\phi\nu\overline{\nu}$	*B1*		$<$ 5.4	$\times 10^{-3}$	90%	2587

BOTTOM, CHARMED MESONS ($B = C = \pm1$)

$B_c^+ = c\overline{b}$, $B_c^- = \overline{c}\,b$, 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 $m = 6.286 \pm 0.005$ GeV
Mean life $\tau = (0.46^{+0.18}_{-0.16}) \times 10^{-12}$ s

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

The following quantities are not pure branching ratios; rather the fraction $\Gamma_i/\Gamma \times$ B($\overline{b} \to B_c$).

B_c^+ DECAY MODES × B($\overline{b} \to B_c$)	Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
$J/\psi(1S)\ell^+\nu_\ell$ anything	$(5.2^{+2.4}_{-2.1}) \times 10^{-5}$			–
$J/\psi(1S)\pi^+$	$<$ 8.2	$\times 10^{-5}$	90%	2377
$J/\psi(1S)\pi^+\pi^+\pi^-$	$<$ 5.7	$\times 10^{-4}$	90%	2357
$J/\psi(1S)a_1(1260)$	$<$ 1.2	$\times 10^{-3}$	90%	2177
$D^*(2010)^+\overline{D}^0$	$<$ 6.2	$\times 10^{-3}$	90%	2474

$c\overline{c}$ MESONS

$\eta_c(1S)$

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

Mass $m = 2980.4 \pm 1.2$ MeV (S = 1.5)
Full width $\Gamma = 25.5 \pm 3.4$ MeV (S = 2.0)

$\eta_c(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Decays involving hadronic resonances				
$\eta'(958)\pi\pi$		(4.1 ± 1.7) %		1321
$\rho\rho$		(2.0 ± 0.7) %		1273
$K^*(892)^0 K^- \pi^+ +$ c.c.		(2.0 ± 0.7) %		1276
$K^*(892)\overline{K}^*(892)$		$(9.2 \pm 3.4) \times 10^{-3}$		1194
$K^{*0}\overline{K}^{*0}\pi^+\pi^-$		(1.5 ± 0.8) %		1071
$\phi K^+ K^-$		$(2.9 \pm 1.4) \times 10^{-3}$		1102
$\phi\phi$		$(2.7 \pm 0.9) \times 10^{-3}$		1087
$\phi 2(\pi^+\pi^-)$		$< 4.7 \times 10^{-3}$	90%	1249
$a_0(980)\pi$		< 2 %	90%	1324
$a_2(1320)\pi$		< 2 %	90%	1194
$K^*(892)\overline{K} +$ c.c.		< 1.28 %	90%	1308
$f_2(1270)\eta$		< 1.1 %	90%	1143
$\omega\omega$		$< 3.1 \times 10^{-3}$	90%	1268
$\omega\phi$		$< 1.7 \times 10^{-3}$	90%	1183
$f_2(1270) f_2(1270)$		$(1.0 ^{+0.4}_{-0.5})$ %		771
Decays into stable hadrons				
$K\overline{K}\pi$		(7.0 ± 1.2) %		1379
$\eta\pi\pi$		(4.9 ± 1.8) %		1427
$\pi^+\pi^- K^+ K^-$		(1.5 ± 0.6) %		1343
$K^+ K^- 2(\pi^+\pi^-)$		$(10 \pm 4) \times 10^{-3}$		1252
$2(K^+ K^-)$		$(1.5 \pm 0.7) \times 10^{-3}$		1053
$2(\pi^+\pi^-)$		(1.20 ± 0.30) %		1457
$3(\pi^+\pi^-)$		(2.0 ± 0.7) %		1405
$p\overline{p}$		$(1.3 \pm 0.4) \times 10^{-3}$		1158
$K\overline{K}\eta$		< 3.1 %	90%	1263
$\pi^+\pi^- p\overline{p}$		< 1.2 %	90%	1025
$\Lambda\overline{\Lambda}$		$< 2 \times 10^{-3}$	90%	988
Radiative decays				
$\gamma\gamma$		$(2.8 \pm 0.9) \times 10^{-4}$		1490
Charge conjugation (C), Parity (P), Lepton family number (LF) violating modes				
$\pi^+\pi^-$	P,CP	$< 8.7 \times 10^{-4}$	90%	1484
$\pi^0\pi^0$	P,CP	$< 5.6 \times 10^{-4}$	90%	1484
$K^+ K^-$	P,CP	$< 7.6 \times 10^{-4}$	90%	1406
$K^0_S K^0_S$	P,CP	$< 4.2 \times 10^{-4}$	90%	1405

$J/\psi(1S)$

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

Mass $m = 3096.916 \pm 0.011$ MeV
Full width $\Gamma = 93.4 \pm 2.1$ keV
$\Gamma_{ee} = 5.55 \pm 0.14 \pm 0.02$ keV

$J/\psi(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons		(87.7 ± 0.5) %		–
virtual$\gamma \to$ hadrons		(13.50 ± 0.30) %		–
$e^+ e^-$		(5.94 ± 0.06) %		1548
$\mu^+ \mu^-$		(5.93 ± 0.06) %		1545
Decays involving hadronic resonances				
$\rho\pi$		(1.69 ± 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 ± 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
$\omega\pi^+\pi^-$		$(7.2 \pm 1.0) \times 10^{-3}$		1435
$\omega f_2(1270)$		$(4.3 \pm 0.6) \times 10^{-3}$		1142
$K^*(892)^0\overline{K}{}^*_2(1430)^0 +$ c.c.		$(6.7 \pm 2.6) \times 10^{-3}$		1012
$\omega K^*(892)\overline{K} +$ c.c.		$(5.3 \pm 2.0) \times 10^{-3}$		1097
$K^+\overline{K}{}^*(892)^- +$ c.c.		$(5.0 \pm 0.4) \times 10^{-3}$		1373
$K^0\overline{K}{}^*(892)^0 +$ c.c.		$(4.2 \pm 0.4) \times 10^{-3}$		1373
$K_1(1400)^\pm K^\mp$		$(3.8 \pm 1.4) \times 10^{-3}$		1171
$\omega\pi^0\pi^0$		$(3.4 \pm 0.8) \times 10^{-3}$		1436
$b_1(1235)^\pm\pi^\mp$	[gg]	$(3.0 \pm 0.5) \times 10^{-3}$		1300
$\omega K^\pm K^0_S\pi^\mp$	[gg]	$(2.9 \pm 0.7) \times 10^{-3}$		1210
$b_1(1235)^0\pi^0$		$(2.3 \pm 0.6) \times 10^{-3}$		1300
$\phi K^*(892)\overline{K} +$ c.c.		$(2.04 \pm 0.28) \times 10^{-3}$		969
$\omega K\overline{K}$		$(1.9 \pm 0.4) \times 10^{-3}$		1268
$\omega f_0(1710) \to \omega K\overline{K}$		$(4.8 \pm 1.1) \times 10^{-4}$		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
$\phi f_0(1710) \to \phi K\overline{K}$		$(3.6 \pm 0.6) \times 10^{-4}$		875
$p\overline{p}\omega$		$(1.30 \pm 0.25) \times 10^{-3}$	S=1.3	768
$\Delta(1232)^{++}\overline{\Delta}(1232)^{--}$		$(1.10 \pm 0.29) \times 10^{-3}$		938
$\Sigma(1385)^-\overline{\Sigma}(1385)^+$ (or c.c.)	[gg]	$(1.03 \pm 0.13) \times 10^{-3}$		697
$p\overline{p}\eta'(958)$		$(9 \pm 4) \times 10^{-4}$	S=1.7	596
$\phi f'_2(1525)$		$(8 \pm 4) \times 10^{-4}$	S=2.7	871
$\phi\pi^+\pi^-$		$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	1365

$\phi K^{\pm} K^0_S \pi^{\mp}$	[gg]	$(7.2 \pm 0.9) \times 10^{-4}$			1114
$\omega f_1(1420)$		$(6.8 \pm 2.4) \times 10^{-4}$			1062
$\phi\eta$		$(7.4 \pm 0.8) \times 10^{-4}$		S=1.5	1320
$\Xi(1530)^- \overline{\Xi}^+$		$(5.9 \pm 1.5) \times 10^{-4}$			601
$p K^- \overline{\Sigma}(1385)^0$		$(5.1 \pm 3.2) \times 10^{-4}$			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	1182
$\Xi(1530)^0 \overline{\Xi}^0$		$(3.2 \pm 1.4) \times 10^{-4}$			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
$\rho\eta$		$(1.93 \pm 0.23) \times 10^{-4}$			1396
$\omega\eta'(958)$		$(1.82 \pm 0.21) \times 10^{-4}$			1279
$\omega f_0(980)$		$(1.4 \pm 0.5) \times 10^{-4}$			1271
$\rho\eta'(958)$		$(1.05 \pm 0.18) \times 10^{-4}$			1281
$p\overline{p}\phi$		$(4.5 \pm 1.5) \times 10^{-5}$			527
$a_2(1320)^{\pm}\pi^{\mp}$	[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
$K^*(892)^0 \overline{K}^*(892)^0$		< 5	$\times 10^{-4}$	CL=90%	1266
$\phi f_2(1270)$		< 3.7	$\times 10^{-4}$	CL=90%	1036
$p\overline{p}\rho$		< 3.1	$\times 10^{-4}$	CL=90%	774
$\phi\eta(1405) \rightarrow \phi\eta\pi\pi$		< 2.5	$\times 10^{-4}$	CL=90%	946
$\omega f'_2(1525)$		< 2.2	$\times 10^{-4}$	CL=90%	1003
$\Sigma(1385)^0 \overline{\Lambda}$		< 2	$\times 10^{-4}$	CL=90%	912
$\Delta(1232)^+ \overline{p}$		< 1	$\times 10^{-4}$	CL=90%	1100
$\Theta(1540)\overline{\Theta}(1540) \rightarrow K^0_S p K^- \overline{n}+$ c.c.		< 1.1	$\times 10^{-5}$	CL=90%	–
$\Theta(1540) K^- \overline{n} \rightarrow K^0_S p K^- \overline{n}$		< 2.1	$\times 10^{-5}$	CL=90%	–
$\Theta(1540) K^0_S \overline{p} \rightarrow K^0_S \overline{p} K^+ n$		< 1.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^+ n \rightarrow K^0_S \overline{p} K^+ n$		< 5.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^0_S p \rightarrow K^0_S p K^- \overline{n}$		< 1.1	$\times 10^{-5}$	CL=90%	–
$\Sigma^0 \overline{\Lambda}$		< 9	$\times 10^{-5}$	CL=90%	1032
$\phi\pi^0$		< 6.4	$\times 10^{-6}$	CL=90%	1377

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$	(3.37 ± 0.26) %		1496
$3(\pi^+\pi^-)\pi^0$	(2.9 ± 0.6) %		1433
$\pi^+\pi^-\pi^0$	(2.02 ± 0.14) %	S=1.7	1533
$\pi^+\pi^-\pi^0 K^+ K^-$	(1.20 ± 0.30) %		1368
$4(\pi^+\pi^-)\pi^0$	$(9.0 \pm 3.0) \times 10^{-3}$		1345
$\pi^+\pi^- K^+ K^-$	$(6.2 \pm 0.7) \times 10^{-3}$		1407
$K\overline{K}\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1442

$p\overline{p}\pi^+\pi^-$		$(6.0 \pm 0.5) \times 10^{-3}$	S=1.3	1107
$2(\pi^+\pi^-)$		$(3.55\pm0.23) \times 10^{-3}$		1517
$3(\pi^+\pi^-)$		$(4.3 \pm 0.4) \times 10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$		(1.62 ± 0.21) %		1468
$2(\pi^+\pi^-)\eta$		$(2.26\pm0.28) \times 10^{-3}$		1446
$3(\pi^+\pi^-)\eta$		$(7.2 \pm 1.5) \times 10^{-4}$		1379
$n\overline{n}\pi^+\pi^-$		$(4 \pm 4) \times 10^{-3}$		1106
$\Sigma^0\overline{\Sigma}^0$		$(1.31\pm0.10) \times 10^{-3}$		988
$2(\pi^+\pi^-)K^+K^-$		$(4.7 \pm 0.7) \times 10^{-3}$	S=1.3	1320
$p\overline{p}\pi^+\pi^-\pi^0$	[www]	$(2.3 \pm 0.9) \times 10^{-3}$	S=1.9	1033
$p\overline{p}$		$(2.17\pm0.08) \times 10^{-3}$		1232
$p\overline{p}\eta$		$(2.09\pm0.18) \times 10^{-3}$		949
$p\overline{n}\pi^-$		$(2.00\pm0.10) \times 10^{-3}$		1174
$n\overline{n}$		$(2.2 \pm 0.4) \times 10^{-3}$		1231
$\Xi\overline{\Xi}$		$(1.8 \pm 0.4) \times 10^{-3}$	S=1.8	818
$\Lambda\overline{\Lambda}$		$(1.54\pm0.19) \times 10^{-3}$	S=2.2	1074
$p\overline{p}\pi^0$		$(1.09\pm0.09) \times 10^{-3}$		1176
$\Lambda\overline{\Sigma}^-\pi^+$ (or c.c.)	[gg]	$(1.06\pm0.12) \times 10^{-3}$		950
$pK^-\overline{\Lambda}$		$(8.9 \pm 1.6) \times 10^{-4}$		876
$2(K^+K^-)$		$(7.8 \pm 1.4) \times 10^{-4}$		1131
$pK^-\overline{\Sigma}^0$		$(2.9 \pm 0.8) \times 10^{-4}$		819
K^+K^-		$(2.37\pm0.31) \times 10^{-4}$		1468
$K^0_S K^0_L$		$(1.46\pm0.26) \times 10^{-4}$	S=2.7	1466
$\Lambda\overline{\Lambda}\pi^0$		$(2.2 \pm 0.6) \times 10^{-4}$		998
$\pi^+\pi^-$		$(1.47\pm0.23) \times 10^{-4}$		1542
$\Lambda\overline{\Sigma}$ + c.c.		$< 1.5 \times 10^{-4}$	CL=90%	1034
$K^0_S K^0_S$		$< 1 \times 10^{-6}$	CL=95%	1466

Radiative decays

$\gamma\eta_c(1S)$		(1.3 ± 0.4) %		114
$\gamma\pi^+\pi^-2\pi^0$		$(8.3 \pm 3.1) \times 10^{-3}$		1518
$\gamma\eta\pi\pi$		$(6.1 \pm 1.0) \times 10^{-3}$		1488
$\gamma\eta(1405/1475) \to \gamma K\overline{K}\pi$	[p]	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223
$\gamma\eta(1405/1475) \to \gamma\gamma\rho^0$		$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223
$\gamma\eta(1405/1475) \to \gamma\eta\pi^+\pi^-$		$(3.0 \pm 0.5) \times 10^{-4}$		–
$\gamma\eta(1405/1475) \to \gamma\gamma\phi$		$< 8.2 \times 10^{-5}$	CL=95%	–
$\gamma\rho\rho$		$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma\eta_2(1870) \to \gamma\pi^+\pi^-$		$(6.2 \pm 2.4) \times 10^{-4}$		–
$\gamma\eta'(958)$		$(4.71\pm0.27) \times 10^{-3}$	S=1.1	1400
$\gamma 2\pi^+ 2\pi^-$		$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517
$\gamma f_2(1270) f_2(1270)$		$(9.5 \pm 1.7) \times 10^{-4}$		878
$\gamma f_2(1270) f_2(1270)$ (non resonant)		$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma K^+K^-\pi^+\pi^-$		$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma f_4(2050)$		$(2.7 \pm 0.7) \times 10^{-3}$		886

$\gamma\omega\omega$		$(1.59\pm0.33)\times10^{-3}$		1336
$\gamma\eta(1405/1475)\to\gamma\rho^0\rho^0$		$(1.7\ \pm0.4\ )\times10^{-3}$	S=1.3	1223
$\gamma f_2(1270)$		$(1.38\pm0.14)\times10^{-3}$		1286
$\gamma f_0(1710)\to\gamma K\overline{K}$		$(8.5\ {}^{+1.2}_{-0.9}\ )\times10^{-4}$	S=1.2	1075
$\gamma\eta$		$(9.8\ \pm1.0\ )\times10^{-4}$	S=1.7	1500
$\gamma f_1(1420)\to\gamma K\overline{K}\pi$		$(7.9\ \pm1.3\ )\times10^{-4}$		1220
$\gamma f_1(1285)$		$(6.1\ \pm0.8\ )\times10^{-4}$		1283
$\gamma f_1(1510)\to\gamma\eta\pi^+\pi^-$		$(4.5\ \pm1.2\ )\times10^{-4}$		–
$\gamma f_2'(1525)$		$(4.5\ {}^{+0.7}_{-0.4}\ )\times10^{-4}$		1173
$\gamma f_2(1950)\to\gamma K^*(892)\overline{K}^*(892)$		$(7.0\ \pm2.2\ )\times10^{-4}$		–
$\gamma K^*(892)\overline{K}^*(892)$		$(4.0\ \pm1.3\ )\times10^{-3}$		1266
$\gamma\phi\phi$		$(4.0\ \pm1.2\ )\times10^{-4}$	S=2.1	1166
$\gamma p\overline{p}$		$(3.8\ \pm1.0\ )\times10^{-4}$		1232
$\gamma\eta(2225)$		$(2.9\ \pm0.6\ )\times10^{-4}$		752
$\gamma\eta(1760)\to\gamma\rho^0\rho^0$		$(1.3\ \pm0.9\ )\times10^{-4}$		1048
$\gamma X(1835)$		$(2.2\ \pm0.6\ )\times10^{-4}$		1006
$\gamma(K\overline{K}\pi)_{J^{PC}=0^{-+}}$		$(7\ \pm4\ )\times10^{-4}$	S=2.1	1442
$\gamma\pi^0$		$(3.3\ {}^{+0.6}_{-0.4}\ )\times10^{-5}$		1546
$\gamma p\overline{p}\pi^+\pi^-$		$<7.9\times10^{-4}$	CL=90%	1107
$\gamma\gamma$		$<5\times10^{-4}$	CL=90%	1548
$\gamma\Lambda\overline{\Lambda}$		$<1.3\times10^{-4}$	CL=90%	1074
3γ		$<5.5\times10^{-5}$	CL=90%	1548
$\gamma f_J(2220)$		$>2.50\times10^{-3}$	CL=99.9%	745
$\gamma f_J(2220)\to\gamma\pi\pi$		$(8\ \pm4\ )\times10^{-5}$		–
$\gamma f_J(2220)\to\gamma K\overline{K}$		$(8.1\ \pm3.0\ )\times10^{-5}$		–
$\gamma f_J(2220)\to\gamma p\overline{p}$		$(1.5\ \pm0.8\ )\times10^{-5}$		–
$\gamma f_0(1500)$		$>(5.7\ \pm0.8\ )\times10^{-4}$		1182
γe^+e^-		$(8.8\ \pm1.4\ )\times10^{-3}$		1548
Lepton Family number (*LF*) violating modes				
$e^\pm\mu^\mp$	*LF*	$<1.1\times10^{-6}$	CL=90%	1547
$e^\pm\tau^\mp$	*LF*	$<8.3\times10^{-6}$	CL=90%	1039
$\mu^\pm\tau^\mp$	*LF*	$<2.0\times10^{-6}$	CL=90%	1035

$\chi_{c0}(1P)$

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

Mass $m = 3414.76 \pm 0.35$ MeV (S = 1.2)
Full width $\Gamma = 10.4 \pm 0.7$ MeV

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(2.41 ± 0.23) %		1679
$f_0(980) f_0(980) \to 2\pi^+ 2\pi^-$	$(7.1 \pm2.3) \times 10^{-4}$		–
$\pi^+\pi^- K^+ K^-$	(2.0 ± 0.4) %	S=1.6	1580
$f_0(980) f_0(980) \to \pi^+\pi^- K^+ K^-$	$(1.7 {}^{+1.1}_{-1.0}) \times 10^{-4}$		–
$f_0(980) f_0(2200) \to \pi^+\pi^- K^+ K^-$	$(8.4 {}^{+2.2}_{-2.7}) \times 10^{-4}$		–
$f_0(1370) f_0(1370) \to \pi^+\pi^- K^+ K^-$	$< 2.9 \times 10^{-4}$	CL=90%	–
$f_0(1370) f_0(1500) \to \pi^+\pi^- K^+ K^-$	$< 1.8 \times 10^{-4}$	CL=90%	–
$f_0(1370) f_0(1710) \to \pi^+\pi^- K^+ K^-$	$(7.1 {}^{+3.8}_{-2.5}) \times 10^{-4}$		–
$f_0(1500) f_0(1370) \to \pi^+\pi^- K^+ K^-$	$< 1.4 \times 10^{-4}$	CL=90%	–
$f_0(1500) f_0(1500) \to \pi^+\pi^- K^+ K^-$	$< 6 \times 10^{-5}$	CL=90%	–
$f_0(1500) f_0(1710) \to \pi^+\pi^- K^+ K^-$	$< 7 \times 10^{-5}$	CL=90%	–
$\rho^0 \pi^+\pi^-$	(1.6 ± 0.5) %		1607
$3(\pi^+\pi^-)$	(1.19 ± 0.18) %		1633
$K^+ \overline{K}^*(892)^0 \pi^- +$ c.c.	(1.2 ± 0.4) %		1523
$K_1(1270)^+ K^- +$ c.c. $\to \pi^+\pi^- K^+ K^-$	$(6.7 \pm2.0) \times 10^{-3}$		–
$K_1(1400)^+ K^- +$ c.c. $\to \pi^+\pi^- K^+ K^-$	$< 2.9 \times 10^{-3}$	CL=90%	–
$K^*(892)^0 \overline{K}^*(892)^0$	$(1.8 \pm0.6) \times 10^{-3}$		1456
$K_0^*(1430)^0 \overline{K}_0^*(1430)^0 \to \pi^+\pi^- K^+ K^-$	$(1.05{}^{+0.39}_{-0.30}) \times 10^{-3}$		–
$K_0^*(1430)^0 \overline{K}_2^*(1430)^0 +$ c.c. $\to \pi^+\pi^- K^+ K^-$	$(8.5 {}^{+2.1}_{-2.6}) \times 10^{-4}$		–
$K^+ K^-$	$(5.4 \pm0.6) \times 10^{-3}$		1634
$\pi\pi$	$(7.2 \pm0.6) \times 10^{-3}$		1702
$\eta\eta$	$(1.9 \pm0.5) \times 10^{-3}$		1617
$\omega\omega$	$(2.3 \pm0.7) \times 10^{-3}$		1517
$K^+ K^- K_S^0 K_S^0$	$(1.5 \pm0.5) \times 10^{-3}$		1331
$K^+ K^- K^+ K^-$	$(2.1 \pm0.4) \times 10^{-3}$		1333
$K_S^0 K_S^0$	$(2.8 \pm0.7) \times 10^{-3}$	S=1.9	1633
$K_S^0 K_S^0 \pi^+\pi^-$	$(6.1 \pm1.1) \times 10^{-3}$		1579
$K_S^0 K_S^0 p\overline{p}$	$< 8.8 \times 10^{-4}$	CL=90%	884

$\pi^+\pi^- p\overline{p}$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320
$\phi\phi$	$(9 \pm 5) \times 10^{-4}$		1370
$p\overline{p}$	$(2.16\pm0.19) \times 10^{-4}$		1426
$\Lambda\overline{\Lambda}$	$(4.4 \pm 1.5) \times 10^{-4}$		1292
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$< 4.0 \times 10^{-3}$	CL=90%	1153
$\Xi^-\overline{\Xi}^+$	$< 1.03 \times 10^{-3}$	CL=90%	1081
$K_S^0 K^+\pi^- +$ c.c.	$< 7 \times 10^{-4}$	CL=90%	1610
Radiative decays			
$\gamma J/\psi(1S)$	(1.30 ± 0.11) %		303
$\gamma\gamma$	$(2.76\pm0.33) \times 10^{-4}$		1707

$\chi_{c1}(1P)$

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

Mass $m = 3510.66 \pm 0.07$ MeV (S = 1.5)
Full width $\Gamma = 0.89 \pm 0.05$ MeV

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$3(\pi^+\pi^-)$	$(5.8\pm1.4) \times 10^{-3}$	S=1.2	1683
$2(\pi^+\pi^-)$	$(7.6\pm2.6) \times 10^{-3}$		1728
$\pi^+\pi^- K^+K^-$	$(4.5\pm1.0) \times 10^{-3}$		1632
$\rho^0\pi^+\pi^-$	$(3.9\pm3.5) \times 10^{-3}$		1657
$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	$(3.2\pm2.1) \times 10^{-3}$		1577
$K^*(892)^0\overline{K}^*(892)^0$	$(1.6\pm0.4) \times 10^{-3}$		1512
$K_S^0 K^+\pi^- +$ c.c.	$(2.3\pm0.7) \times 10^{-3}$		1661
$\pi^+\pi^- K_S^0 K_S^0$	$(7.7\pm3.3) \times 10^{-4}$		1630
$\pi^+\pi^- p\overline{p}$	$(4.9\pm1.9) \times 10^{-4}$		1381
$K^+K^-K^+K^-$	$(3.9\pm1.7) \times 10^{-4}$		1393
$p\overline{p}$	$(6.7\pm0.5) \times 10^{-5}$		1484
$\Lambda\overline{\Lambda}$	$(2.4\pm1.0) \times 10^{-4}$		1355
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$< 1.5 \times 10^{-3}$	CL=90%	1223
$K_S^0 K_S^0 p\overline{p}$	$< 4.5 \times 10^{-4}$	CL=90%	968
$\Xi^-\overline{\Xi}^+$	$< 3.4 \times 10^{-4}$	CL=90%	1156
$\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$		–
$K_S^0 K_S^0$	$< 7 \times 10^{-5}$	CL=90%	1683
Radiative decays			
$\gamma J/\psi(1S)$	(35.6 ± 1.9) %		389

$\chi_{c2}(1P)$

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

Mass $m = 3556.20 \pm 0.09$ MeV
Full width $\Gamma = 2.06 \pm 0.12$ MeV

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(1.23 ± 0.15) %		1751
$\pi^+\pi^-K^+K^-$	$(9.9\pm2.5)\times10^{-3}$	S=1.6	1656
$3(\pi^+\pi^-)$	$(8.6\pm1.8)\times10^{-3}$		1707
$\rho^0\pi^+\pi^-$	$(7\pm4)\times10^{-3}$		1681
$K^+\overline{K}^*(892)^0\pi^-+$ c.c.	$(4.8\pm2.8)\times10^{-3}$		1602
$K^*(892)^0\overline{K}^*(892)^0$	$(3.8\pm0.8)\times10^{-3}$		1538
$\phi\phi$	$(1.9\pm0.7)\times10^{-3}$		1457
$\omega\omega$	$(2.0\pm0.7)\times10^{-3}$		1597
$\pi\pi$	$(2.14\pm0.25)\times10^{-3}$		1773
$\eta\eta$	$<1.2\times10^{-3}$	CL=90%	1692
$\pi^+\pi^-K^0_SK^0_S$	$(2.6\pm0.6)\times10^{-3}$		1655
$K^+K^-K^+K^-$	$(1.41\pm0.35)\times10^{-3}$		1421
$\pi^+\pi^-p\overline{p}$	$(1.32\pm0.34)\times10^{-3}$		1410
K^+K^-	$(7.7\pm1.4)\times10^{-4}$		1708
$K^0_SK^0_S$	$(6.7\pm1.1)\times10^{-4}$		1707
$K^0_SK^0_Sp\overline{p}$	$<7.9\times10^{-4}$	CL=90%	1007
$p\overline{p}$	$(6.6\pm0.5)\times10^{-5}$		1510
$\Lambda\overline{\Lambda}$	$(2.7\pm1.3)\times10^{-4}$		1385
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$<3.5\times10^{-3}$	CL=90%	1255
$J/\psi(1S)\pi^+\pi^-\pi^0$	<1.5 %	CL=90%	185
$K^0_SK^+\pi^-+$ c.c.	$<1.0\times10^{-3}$	CL=90%	1685
$\Xi^-\overline{\Xi}^+$	$<3.7\times10^{-4}$	CL=90%	1190
Radiative decays			
$\gamma J/\psi(1S)$	(20.2 ± 1.0) %		430
$\gamma\gamma$	$(2.59\pm0.19)\times10^{-4}$		1778

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

Mass $m = 3638 \pm 4$ MeV (S = 1.8)
Full width $\Gamma = 14 \pm 7$ MeV

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	seen	1729
$\gamma\gamma$	seen	1819

$\psi(2S)$

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

Mass $m = 3686.093 \pm 0.034$ MeV (S = 1.4)
Full width $\Gamma = 337 \pm 13$ keV
$\Gamma_{ee} = 2.48 \pm 0.06$ 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	–
e^+e^-	$(7.35 \pm 0.18) \times 10^{-3}$		1843
$\mu^+\mu^-$	$(7.3 \pm 0.8) \times 10^{-3}$		1840
$\tau^+\tau^-$	$(2.8 \pm 0.7) \times 10^{-3}$		489
Decays into $J/\psi(1S)$ and anything			
$J/\psi(1S)$ anything	(56.1 ± 0.9) %		–
$J/\psi(1S)$ neutrals	(23.0 ± 0.4) %		–
$J/\psi(1S)\pi^+\pi^-$	(31.8 ± 0.6) %		477
$J/\psi(1S)\pi^0\pi^0$	(16.46 ± 0.35) %		481
$J/\psi(1S)\eta$	(3.09 ± 0.08) %		200
$J/\psi(1S)\pi^0$	$(1.26 \pm 0.13) \times 10^{-3}$	S=1.3	528
Hadronic decays			
$3(\pi^+\pi^-)\pi^0$	$(3.5 \pm 1.6) \times 10^{-3}$		1746
$2(\pi^+\pi^-)\pi^0$	$(2.66 \pm 0.29) \times 10^{-3}$		1799
$\rho a_2(1320)$	$(2.6 \pm 0.9) \times 10^{-4}$		1500
$p\overline{p}$	$(2.65 \pm 0.22) \times 10^{-4}$	S=1.4	1586
$\Delta^{++}\overline{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		1371
$\Lambda\overline{\Lambda}$	$(2.5 \pm 0.7) \times 10^{-4}$	S=3.1	1467
$\Sigma^+\overline{\Sigma}^-$	$(2.6 \pm 0.8) \times 10^{-4}$		1408
$\Sigma^0\overline{\Sigma}^0$	$(2.1 \pm 0.7) \times 10^{-4}$	S=2.0	1405
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	$(1.1 \pm 0.4) \times 10^{-4}$		1218
$\Xi^-\overline{\Xi}^+$	$(1.5 \pm 0.7) \times 10^{-4}$	S=3.0	1285

$\Xi^0 \overline{\Xi}^0$	$(2.8 \pm 0.9) \times 10^{-4}$		1292
$\Xi(1530)^0 \overline{\Xi}(1530)^0$	$< 8.1 \times 10^{-5}$	CL=90%	1025
$\Omega^- \overline{\Omega}^+$	$< 7.3 \times 10^{-5}$	CL=90%	774
$\pi^0 p \overline{p}$	$(1.33 \pm 0.17) \times 10^{-4}$		1543
$\eta p \overline{p}$	$(6.0 \pm 1.2) \times 10^{-5}$		1373
$\omega p \overline{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		1247
$\phi p \overline{p}$	$< 2.4 \times 10^{-5}$	CL=90%	1109
$\pi^+ \pi^- p \overline{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		1491
$2(\pi^+ \pi^- \pi^0)$	$(4.5 \pm 1.4) \times 10^{-3}$		1776
$\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	1791
$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		1778
$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		–
$\omega \pi^+ \pi^-$	$(6.6 \pm 1.7) \times 10^{-4}$	S=2.7	1748
$b_1^{\pm} \pi^{\mp}$	$(3.6 \pm 0.6) \times 10^{-4}$		1635
$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		–
$\omega f_2(1270)$	$(2.0 \pm 0.6) \times 10^{-4}$		1515
$\pi^+ \pi^- K^+ K^-$	$(7.2 \pm 0.5) \times 10^{-4}$		1726
$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1616
$K^*(892)^0 \overline{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		1418
$K^+ K^- 2(\pi^+ \pi^-)$	$(1.8 \pm 0.9) \times 10^{-3}$		1654
$K_1(1270)^{\pm} K^{\mp}$	$(1.00 \pm 0.28) \times 10^{-3}$		1581
$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1724
$\rho^0 p \overline{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		1251
$K^+ \overline{K}^*(892)^0 \pi^- +$ c.c.	$(6.7 \pm 2.5) \times 10^{-4}$		1674
$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	1817
$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	1750
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.24 \pm 0.10) \times 10^{-3}$		1694
$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		–
$K^*(892)^0 K^- \pi^+ \pi^0 +$ c.c.	$(8.6 \pm 2.2) \times 10^{-4}$		–
$K^*(892)^+ K^- \pi^+ \pi^- +$ c.c.	$(9.6 \pm 2.8) \times 10^{-4}$		–
$K^*(892)^+ K^- \rho^0 +$ c.c.	$(7.3 \pm 2.6) \times 10^{-4}$		–
$K^*(892)^0 K^- \rho^+ +$ c.c.	$(6.1 \pm 1.8) \times 10^{-4}$		–
$\eta K^+ K^-$	$< 1.3 \times 10^{-4}$	CL=90%	1664
$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$	S=1.1	1614
$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	1774
$p \overline{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		1435
$K^+ K^-$	$(1.0 \pm 0.7) \times 10^{-4}$		1776
$K_S^0 K_L^0$	$(5.2 \pm 0.7) \times 10^{-5}$		1775
$\pi^+ \pi^- \pi^0$	$(1.68 \pm 0.26) \times 10^{-4}$	S=1.4	1830
$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 {}^{+1.2}_{-0.4}) \times 10^{-4}$		–
$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	–
$\pi^+ \pi^-$	$(8 \pm 5) \times 10^{-5}$		1838
$K_1(1400)^{\pm} K^{\mp}$	$< 3.1 \times 10^{-4}$	CL=90%	1532

$K^+K^-\pi^0$	< 2.96	$\times 10^{-5}$	CL=90%	1754
$\quad K^+\overline{K}^*(892)^- +$ c.c.	$(1.7\ ^{+0.8}_{-0.7})$	$\times 10^{-5}$		1698
$K^*(892)^0\overline{K}^0 +$ c.c.	(1.09 ± 0.20)	$\times 10^{-4}$		1697
$\phi\pi^+\pi^-$	(1.13 ± 0.29)	$\times 10^{-4}$	S=1.7	1690
$\quad \phi f_0(980) \rightarrow \pi^+\pi^-$	$(6.0\ \pm2.2\ )$	$\times 10^{-5}$		–
$2(K^+K^-)$	$(6.0\ \pm1.4\ )$	$\times 10^{-5}$		1499
ϕK^+K^-	$(7.0\ \pm1.6\ )$	$\times 10^{-5}$		1546
$2(K^+K^-)\pi^0$	(1.10 ± 0.28)	$\times 10^{-4}$		1440
$\phi\eta$	$(2.8\ ^{+1.0}_{-0.8})$	$\times 10^{-5}$		1654
$\phi\eta'$	$(3.1\ \pm1.6\ )$	$\times 10^{-5}$		1555
$\omega\eta'$	$(3.2\ ^{+2.5}_{-2.1})$	$\times 10^{-5}$		1623
$\omega\pi^0$	$(2.1\ \pm0.6\ )$	$\times 10^{-5}$		1757
$\rho\eta'$	$(1.9\ ^{+1.7}_{-1.2})$	$\times 10^{-5}$		1625
$\rho\eta$	$(2.2\ \pm0.6\ )$	$\times 10^{-5}$	S=1.1	1717
$\omega\eta$	< 1.1	$\times 10^{-5}$	CL=90%	1715
$\phi\pi^0$	< 4	$\times 10^{-6}$	CL=90%	1699
$p\overline{p}K^+K^-$	$(2.7\ \pm0.7\ )$	$\times 10^{-5}$		1118
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$(2.8\ \pm0.6\ )$	$\times 10^{-4}$		1346
$\Lambda\overline{p}K^+$	(1.00 ± 0.14)	$\times 10^{-4}$		1327
$\Lambda\overline{p}K^+\pi^+\pi^-$	$(1.8\ \pm0.4\ )$	$\times 10^{-4}$		1167
$\phi f_2'(1525)$	$(4.4\ \pm1.6\ )$	$\times 10^{-5}$		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

$\gamma\chi_{c0}(1P)$	$(9.2\ \pm0.4\ )$	%		261
$\gamma\chi_{c1}(1P)$	$(8.7\ \pm0.4\ )$	%		171
$\gamma\chi_{c2}(1P)$	$(8.1\ \pm0.4\ )$	%		128
$\gamma\eta_c(1S)$	$(2.6\ \pm0.4\ )$	$\times 10^{-3}$		638
$\gamma\eta_c(2S)$	< 2.0	$\times 10^{-3}$	CL=90%	47
$\gamma\eta'(958)$	$(1.5\ \pm0.4\ )$	$\times 10^{-4}$		1719
$\gamma f_2(1270)$	$(2.1\ \pm0.4\ )$	$\times 10^{-4}$		1622
$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(3.0\ \pm1.3\ )$	$\times 10^{-5}$		–
$\gamma f_0(1710) \rightarrow \gamma K\overline{K}$	$(6.0\ \pm1.6\ )$	$\times 10^{-5}$		–

$\gamma\gamma$	$<$ 1.3	$\times 10^{-4}$	CL=90%	1843
$\gamma\eta$	$<$ 9	$\times 10^{-5}$	CL=90%	1802
$\gamma\eta(1405) \to \gamma K\overline{K}\pi$	$<$ 1.2	$\times 10^{-4}$	CL=90%	1569

$\psi(3770)$

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

Mass $m = 3771.1 \pm 2.4$ MeV
Full width $\Gamma = 23.0 \pm 2.7$ MeV (S = 1.1)
$\Gamma_{ee} = 0.242^{+0.027}_{-0.024}$ keV (S = 1.1)

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).

ψ(3770) DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\overline{D}$	dominant		281
$D^0\overline{D}^0$	seen		281
D^+D^-	seen		247
$J/\psi\pi^+\pi^-$	$(1.93\pm0.28) \times 10^{-3}$		558
$J/\psi\pi^0\pi^0$	$(8.0 \pm3.0) \times 10^{-4}$		562
$J/\psi\eta$	$(9 \pm4) \times 10^{-4}$		357
$J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	601
e^+e^-	$(1.05\pm0.14) \times 10^{-5}$	S=1.1	1886
$K^0_S K^0_L$	$< 2.1 \times 10^{-4}$	CL=90%	1819
$2(\pi^+\pi^-)$	$< 1.12 \times 10^{-3}$	CL=90%	1860
$2(\pi^+\pi^-)\pi^0$	$< 1.06 \times 10^{-3}$	CL=90%	1842
$\eta\pi^+\pi^-$	$< 1.24 \times 10^{-3}$	CL=90%	1835
$\omega\pi^+\pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	1793
$\eta 3\pi$	$< 1.34 \times 10^{-3}$	CL=90%	1823
$\eta' 3\pi$	$< 2.44 \times 10^{-3}$	CL=90%	1739
$K^+K^-\pi^+\pi^-$	$< 9.0 \times 10^{-4}$	CL=90%	1771
$\phi\pi^+\pi^-$	$< 4.1 \times 10^{-4}$	CL=90%	1736
$\phi f_0(980)$	$< 4.5 \times 10^{-4}$	CL=90%	1599
$K^+K^-\pi^+\pi^-\pi^0$	$< 2.36 \times 10^{-3}$	CL=90%	1740
ηK^+K^-	$< 4.1 \times 10^{-4}$	CL=90%	1711
ωK^+K^-	$< 3.4 \times 10^{-4}$	CL=90%	1663
$2(K^+K^-)$	$< 6.0 \times 10^{-4}$	CL=90%	1550
ϕK^+K^-	$< 7.5 \times 10^{-4}$	CL=90%	1596
$2(K^+K^-)\pi^0$	$< 2.9 \times 10^{-4}$	CL=90%	1492
$p\overline{p}\pi^+\pi^-$	$< 5.8 \times 10^{-4}$	CL=90%	1543
$p\overline{p}\pi^+\pi^-\pi^0$	$< 1.85 \times 10^{-3}$	CL=90%	1489

$\eta p \overline{p}$	< 5.4	$\times 10^{-4}$	CL=90%	1429
$\omega p \overline{p}$	< 2.9	$\times 10^{-4}$	CL=90%	1308
$p \overline{p} K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	1184
$\phi p \overline{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1176
$\Lambda \overline{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	1520
$\Lambda \overline{\Lambda} \pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	1403
$\Lambda \overline{p} K^+$	< 2.8	$\times 10^{-4}$	CL=90%	1385
$\Lambda \overline{p} K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	1232
$\phi \eta$	$(3.1 \pm 0.7\ )$	$\times 10^{-4}$		1702
$\pi^+ \pi^- \pi^0$	not seen			1873
$\rho \pi$	not seen			1803
$\omega \pi^0$	not seen			1802
$\phi \pi^0$	not seen			1745
$\rho \eta$	not seen			1762
$\omega \eta$	not seen			1761
$\rho \eta'$	not seen			1673
$\omega \eta'$	not seen			1671
$\phi \eta'$	not seen			1605
$K^{*0} \overline{K}^0$	not seen			1743
$K^{*+} K^-$	not seen			1744
$b_1 \pi$	not seen			1682

$X(3872)$

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

Quantum numbers not established.

Mass $m = 3871.2 \pm 0.5$ MeV (S = 1.4)
$m_{X(3872)^\pm} - m_{J/\psi} = 775 \pm 4$ MeV
$m_{X(3872)^\pm} - m_{\psi(2S)}$
Full width $\Gamma < 2.3$ MeV, CL = 90%

$X(3872)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+ \pi^- J/\psi(1S)$	seen	649
$D^0 \overline{D}^0$	not seen	520
$D^+ D^-$	not seen	502
$D^0 \overline{D}^0 \pi^0$	not seen	117

$\chi_{c2}(2P)$

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

Mass $m = 3929 \pm 5$ MeV
Full width $\Gamma = 29 \pm 10$ MeV

$\psi(4040)$ [xxx]

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

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

ψ(4040) DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$(1.07\pm0.16) \times 10^{-5}$		2019
$D^0 \overline{D}{}^0$	seen		776
$D^*(2007)^0 \overline{D}{}^0$ + c.c.	seen		576
$D^*(2007)^0 \overline{D}{}^*(2007)^0$	seen		227
$J/\psi \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	794
$J/\psi \pi^0 \pi^0$	$< 2 \times 10^{-3}$	90%	797
$J/\psi \eta$	$< 7 \times 10^{-3}$	90%	675
$J/\psi \pi^0$	$< 2 \times 10^{-3}$	90%	823
$J/\psi \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	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
$\phi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%	1880

$\psi(4160)$ [xxx]

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

Mass $m = 4153 \pm 3$ MeV
Full width $\Gamma = 103 \pm 8$ MeV
$\Gamma_{ee} = 0.83 \pm 0.07$ keV

ψ(4160) DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$(8.1\pm0.9) \times 10^{-6}$		2076
$J/\psi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%	888
$J/\psi \pi^0 \pi^0$	$< 3 \times 10^{-3}$	90%	891
$J/\psi K^+ K^-$	$< 2 \times 10^{-3}$	90%	324
$J/\psi \eta$	$< 8 \times 10^{-3}$	90%	786
$J/\psi \pi^0$	$< 1 \times 10^{-3}$	90%	914
$J/\psi \eta'$	$< 5 \times 10^{-3}$	90%	385
$J/\psi \pi^+ \pi^- \pi^0$	$< 1 \times 10^{-3}$	90%	847
$\psi(2S) \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	353
$\chi_{c1} \gamma$	$< 7 \times 10^{-3}$	90%	593
$\chi_{c2} \gamma$	< 1.3 %	90%	554

$\chi_{c1}\pi^+\pi^-\pi^0$	< 2	$\times 10^{-3}$	90%	452
$\chi_{c2}\pi^+\pi^-\pi^0$	< 8	$\times 10^{-3}$	90%	398
$\phi\pi^+\pi^-$	< 2	$\times 10^{-3}$	90%	1941

$\psi(4415)$ [xxx]

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

Mass $m = 4421 \pm 4$ MeV
Full width $\Gamma = 62 \pm 20$ MeV
$\Gamma_{ee} = 0.58 \pm 0.07$ keV

ψ(4415) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
hadrons	dominant	–
e^+e^-	$(9.4\pm3.2) \times 10^{-6}$	2210

$b\overline{b}$ 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)
$\tau^+\tau^-$	$(2.67^{+0.14}_{-0.16})$ %		4384
e^+e^-	(2.38 ± 0.11) %		4730
$\mu^+\mu^-$	(2.48 ± 0.05) %		4729
Hadronic decays			
$\eta'(958)$ anything	(2.8 ± 0.4) %		–
$J/\psi(1S)$ anything	$(6.5 \pm0.7) \times 10^{-4}$		4223
χ_{c0} anything	$< 5 \times 10^{-3}$	90%	–
χ_{c1} anything	$(2.3 \pm0.7) \times 10^{-4}$		–
χ_{c2} anything	$(3.4 \pm1.0) \times 10^{-4}$		–
$\psi(2S)$ anything	$(2.7 \pm0.9) \times 10^{-4}$		–
$\rho\pi$	$< 2 \times 10^{-4}$	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
$\pi^0\pi^+\pi^-$	$< 1.84 \times 10^{-5}$	90%	4725

Radiative decays

$\gamma \pi^+ \pi^-$	$(6.3 \pm 1.8) \times 10^{-5}$		4728
$\gamma \pi^0 \pi^0$	$(1.7 \pm 0.7) \times 10^{-5}$		4728
$K^+ K^-$ with $2 < m_{K^+ K^-} < 3$ GeV	$(1.14 \pm 0.13) \times 10^{-5}$		–
$\gamma p \overline{p}$ with $2 < m_{p \overline{p}} < 3$ GeV	$< 6 \times 10^{-6}$	90%	–
$\gamma 2h^+ 2h^-$	$(7.0 \pm 1.5) \times 10^{-4}$		4720
$\gamma 3h^+ 3h^-$	$(5.4 \pm 2.0) \times 10^{-4}$		4703
$\gamma 4h^+ 4h^-$	$(7.4 \pm 3.5) \times 10^{-4}$		4679
$\gamma \pi^+ \pi^- K^+ K^-$	$(2.9 \pm 0.9) \times 10^{-4}$		4686
$\gamma 2\pi^+ 2\pi^-$	$(2.5 \pm 0.9) \times 10^{-4}$		4720
$\gamma 3\pi^+ 3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$		4703
$\gamma 2\pi^+ 2\pi^- K^+ K^-$	$(2.4 \pm 1.2) \times 10^{-4}$		4658
$\gamma \pi^+ \pi^- p \overline{p}$	$(1.5 \pm 0.6) \times 10^{-4}$		4604
$\gamma 2\pi^+ 2\pi^- p \overline{p}$	$(4 \pm 6) \times 10^{-5}$		4563
$\gamma 2K^+ 2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$		4601
$\gamma \eta'(958)$	$< 1.6 \times 10^{-5}$	90%	4682
$\gamma \eta$	$< 2.1 \times 10^{-5}$	90%	4714
$\gamma f_0(980)$	$< 3 \times 10^{-5}$	90%	4679
$\gamma f'_2(1525)$	$(3.7 {}^{+1.2}_{-1.1}) \times 10^{-5}$		4607
$\gamma f_2(1270)$	$(1.00 \pm 0.10) \times 10^{-4}$		4644
$\gamma \eta(1405)$	$< 8.2 \times 10^{-5}$	90%	4625
$\gamma f_0(1710)$	$< 1.8 \times 10^{-4}$	90%	4574
$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$	90%	4513
$\gamma f_0(2200) \to \gamma K^+ K^-$	$< 2 \times 10^{-4}$	90%	4475
$\gamma f_J(2220) \to \gamma K^+ K^-$	$< 8 \times 10^{-7}$	90%	4469
$\gamma f_J(2220) \to \gamma \pi^+ \pi^-$	$< 6 \times 10^{-7}$	90%	–
$\gamma f_J(2220) \to \gamma p \overline{p}$	$< 1.1 \times 10^{-6}$	90%	–
$\gamma \eta(2225) \to \gamma \phi \phi$	$< 3 \times 10^{-3}$	90%	4469
γX (X = pseudoscalar with $m < 7.2$ GeV)	$< 3 \times 10^{-5}$	90%	–
$\gamma X \overline{X}$ ($X \overline{X}$ = vectors with $m < 3.1$ GeV)	$< 1 \times 10^{-3}$	90%	–

$\chi_{b0}(1P)$ [yyy]

$I^G(J^{PC}) = 0^+(0^{++})$
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)
$\gamma \Upsilon(1S)$	<6 %	90%	391

$\chi_{b1}(1P)$ [yyy]

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

Mass $m = 9892.78 \pm 0.26 \pm 0.31$ MeV

$\chi_{b1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(35±8) %	423

$\chi_{b2}(1P)$ [yyy]

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

Mass $m = 9912.21 \pm 0.26 \pm 0.31$ MeV

$\chi_{b2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(22±4) %	442

$\Upsilon(2S)$

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

Mass $m = 10.02326 \pm 0.00031$ GeV
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)
$\Upsilon(1S)\pi^+\pi^-$	(18.8 ±0.6) %		475
$\Upsilon(1S)\pi^0\pi^0$	(9.0 ±0.8) %		480
$\tau^+\tau^-$	(1.7 ±1.6) %		4686
$\mu^+\mu^-$	(1.93±0.17) %	S=2.2	5011
e^+e^-	(1.91±0.16) %		5012
$\Upsilon(1S)\pi^0$	$< 1.1 \times 10^{-3}$	CL=90%	531
$\Upsilon(1S)\eta$	$< 2 \times 10^{-3}$	CL=90%	127
$J/\psi(1S)$ anything	$< 6 \times 10^{-3}$	CL=90%	4533
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%	4930
$\gamma\,\eta_b(1S)$	$< 5.1 \times 10^{-4}$	CL=90%	697

$\chi_{b0}(2P)$ [yyy]

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

Mass $m = 10.2325 \pm 0.0004 \pm 0.0005$ GeV

$\chi_{b0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\,\Upsilon(2S)$	(4.6 ± 2.1) %	207
$\gamma\,\Upsilon(1S)$	$(9\ \pm6\ ) \times 10^{-3}$	743

$\chi_{b1}(2P)$ [yyy]

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

Mass $m = 10.25546 \pm 0.00022 \pm 0.00050$ GeV
$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$ MeV

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(\ 1.63^{+0.38}_{-0.34})$ %		135
$\gamma\,\Upsilon(2S)$	$(21\ \ \pm4\ \ )$ %	1.5	230
$\gamma\,\Upsilon(1S)$	$(\ 8.5\ \pm1.3\ )$ %	1.3	764
$\pi\pi\,\chi_{b1}(1P)$	$(\ 8.6\ \pm3.1\ ) \times 10^{-3}$		238

$\chi_{b2}(2P)$ [yyy]

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

Mass $m = 10.26865 \pm 0.00022 \pm 0.00050$ GeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.5 \pm 0.6$ MeV

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(\ 1.10^{+0.34}_{-0.30})$ %	194
$\gamma\,\Upsilon(2S)$	$(16.2\ \pm2.4\ )$ %	242
$\gamma\,\Upsilon(1S)$	$(\ 7.1\ \pm1.0\ )$ %	777
$\pi\pi\,\chi_{b2}(1P)$	$(\ 6.0\ \pm2.1\ ) \times 10^{-3}$	229

$\Upsilon(3S)$

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

Mass $m = 10.3552 \pm 0.0005$ GeV
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
$\Upsilon(2S)\pi^+\pi^-$	(2.8 ± 0.6) %	S=2.2	177
$\Upsilon(2S)\pi^0\pi^0$	(2.00 ± 0.32) %		190
$\Upsilon(2S)\gamma\gamma$	(5.0 ± 0.7) %		327
$\Upsilon(1S)\pi^+\pi^-$	(4.48 ± 0.21) %		813
$\Upsilon(1S)\pi^0\pi^0$	(2.06 ± 0.28) %		816
$\Upsilon(1S)\eta$	$< 2.2 \times 10^{-3}$	CL=90%	677
$\mu^+\mu^-$	(2.18 ± 0.21) %	S=2.1	5177
e^+e^-	seen		5178
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
$\gamma\chi_{b0}(1P)$	$(3.0 \pm 1.1) \times 10^{-3}$		484
$\gamma\eta_b(2S)$	$< 6.2 \times 10^{-4}$	CL=90%	–
$\gamma\eta_b(1S)$	$< 4.3 \times 10^{-4}$	CL=90%	1001

$\Upsilon(4S)$ or $\Upsilon(10580)$

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

Mass $m = 10.5794 \pm 0.0012$ GeV
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%	330
B^+B^-	(50.9 ± 0.7) %		335
D_s^+ anything + c.c.	(18.2 ± 3.2) %		–
$B^0\overline{B}^0$	(49.1 ± 0.7) %		330
non-$B\overline{B}$	< 4 %	95%	–
e^+e^-	$(1.57 \pm 0.08) \times 10^{-5}$		5290
$J/\psi(1S)$ anything	$< 1.9 \times 10^{-4}$	95%	–
D^{*+} anything + c.c.	< 7.4 %	90%	5099
ϕ anything	$< 2.3 \times 10^{-3}$	90%	5240
$\Upsilon(1S)$ anything	$< 4 \times 10^{-3}$	90%	1053
$\Upsilon(1S)\pi^+\pi^-$	$< 1.2 \times 10^{-4}$	90%	1026
$\Upsilon(2S)\pi^+\pi^-$	$< 3.9 \times 10^{-4}$	90%	468

$\Upsilon(10860)$

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

Mass $m = 10.865 \pm 0.008$ GeV (S = 1.1)
Full width $\Gamma = 110 \pm 13$ MeV
$\Gamma_{ee} = 0.31 \pm 0.07$ keV (S = 1.3)

$\Upsilon(10860)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	$(2.8 \pm 0.7) \times 10^{-6}$	5432
D_s anything + c.c.	(45 ± 11) %	–

$\Upsilon(11020)$

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

Mass $m = 11.019 \pm 0.008$ GeV
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^-	$(1.6 \pm 0.5) \times 10^{-6}$	5510

NOTES

[*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 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 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.

[*f*] Due to a new measurement in the average, this is 0.45 MeV larger than the mass we gave in our 2002 edition, 547.30 ± 0.12 MeV.

[*g*] Due to removing an old measurement from the average, this is 0.11 keV larger than the width we gave in our 2002 edition, 1.18 ± 0.11 keV. See the $\Gamma(2\gamma)$ data block in the Data Listings.

[*h*] *C* parity forbids this to occur as a single-photon process.

[*i*] See the "Note on scalar mesons" in the $f_0(1370)$ Particle Listings . The interpretation of this entry as a particle is controversial.

[*j*] See the "Note on $\rho(770)$" in the $\rho(770)$ Particle Listings .

[*k*] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \to \mu^+ \mu^-) = \Gamma(\rho^0 \to e^+ e^-) \times 0.99785$.

[*l*] See the "Note on scalar mesons" in the $f_0(1370)$ Particle Listings .

[*m*] See the "Note on $a_1(1260)$" in the $a_1(1260)$ Particle Listings .

[*n*] 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 for details.

[*o*] See the "Note on non-$q\overline{q}$ mesons" in the Particle Listings (see the index for the page number).

[*p*] See the "Note on the $\eta(1405)$" in the $\eta(1405)$ Particle Listings.

[*q*] See the "Note on the $f_1(1420)$" in the $\eta(1405)$ Particle Listings.

[*r*] See also the $\omega(1650)$ Particle Listings.

[*s*] See the "Note on the $\rho(1450)$ and the $\rho(1700)$" in the $\rho(1700)$ Particle Listings.

[*t*] See also the $\omega(1420)$ Particle Listings.

[*u*] See the "Note on $f_0(1710)$" in the $f_0(1710)$ Particle Listings .

[*v*] See the note in the $K^{\pm}$ Particle Listings.

[*w*] The definition of the slope parameter g of the $K \rightarrow 3\pi$ Dalitz plot is as follows (see also "Note on Dalitz Plot Parameters for $K \rightarrow 3\pi$ Decays" in the $K^{\pm}$ Particle Listings):

$$\left|M\right|^2 = 1 + g(s_3 - s_0)/m^2_{\pi^+} + \cdots .$$

[*x*] For more details and definitions of parameters see the Particle Listings.

[*y*] Most of this radiative mode, the low-momentum γ part, is also included in the parent mode listed without γ's.

[*z*] See the $K^{\pm}$ Particle Listings for the energy limits used in this measurement.

[*aa*] Structure-dependent part.

[*bb*] Direct-emission branching fraction.

[*cc*] Violates angular-momentum conservation.

[*dd*] Derived from measured values of ϕ_{+-}, ϕ_{00}, $\left|\eta\right|$, $\left|m_{K^0_L} - m_{K^0_S}\right|$, 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 $K_S \rightarrow 3\pi$" and "Note on *CP* Violation in K^0_L Decay" in the Particle Listings):

$$\eta_{+-} = \left|\eta_{+-}\right| e^{i\phi_{+-}} = \frac{A(K^0_L \rightarrow \pi^+\pi^-)}{A(K^0_S \rightarrow \pi^+\pi^-)} = \epsilon + \epsilon'$$

$$\eta_{00} = \left|\eta_{00}\right| e^{i\phi_{00}} = \frac{A(K^0_L \rightarrow \pi^0\pi^0)}{A(K^0_S \rightarrow \pi^0\pi^0)} = \epsilon - 2\epsilon'$$

$$\delta = \frac{\Gamma(K^0_L \rightarrow \pi^-\ell^+\nu) - \Gamma(K^0_L \rightarrow \pi^+\ell^-\nu)}{\Gamma(K^0_L \rightarrow \pi^-\ell^+\nu) + \Gamma(K^0_L \rightarrow \pi^+\ell^-\nu)} ,$$

$$\mathrm{Im}(\eta_{+-0})^2 = \frac{\Gamma(K^0_S \rightarrow \pi^+\pi^-\pi^0)^{CP \text{ viol.}}}{\Gamma(K^0_L \rightarrow \pi^+\pi^-\pi^0)} ,$$

$$\mathrm{Im}(\eta_{000})^2 = \frac{\Gamma(K^0_S \rightarrow \pi^0\pi^0\pi^0)}{\Gamma(K^0_L \rightarrow \pi^0\pi^0\pi^0)} .$$

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 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*] Re(ϵ'/ϵ) = ϵ'/ϵ to a very good approximation provided the phases satisfy *CPT* invariance.

[*ii*] See the K^0_L Particle Listings for the energy limits used in this measurement.

[*jj*] Allowed by higher-order electroweak interactions.

[*kk*] Violates *CP* in leading order. Test of direct *CP* violation since the indirect *CP*-violating and *CP*-conserving contributions are expected to be suppressed.

[*ll*] See the "Note on $f_0(1370)$" in the $f_0(1370)$ Particle Listings and in the 1994 edition.

[*mm*] See the note in the $L(1770)$ Particle Listings in Reviews of Modern Physics **56** No. 2 Pt. II (1984), p. S200. See also the "Note on $K_2(1770)$ and the $K_2(1820)$" in the $K_2(1770)$ Particle Listings .

[*nn*] See the "Note on $K_2(1770)$ and the $K_2(1820)$" in the $K_2(1770)$ Particle Listings .

[*oo*] This result applies to $Z^0 \rightarrow c\overline{c}$ decays only. Here ℓ^+ is an average (not a sum) of e^+ and μ^+ decays.

[*pp*] This is a weighted average of $D^{\pm}$ (44%) and D^0 (56%) branching fractions. See "$D^+ \text{and} D^0 \rightarrow$ (η anything) / (total D^+ and D^0)" under "D^+ Branching Ratios" in the Particle Listings.

[*qq*] 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.

[*rr*] These subfractions of the $K^-\pi^+\pi^+$ mode are uncertain: see the Particle Listings.

[*ss*] The two experiments measuring this fraction are in serious disagreement. See the Particle Listings.

[*tt*] This is *not* a test for the ΔC=1 weak neutral current, but leads to the $\pi^+ e^+ e^-$ final state.

[*uu*] This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

[*vv*] This $D^0_1 - D^0_2$ limit is inferred from the D^0-$\overline{D}^0$ mixing ratio $\Gamma(K^+\pi^-$ (via $\overline{D}^0$)) / $\Gamma(K^-\pi^+)$ near the end of the D^0 Listings.

[*ww*] This value is obtained by subtracting the branching fractions for 2-, 4- and 6-prongs from unity.

[*xx*] This is the sum of our $K^-\pi^+\pi^+\pi^-$, $K^-\pi^+\pi^+\pi^-\pi^0$, $\overline{K}^0 2\pi^+ 2\pi^-$, $2\pi^+ 2\pi^-$, $2\pi^+ 2\pi^- \pi^0$, $K^+ K^- \pi^+ \pi^-$, and $K^+ K^- \pi^+ \pi^- \pi^0$, branching fractions.

[*yy*] 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 6.14 ± 0.20 %.

[*zz*] This is a doubly Cabibbo-suppressed mode.

[*aaa*] This branching fraction includes all the decay modes of the resonance in the final state.

[*bbb*] The experiments on the division of this charge mode amongst its submodes disagree, and the submode branching fractions here add up to considerably more than the charged-mode fraction.

[*ccc*] However, these upper limits are in serious disagreement with values obtained in another experiment.

[*ddd*] For now, we average together measurements of the $X e^+ \nu_e$ and $X \mu^+ \nu_\mu$ branching fractions. This is the *average*, not the *sum*.

[*eee*] This branching fraction includes all the decay modes of the final-state resonance.

[*fff*] This comes from a K-matrix parametrization of the $\pi^+\pi^-$ S-wave and is a sum over the $f_0(980)$, $f_0(1300)$, $f_0(1200\text{–}1600)$, $f_0(1500)$, and $f_0(1750)$. Not all of these correspond to particles in our Tables.

[*ggg*] An ℓ indicates an e or a μ mode, not a sum over these modes.

[*hhh*] An $CP(\pm1)$ indicates the $CP{=}+1$ and $CP{=}-1$ eigenstates of the D^0-$\overline{D}^0$ system.

[*iii*] D denotes D^0 or $\overline{D}^0$.

[*jjj*] $X(3872)^+$ is a hypothetical charged partner of the $X(3872)$.

[*kkk*] $\Theta(1710)^{++}$ is a possible narrow pentaquark state and $G(2220)$ is a possible glueball resonance.

[*lll*] Stands for the possible candidates of $K^*(1410)$, $K_0^*(1430)$ and $K_2^*(1430)$.

[*mmm*] B^0 and B_s^0 contributions not separated. Limit is on weighted average of the two decay rates.

[*nnn*] $\Theta(1540)^+$ denotes a possible narrow pentaquark state.

[*ooo*] These values are model dependent.

[*ppp*] Here "anything" means at least one particle observed.

[*qqq*] 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.

[*rrr*] $D^{(*)}\overline{D}^{(*)}$ stands for the sum of $D^*\overline{D}^*$, $D^*\overline{D}$, $D\overline{D}^*$, and $D\overline{D}$.

[*sss*] $Y(3940)$ denotes a near-threshold enhancement in the $\omega J/\psi$ mass spectrum.

[*ttt*] Inclusive branching fractions have a multiplicity definition and can be greater than 100%.

[*uuu*] D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states.

[*vvv*] Not a pure measurement. See note at head of B_s^0 Decay Modes.

[*www*] Includes $p\overline{p}\pi^+\pi^-\gamma$ and excludes $p\overline{p}\eta$, $p\overline{p}\omega$, $p\overline{p}\eta'$.

[*xxx*] 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.

[*yyy*] Spectroscopic labeling for these states is theoretical, pending experimental information.