

$c\bar{c}$ MESONS

(including possibly non- $q\bar{q}$ states)

$\eta_c(1S)$

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

Mass $m = 2984.09 \pm 0.30$ MeV (S = 1.2)

Full width $\Gamma = 30.0 \pm 0.5$ MeV (S = 1.2)

$\eta_c(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Decays involving hadronic resonances			
$\eta'(958)\pi\pi$	(1.59±0.34) %	S=1.7	1323
$\eta'(958)K\bar{K}$	(1.37±0.31) %		1131
$\eta'(958)\eta\eta$	(2.7 ±0.5) × 10 ⁻³		1081
$\rho\rho$	(1.41±0.34) %		1275
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(1.43±0.35) %		1278
$K^*(892)\bar{K}^*(892)$	(5.5 ±1.1) × 10 ⁻³	S=1.2	1196
$K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.1 ±0.4) %		1073
$\phi K^+ K^-$	(3.0 $\begin{smallmatrix} +1.2 \\ -1.0 \end{smallmatrix}$) × 10 ⁻³		1104
$\phi\phi$	(1.4 ±0.4) × 10 ⁻³	S=2.9	1089
$\phi 2(\pi^+ \pi^-)$	< 3.3 × 10 ⁻³	CL=90%	1251
$a_0(980)\pi$	seen		1327
$a_2(1320)\pi$	seen		1196
$K^*(892)\bar{K} + \text{c.c.}$	< 1.28 %	CL=90%	1310
$f_2(1270)\eta$	seen		1146
$f_2(1270)\eta'$	seen		984
$\omega\omega$	(2.1 ±0.8) × 10 ⁻³	S=2.4	1270
$\omega\phi$	(3.0 ±0.8) × 10 ⁻⁵		1185
$f_2(1270)f_2(1270)$	(8.4 ±2.4) × 10 ⁻³	S=1.2	774
$f_2(1270)f_2'(1525)$	(7.7 ±2.5) × 10 ⁻³		524
$f_0(500)\eta$	seen		-
$f_0(500)\eta'$	seen		-
$f_0(980)\eta$	seen		1265
$f_0(980)\eta'$	seen		1130
$f_0(1500)\eta$	seen		1016
$f_0(1710)\eta'$	seen		633
$f_0(2100)\eta'$	seen		†
$f_0(2200)\eta$	seen		499
$a_0(1320)\pi$	seen		-
$a_0(1450)\pi$	seen		1140

$a_2(1700)\pi$	seen	999
$a_0(1710)\pi$	seen	994
$a_0(1950)\pi$	seen	860
$K_0^*(1430)\bar{K} + \text{c.c.}$	seen	1086
$K_2^*(1430)\bar{K} + \text{c.c.}$	seen	1084
$K_0^*(1950)\bar{K} + \text{c.c.}$	seen	742
$K_0^*(2600)\bar{K} + \text{c.c.}$	seen	—

Decays into stable hadrons

$K\bar{K}\pi$	(5.9 ± 0.5) %	S=1.8	1381
$K\bar{K}\eta$	(1.11 ± 0.15) %	S=1.3	1265
$\eta\pi^+\pi^-$	(1.5 ± 0.4) %		1428
$\eta 2(\pi^+\pi^-)$	(4.0 ± 1.2) %		1386
$K^+K^-\pi^+\pi^-$	(6.7 ± 1.8) × 10 ⁻³	S=2.4	1345
$K^+K^-\pi^+\pi^-\pi^0$	(2.8 ± 0.5) %		1305
$K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.}$	(5.1 ± 1.4) %		1302
$K^+K^-2(\pi^+\pi^-)$	(6.9 ± 2.0) × 10 ⁻³		1254
$2(K^+K^-)$	(1.2 ± 0.4) × 10 ⁻³	S=1.6	1056
$\pi^+\pi^-\pi^0$	< 4 × 10 ⁻⁴	CL=90%	1476
$\pi^+\pi^-\pi^0\pi^0$	(4.3 ± 1.0) %		1461
$2(\pi^+\pi^-)$	(7.5 ± 1.3) × 10 ⁻³	S=1.6	1459
$2(\pi^+\pi^-\pi^0)$	(15.5 ± 2.0) %		1409
$3(\pi^+\pi^-)$	(1.55 ± 0.28) %		1407
$p\bar{p}$	(1.11 ± 0.12) × 10 ⁻³	S=1.4	1160
$p\bar{p}\pi^0$	(3.2 ± 1.2) × 10 ⁻³		1101
$p\bar{p}\pi^+\pi^-$	(3.4 ± 0.5) × 10 ⁻³	S=1.2	1027
$\Lambda\bar{\Lambda}$	(9.4 ± 1.8) × 10 ⁻⁴	S=1.2	991
$K^+\bar{p}\Lambda + \text{c.c.}$	(2.26 ± 0.34) × 10 ⁻³		773
$\bar{\Lambda}(1520)\Lambda + \text{c.c.}$	(2.8 ± 1.2) × 10 ⁻³		694
$\Sigma^+\bar{\Sigma}^-$	(1.98 ± 0.35) × 10 ⁻³		901
$\Xi^-\bar{\Xi}^+$	(8.3 ± 1.8) × 10 ⁻⁴		692

Radiative decays

$\gamma\gamma$	(2.13 ± 0.15) × 10 ⁻⁴	S=1.5	1492
$\gamma\phi$	(1.15 ^{+0.33} _{-0.40}) × 10 ⁻⁵		1318

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

$\pi^+\pi^-$	P, CP	< 1.0	× 10 ⁻⁴	CL=90%	1486
$\pi^0\pi^0$	P, CP	< 3.3	× 10 ⁻⁵	CL=90%	1486
K^+K^-	P, CP	< 5	× 10 ⁻⁴	CL=90%	1408
$K_S^0K_S^0$	P, CP	< 2.9	× 10 ⁻⁴	CL=90%	1407

J/ψ(1S)

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

Mass $m = 3096.900 \pm 0.006$ MeV

Full width $\Gamma = 92.6 \pm 1.7$ keV (S = 1.1)

J/ψ(1S) DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level (MeV/c)	p
hadrons	(87.7 ± 0.5) %		—
virtual $\gamma \rightarrow$ hadrons	(13.46 ± 0.07) %		—
ggg	(64.1 ± 1.0) %		—
γgg	(8.8 ± 1.1) %		—
$e^+ e^-$	(5.971 ± 0.032) %		1548
$e^+ e^- \gamma$	[a] (8.8 ± 1.4) × 10 ⁻³		1548
$\mu^+ \mu^-$	(5.961 ± 0.033) %		1545
$e^+ e^- e^+ e^-$	(5.5 ± 0.5) × 10 ⁻⁵		1548
$e^+ e^- \mu^+ \mu^-$	(3.53 ± 0.26) × 10 ⁻⁵		1545
$\mu^+ \mu^- \mu^+ \mu^-$	(1.11 ± 0.11) × 10 ⁻⁶		1530

Decays involving hadronic resonances

$\rho\pi$	(1.88 ± 0.12) %	S=2.6	1448
$\rho^0\pi^0$	(6.2 ± 0.6) × 10 ⁻³		1448
$a_2(1320)^0\pi^+\pi^- \rightarrow$ $2(\pi^+\pi^-)\pi^0$	(2.8 ± 0.6) × 10 ⁻³		—
$a_2(1320)^+\pi^-\pi^0 + c.c. \rightarrow$ $2(\pi^+\pi^-)\pi^0$	(3.7 ± 0.7) × 10 ⁻³		—
$a_2(1320)\rho$	(1.09 ± 0.22) %		1123
$\eta\pi^+\pi^-$	(3.8 ± 0.7) × 10 ⁻⁴		1487
$\eta\rho$	(1.93 ± 0.23) × 10 ⁻⁴		1396
$\eta\pi^+\pi^-\pi^0$	(1.17 ± 0.20) %		1470
$\eta\pi^+\pi^-3\pi^0$	(4.9 ± 1.0) × 10 ⁻³		1419
$\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow$ $\eta\phi\pi^+\pi^-$	(1.2 ± 0.4) × 10 ⁻⁴		628
$\eta\phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	—
$\eta K^+ K^-$	(8.6 ± 3.0) × 10 ⁻⁴		1331
$\eta K^\pm K_S^0 \pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		1278
$\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		1003
$\rho\eta'(958)$	(8.1 ± 0.8) × 10 ⁻⁵	S=1.6	1281
$\rho^\pm\pi^\mp\pi^+\pi^-\pi^0$	(2.8 ± 0.8) %		1364
$\rho^+\rho^-\pi^+\pi^-\pi^0$	(6 ± 4) × 10 ⁻³		1186
$\rho^+ K^+ K^- \pi^- + c.c. \rightarrow$ $K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 ± 0.8) × 10 ⁻³		—
$\rho^\mp K^\pm K_S^0$	(1.9 ± 0.4) × 10 ⁻³		1269
$\rho(1450)\pi$	seen		1197
$\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.2 ± 1.1) × 10 ⁻⁴		—

$\rho(1450)^\pm \pi^\mp \rightarrow K_S^0 K^\pm \pi^\mp$	$(3.3 \pm 0.6) \times 10^{-4}$		—
$\rho(1450)^0 \pi^0 \rightarrow K^+ K^- \pi^0$	$(2.7 \pm 0.6) \times 10^{-4}$		—
$\rho(1450) \eta'(958) \rightarrow \pi^+ \pi^- \eta'(958)$	$(3.3 \pm 0.7) \times 10^{-6}$		—
$\rho(1700) \pi$	seen		1065
$\rho(1700) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.6 \pm 1.1) \times 10^{-4}$		—
$\rho(2150) \pi$	seen		790
$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(10 \pm 40) \times 10^{-6}$		—
$\omega \pi^0$	$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	1446
$\omega \pi^0 \rightarrow \pi^+ \pi^- \pi^0$	$(1.6 \pm 0.7) \times 10^{-5}$		—
$\omega \pi^+ \pi^-$	$(8.5 \pm 1.0) \times 10^{-3}$	S=1.3	1435
$\omega \pi^0 \pi^0$	$(3.4 \pm 0.8) \times 10^{-3}$		1436
$\omega 3\pi^0$	$(1.9 \pm 0.6) \times 10^{-3}$		1419
$\omega f_2(1270)$	$(4.3 \pm 0.6) \times 10^{-3}$		1142
$\omega \eta$	$(1.74 \pm 0.20) \times 10^{-3}$	S=1.6	1394
$\omega \pi^+ \pi^- \pi^0$	$(4.0 \pm 0.7) \times 10^{-3}$		1418
$\omega \pi^0 \eta$	$(3.4 \pm 1.7) \times 10^{-4}$		1363
$\omega \pi^+ \pi^+ \pi^- \pi^-$	$(8.5 \pm 3.4) \times 10^{-3}$		1392
$\omega \pi^+ \pi^- 2\pi^0$	$(3.3 \pm 0.5) \%$		1394
$\omega \eta' \pi^+ \pi^-$	$(1.12 \pm 0.13) \times 10^{-3}$		1173
$\omega \eta'(958)$	$(1.89 \pm 0.18) \times 10^{-4}$		1279
$\omega f_0(980)$	$(1.4 \pm 0.5) \times 10^{-4}$		1267
$\omega f_0(1710) \rightarrow \omega K \bar{K}$	$(4.8 \pm 1.1) \times 10^{-4}$		878
$\omega f_1(1420)$	$(6.8 \pm 2.4) \times 10^{-4}$		1061
$\omega f_2'(1525)$	$< 2.2 \times 10^{-4}$	CL=90%	1007
$\omega X(1835) \rightarrow \omega p \bar{p}$	$< 3.9 \times 10^{-6}$	CL=95%	—
$\omega K^+ K^- \eta$	$(3.33 \pm 0.12) \times 10^{-4}$		996
$\omega X(1835), X \rightarrow \eta' \pi^+ \pi^-$	$< 6.2 \times 10^{-5}$		—
$\omega K^+ K^-$	$(1.52 \pm 0.31) \times 10^{-3}$		1268
$\omega K^\pm K_S^0 \pi^\mp$	[b] $(3.4 \pm 0.5) \times 10^{-3}$		1210
$\omega K \bar{K}$	$(1.9 \pm 0.4) \times 10^{-3}$		1268
$\omega K^*(892) \bar{K} + \text{c.c.}$	$(6.1 \pm 0.9) \times 10^{-3}$		1097
$\eta' K^{*\pm} K^\mp$	$(1.48 \pm 0.13) \times 10^{-3}$		—
$\eta' K^{*0} \bar{K}^0 + \text{c.c.}$	$(1.66 \pm 0.21) \times 10^{-3}$		1000
$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.}$	$(2.16 \pm 0.31) \times 10^{-4}$		—
$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	$(1.51 \pm 0.23) \times 10^{-4}$		—
$\eta' h_1(1415) \rightarrow \gamma \eta' \eta'$	$(4.7 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.1 \\ 2.0 \end{smallmatrix}) \times 10^{-7}$		—
$\bar{K} K^*(892) + \text{c.c.}$	seen		1373
$\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	$(4.8 \pm 0.5) \times 10^{-3}$		—
$K^+ K^*(892)^- + \text{c.c.}$	$(6.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.8 \\ 1.0 \end{smallmatrix}) \times 10^{-3}$	S=2.9	1373
$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(2.69 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.13 \\ 0.20 \end{smallmatrix}) \times 10^{-3}$		—

$K^+ K^*(892)^- + \text{c.c.} \rightarrow$	$(3.0 \pm 0.4) \times 10^{-3}$	—	
$K^0 K^\pm \pi^\mp + \text{c.c.}$			
$K^0 \bar{K}^*(892)^0 + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-3}$	1373	
$K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow$	$(3.2 \pm 0.4) \times 10^{-3}$	—	
$K^0 K^\pm \pi^\mp + \text{c.c.}$			
$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	$(5.7 \pm 0.8) \times 10^{-3}$	1343	
$K^*(892)^\pm K^\mp \pi^0$	$(4.1 \pm 1.3) \times 10^{-3}$	1344	
$K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$(2.0 \pm 0.5) \times 10^{-3}$	1342	
$K^*(892)^+ K_S^0 \pi^- + \text{c.c.} \rightarrow$	$(6.7 \pm 2.2) \times 10^{-4}$	—	
$K_S^0 K_S^0 \pi^+ \pi^-$			
$K^*(892)^0 K^- \pi^+ + \text{c.c.} \rightarrow$	$(3.8 \pm 0.5) \times 10^{-3}$	—	
$K^+ K^- \pi^+ \pi^-$			
$K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(6.3 \begin{smallmatrix} +0.6 \\ -0.5 \end{smallmatrix}) \times 10^{-6}$	—	
$K^*(892)^0 K_S^0 \pi^0$	$(7 \pm 4) \times 10^{-4}$	1343	
$K^*(892)^\pm K^*(700)^\mp$	$(1.1 \begin{smallmatrix} +1.0 \\ -0.6 \end{smallmatrix}) \times 10^{-3}$	—	
$K^*(892)^0 \bar{K}^*(892)^0$	$(2.3 \pm 0.6) \times 10^{-4}$	1266	
$K^*(892)^\pm K^*(892)^\mp$	$(1.00 \begin{smallmatrix} +0.22 \\ -0.40 \end{smallmatrix}) \times 10^{-3}$	1266	
$K_1(1400)^\pm K^\mp$	$(3.8 \pm 1.4) \times 10^{-3}$	1170	
$K^*(1410) \bar{K} + \text{c.c.}$	seen	1165	
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$	$(7 \pm 4) \times 10^{-5}$	—	
$K^\pm K^\mp \pi^0$			
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$	$(8 \pm 5) \times 10^{-5}$	—	
$K_S^0 K^\pm \pi^\mp$			
$K_2^*(1430) \bar{K} + \text{c.c.}$	seen	1158	
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$	$(1.0 \pm 0.5) \times 10^{-4}$	—	
$K^\pm K^\mp \pi^0$			
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$	$(3.8 \pm 1.0) \times 10^{-4}$	—	
$K_S^0 K^\pm \pi^\mp$			
$\bar{K}_2^*(1430) K + \text{c.c.}$	$< 4.0 \times 10^{-3}$	CL=90%	1158
$K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow$	$(2.69 \begin{smallmatrix} +0.25 \\ -0.19 \end{smallmatrix}) \times 10^{-4}$	—	
$K^+ K^- \pi^0$			
$K_2^*(1430)^0 K^- \pi^+ + \text{c.c.} \rightarrow$	$(2.6 \pm 0.9) \times 10^{-3}$	—	
$K^+ K^- \pi^+ \pi^-$			
$K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}$	$(3.6 \pm 1.8) \times 10^{-3}$	1116	
$\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}$	$(4.67 \pm 0.29) \times 10^{-3}$	1011	
$K_2^*(1430)^- K^*(892)^+ + \text{c.c.}$	$(3.4 \pm 2.9) \times 10^{-3}$	1011	
$K_2^*(1430)^- K^*(892)^+ +$	$(4 \pm 4) \times 10^{-4}$	—	
$\text{c.c.} \rightarrow$			
$K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$			
$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90%	601
$\bar{K}_2^*(1770)^0 K^*(892)^0 + \text{c.c.} \rightarrow$	$(6.9 \pm 0.9) \times 10^{-4}$	—	
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$			

$K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(1.10 \pm_{-0.14}^{+0.60}) \times 10^{-5}$		–
$K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(6.2 \pm_{-1.6}^{+2.9}) \times 10^{-6}$		–
$K_1(1270)^\pm K^\mp$	< 3.0	$\times 10^{-3}$	CL=90% 1238
$K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5) \times 10^{-7}$		–
$a_2(1320)^\pm \pi^\mp$	[b] < 4.3	$\times 10^{-3}$	CL=90% 1263
$\phi \pi^0$	3×10^{-6} or 1×10^{-7}		1377
$\phi \pi^+ \pi^-$	$(9.4 \pm 1.5) \times 10^{-4}$		S=1.7 1365
$\phi \pi^0 \pi^0$	$(4.9 \pm 1.0) \times 10^{-4}$		1366
$\phi 2(\pi^+ \pi^-)$	$(1.60 \pm 0.32) \times 10^{-3}$		1318
$\phi \eta$	$(7.4 \pm 0.6) \times 10^{-4}$		S=1.2 1320
$\phi \eta'(958)$	$(4.6 \pm 0.5) \times 10^{-4}$		S=2.2 1192
$\phi \eta \eta'$	$(2.32 \pm 0.17) \times 10^{-4}$		885
$\phi f_0(980)$	$(3.2 \pm 0.9) \times 10^{-4}$		S=1.9 1178
$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	$(2.57 \pm 0.34) \times 10^{-4}$		–
$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$	$(1.7 \pm 0.5) \times 10^{-4}$		–
$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(4.5 \pm 1.0) \times 10^{-6}$		–
$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \rho^0 \pi^0$	$(1.7 \pm 0.6) \times 10^{-6}$		1045
$\phi f_0(980) \eta \rightarrow \eta \phi \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-4}$		–
$\phi(1680)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(6.7 \pm 1.1) \times 10^{-6}$		–
$X(2000)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(1.70 \pm_{-0.23}^{+0.50}) \times 10^{-6}$		–
$h_1(1900)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(8.4 \pm_{-1.3}^{+1.4}) \times 10^{-6}$		–
$\phi f_2(1270)$	$(3.2 \pm 0.6) \times 10^{-4}$		1036
$\phi f_1(1285)$	$(2.6 \pm 0.5) \times 10^{-4}$		1032
$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(9.4 \pm 2.8) \times 10^{-7}$		952
$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0$	$(2.1 \pm 2.2) \times 10^{-7}$		955
$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$		946
$\phi f_2'(1525)$	$(8 \pm 4) \times 10^{-4}$		S=2.7 877
$\phi X(1835) \rightarrow \phi p \bar{p}$	< 2.1	$\times 10^{-7}$	CL=90% –
$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	< 2.8	$\times 10^{-4}$	CL=90% 578
$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	< 6.13	$\times 10^{-5}$	CL=90% –
$\phi K \bar{K}$	$(1.77 \pm 0.16) \times 10^{-3}$		S=1.3 1179
$\phi f_0(1710) \rightarrow \phi K \bar{K}$	$(3.6 \pm 0.6) \times 10^{-4}$		875
$\phi K^+ K^-$	$(8.2 \pm 1.1) \times 10^{-4}$		1179
$\phi K_S^0 K_S^0$	$(5.8 \pm 1.5) \times 10^{-4}$		1176
$\phi K^\pm K_S^0 \pi^\mp$	[b] $(7.2 \pm 0.8) \times 10^{-4}$		1114
$\phi K^*(892) \bar{K} + \text{c.c.}$	$(2.18 \pm 0.23) \times 10^{-3}$		969
$b_1(1235)^\pm \pi^\mp$	[b] $(3.0 \pm 0.5) \times 10^{-3}$		1300

$b_1(1235)^0 \pi^0$	$(2.3 \pm 0.6) \times 10^{-3}$		1300
$f_2'(1525) K^+ K^-$	$(1.04 \pm 0.35) \times 10^{-3}$		897
$\Delta(1232)^+ \bar{p}$	$< 1 \times 10^{-4}$	CL=90%	1100
$\Delta(1232)^{++} \bar{p} \pi^-$	$(1.6 \pm 0.5) \times 10^{-3}$		1030
$\Delta(1232)^{++} \bar{\Delta}(1232)^{--}$	$(1.10 \pm 0.29) \times 10^{-3}$		938
$\bar{\Sigma}(1385)^0 p K^-$	$(5.1 \pm 3.2) \times 10^{-4}$		646
$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	$< 8.2 \times 10^{-6}$	CL=90%	911
$\Sigma(1385)^- \bar{\Sigma}^+ + \text{c.c.}$	[b] $(3.0 \pm 0.7) \times 10^{-4}$		855
$\Sigma(1385)^+ \bar{\Sigma}^- + \text{c.c.}$	$(3.3 \pm 0.8) \times 10^{-4}$		861
$\Sigma(1385)^- \bar{\Sigma}(1385)^+ + \text{c.c.}$	[b] $(1.08 \pm 0.06) \times 10^{-3}$		697
$\Sigma(1385)^+ \bar{\Sigma}(1385)^- + \text{c.c.}$	$(1.25 \pm 0.07) \times 10^{-3}$		697
$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(1.07 \pm 0.08) \times 10^{-3}$		697
$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	$< 4.1 \times 10^{-6}$	CL=90%	–
$\bar{\Lambda}(1520) \Lambda + \text{c.c.}$	$< 1.80 \times 10^{-3}$	CL=90%	807
$\Xi^0 \Xi^0$	$(1.17 \pm 0.04) \times 10^{-3}$		818
$\Xi(1530)^- \Xi^+ + \text{c.c.}$	$(3.18 \pm 0.08) \times 10^{-4}$		600
$\Xi(1530)^0 \Xi^0$	$(3.2 \pm 1.4) \times 10^{-4}$		608
$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	[c] $< 1.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	[c] $< 2.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	[c] $< 1.6 \times 10^{-5}$	CL=90%	–
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	[c] $< 5.6 \times 10^{-5}$	CL=90%	–
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	[c] $< 1.1 \times 10^{-5}$	CL=90%	–

Decays into stable hadrons

$2(\pi^+ \pi^-) \pi^0$	$(4.2 \pm 0.4) \%$	S=2.1	1496
$3(\pi^+ \pi^-) \pi^0$	$(2.9 \pm 0.6) \%$		1433
$\pi^+ \pi^- 3\pi^0$	$(1.9 \pm 0.9) \%$		1497
$\rho^\pm \pi^\mp \pi^0 \pi^0$	$(1.41 \pm 0.22) \%$		1421
$\rho^+ \rho^- \pi^0$	$(6.0 \pm 1.1) \times 10^{-3}$		1298
$\pi^+ \pi^- 4\pi^0$	$(6.5 \pm 1.3) \times 10^{-3}$		1470
$\pi^+ \pi^- \pi^0$	$(2.00 \pm 0.07) \%$	S=2.0	1533
$2(\pi^+ \pi^- \pi^0)$	$(1.61 \pm 0.20) \%$		1468
$\pi^+ \pi^- \pi^0 K^+ K^-$	$(1.52 \pm 0.27) \%$	S=1.4	1368
$\pi^+ \pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		1542
$2(\pi^+ \pi^-)$	$(3.20 \pm 0.25) \times 10^{-3}$	S=1.2	1517
$3(\pi^+ \pi^-)$	$(4.3 \pm 0.4) \times 10^{-3}$		1466
$2(\pi^+ \pi^-) 3\pi^0$	$(6.2 \pm 0.9) \%$		1435
$4(\pi^+ \pi^-) \pi^0$	$(9.0 \pm 3.0) \times 10^{-3}$		1345
$2(\pi^+ \pi^-) \eta$	$(2.29 \pm 0.28) \times 10^{-3}$		1446
$3(\pi^+ \pi^-) \eta$	$(7.2 \pm 1.5) \times 10^{-4}$		1379
$2(\pi^+ \pi^- \pi^0) \eta$	$(1.6 \pm 0.5) \times 10^{-3}$		1381
$\pi^+ \pi^- \pi^0 \pi^0 \eta$	$(2.4 \pm 0.5) \times 10^{-3}$		1448
$\rho^\pm \pi^\mp \pi^0 \eta$	$(1.9 \pm 0.8) \times 10^{-3}$		1326

$K^+ K^-$	$(3.06 \pm 0.05) \times 10^{-4}$		1468
$K_S^0 K_L^0$	$(1.95 \pm 0.11) \times 10^{-4}$	S=2.4	1466
$K_S^0 K_S^0$	$< 4.7 \times 10^{-9}$	CL=90%	1466
$K \bar{K} \pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1442
$K^+ K^- \pi^0$	$(2.88 \pm 0.12) \times 10^{-3}$		1442
$K_S^0 K^\pm \pi^\mp$	$(5.3 \pm 0.5) \times 10^{-3}$		1440
$K_S^0 K_L^0 \pi^0$	$(2.06 \pm 0.26) \times 10^{-3}$		1440
$K^*(892)^0 \bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0 K_L^0 \pi^0$	$(1.21 \pm 0.18) \times 10^{-3}$		—
$K_2^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0 K_L^0 \pi^0$	$(4.3 \pm 1.3) \times 10^{-4}$		—
$K^+ K^- \pi^+ \pi^-$	$(7.0 \pm 1.0) \times 10^{-3}$		1407
$K^+ K^- \pi^0 \pi^0$	$(2.13 \pm 0.22) \times 10^{-3}$		1410
$K^+ K^- \pi^0 \pi^0 \pi^0$	$(1.61 \pm 0.29) \times 10^{-3}$		1371
$K_S^0 K^\pm \pi^\mp \pi^0 \pi^0$	$(5.3 \pm 0.7) \times 10^{-3}$		1369
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(6.3 \pm 0.4) \times 10^{-3}$		1366
$K_S^0 K^\pm \rho(770)^\pm \pi^0$	$(2.9 \pm 0.8) \times 10^{-3}$		—
$K_S^0 K_L^0 \pi^+ \pi^-$	$(3.8 \pm 0.6) \times 10^{-3}$		1406
$K_S^0 K_L^0 \pi^0 \pi^0$	$(1.9 \pm 0.4) \times 10^{-3}$		1408
$K_S^0 K_L^0 \eta$	$(1.45 \pm 0.33) \times 10^{-3}$		1328
$K_S^0 K_S^0 \pi^+ \pi^-$	$(1.68 \pm 0.19) \times 10^{-3}$		1406
$K^\mp K_S^0 \pi^\pm \pi^0$	$(5.7 \pm 0.5) \times 10^{-3}$		1408
$K_S^0 K^\pm \pi^\mp \rho(770)^0$	$(3.1 \pm 0.5) \times 10^{-3}$		—
$K^+ K^- 2(\pi^+ \pi^-)$	$(3.1 \pm 1.3) \times 10^{-3}$		1320
$K^+ K^- \pi^+ \pi^- \eta$	$(4.7 \pm 0.7) \times 10^{-3}$		1221
$2(K^+ K^-)$	$(7.2 \pm 0.8) \times 10^{-4}$		1131
$K^+ K^- K_S^0 K_S^0$	$(4.2 \pm 0.7) \times 10^{-4}$		1127
$K_S^0 K^*(892)^0 \pi^+ \pi^-$	$(1.7 \pm 0.6) \times 10^{-3}$		1304
$K_S^0 K^*(892)^0 \pi^0 \pi^0$	$(1.01 \pm 0.18) \times 10^{-3}$		1306
$K^\mp K^*(892)^\pm \pi^+ \pi^-$	$(3.4 \pm 1.2) \times 10^{-3}$		1305
$K^*(892)^\pm K^*(892)^0 \pi^\mp$	$(4.8 \pm 1.0) \times 10^{-3}$		1212
$K^\mp K^*(892)^\pm \pi^0 \pi^0$	$(1.57 \pm 0.32) \times 10^{-3}$		1308
$K^*(892)^+ K^*(892)^- \pi^0$	$(1.12 \pm 0.23) \%$		1214
$p \bar{p}$	$(2.121 \pm 0.029) \times 10^{-3}$		1232
$p \bar{p} \pi^0$	$(1.19 \pm 0.08) \times 10^{-3}$	S=1.1	1176
$p \bar{p} \pi^+ \pi^-$	$(6.0 \pm 0.5) \times 10^{-3}$	S=1.3	1107
$p \bar{p} \pi^+ \pi^- \pi^0$	[d] $(2.3 \pm 0.9) \times 10^{-3}$	S=1.9	1033
$p \bar{p} \eta$	$(1.513 \pm 0.023) \times 10^{-3}$		948
$p \bar{p} \rho$	$< 3.1 \times 10^{-4}$	CL=90%	774
$p \bar{p} \omega$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.3	768
$p \bar{p} \eta'(958)$	$(1.29 \pm 0.14) \times 10^{-4}$	S=2.0	596
$p \bar{p} a_0(980) \rightarrow p \bar{p} \pi^0 \eta$	$(6.8 \pm 1.8) \times 10^{-5}$		—

$p\bar{p}\phi$		$(5.19 \pm 0.33) \times 10^{-5}$		527
$p\bar{n}\pi^{-}$		$(2.12 \pm 0.09) \times 10^{-3}$		1174
$n\bar{n}$		$(2.09 \pm 0.16) \times 10^{-3}$		1231
$n\bar{n}\pi^{+}\pi^{-}$		$(4 \pm 4) \times 10^{-3}$		1106
$nN(1440)$		seen		978
$nN(1520)$		seen		928
$nN(1535)$		seen		917
$\Lambda\bar{\Lambda}$		$(1.88 \pm 0.08) \times 10^{-3}$	S=2.6	1074
$\Lambda\bar{\Lambda}\pi^0$		$(3.8 \pm 0.4) \times 10^{-5}$		998
$\Lambda\bar{\Lambda}\pi^{+}\pi^{-}$		$(4.3 \pm 1.0) \times 10^{-3}$		903
$\Lambda\bar{\Lambda}\eta$		$(1.62 \pm 0.17) \times 10^{-4}$		672
$\Lambda\bar{\Sigma}^{-}\pi^{+} + \text{c.c.}$	[b]	$(1.26 \pm 0.05) \times 10^{-3}$	S=1.2	950
$\Lambda\bar{\Sigma}^{+}\pi^{-} + \text{c.c.}$		$(1.21 \pm 0.07) \times 10^{-3}$	S=1.8	945
$\rho K^{-}\bar{\Lambda} + \text{c.c.}$		$(8.6 \pm 1.1) \times 10^{-4}$		876
$\rho K^{-}\bar{\Sigma}^0$		$(2.9 \pm 0.8) \times 10^{-4}$		819
$\rho K_S^0\bar{\Sigma}^{-} + \text{c.c.}$		$(2.73 \pm 0.05) \times 10^{-4}$		819
$\bar{\Lambda}nK_S^0 + \text{c.c.}$		$(6.5 \pm 1.1) \times 10^{-4}$		872
$\Lambda\bar{\Sigma} + \text{c.c.}$		$(2.83 \pm 0.23) \times 10^{-5}$		1034
$\Sigma^{+}\bar{\Sigma}^{-}$		$(1.07 \pm 0.04) \times 10^{-3}$		992
$\Sigma^0\bar{\Sigma}^0$		$(1.172 \pm 0.032) \times 10^{-3}$	S=1.4	988
$\Sigma^{+}\bar{\Sigma}^{-}\eta$		$(6.3 \pm 0.4) \times 10^{-5}$		498
$\Xi^{-}\bar{\Xi}^{+}$		$(9.7 \pm 0.8) \times 10^{-4}$	S=1.4	807
$\Xi^0\bar{\Sigma}^{-}K^{+} + \text{c.c.}$		$(5.64 \pm 0.33) \times 10^{-5}$		–
$\Xi^0\bar{\Sigma}^0K_S^0 + \text{c.c.}$		$(2.2 \pm 0.4) \times 10^{-5}$		–
$\Xi^0\bar{\Lambda}K_S^0 + \text{c.c.}$		$(3.76 \pm 0.27) \times 10^{-5}$		–

Radiative decays

$\gamma\eta_c(1S)$		$(1.82 \pm 0.15) \%$	S=1.6	111
$\gamma\eta_c(1S) \rightarrow 3\gamma$		seen		–
$\gamma\eta_c(1S) \rightarrow \gamma\eta\eta\eta'$		seen		–
3γ		$(1.16 \pm 0.22) \times 10^{-5}$		1548
4γ		$< 9 \times 10^{-6}$	CL=90%	1548
5γ		$< 1.5 \times 10^{-5}$	CL=90%	1548
$\gamma\pi^0$		$(3.39 \pm 0.08) \times 10^{-5}$		1546
$\gamma\pi^0\pi^0$		$(1.15 \pm 0.05) \times 10^{-3}$		1543
$\gamma 2\pi^{+}2\pi^{-}$		$(2.8 \pm 0.5) \times 10^{-3}$	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)		$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma\pi^{+}\pi^{-}2\pi^0$		$(8.3 \pm 3.1) \times 10^{-3}$		1518
$\gamma K_S^0 K_S^0$		$(8.1 \pm 0.4) \times 10^{-4}$		1466
$\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}]$		$(7 \pm 4) \times 10^{-4}$	S=2.1	1442
$\gamma K^{+}K^{-}\pi^{+}\pi^{-}$		$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma K^{*}(892)\bar{K}^{*}(892)$		$(4.0 \pm 1.3) \times 10^{-3}$		1266

$\gamma\eta$	$(1.090 \pm 0.013) \times 10^{-3}$		1500
$\gamma\eta\pi^0$	$(2.14 \pm 0.31) \times 10^{-5}$		1497
$\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0$	$< 2.5 \times 10^{-6}$	CL=95%	—
$\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0$	$< 6.6 \times 10^{-6}$	CL=95%	—
$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1487
$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		—
$\gamma\eta'(958)$	$(5.28 \pm 0.06) \times 10^{-3}$	S=1.3	1400
$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma\rho\omega$	$< 5.4 \times 10^{-4}$	CL=90%	1338
$\gamma\rho\phi$	$< 8.8 \times 10^{-5}$	CL=90%	1258
$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		1336
$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166
$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		—
$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	$(3.6 \pm 0.6) \times 10^{-6}$		—
$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0$	$(1.50 \pm 0.16) \times 10^{-5}$		—
$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^0\pi^0\pi^0$	$(6.64 \pm 1.10 - 0.23) \times 10^{-6}$		—
$\gamma\eta(1405) \rightarrow \gamma\gamma\gamma$	$< 2.63 \times 10^{-6}$	CL=90%	—
$\gamma\eta(1475) \rightarrow \gamma\gamma\gamma$	$< 1.86 \times 10^{-6}$	CL=90%	—
$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048
$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		—
$\gamma\eta(1760) \rightarrow \gamma\gamma\gamma$	$< 4.80 \times 10^{-6}$	CL=90%	—
$\gamma\eta(2225)$	$(3.14 \pm 0.50 - 0.19) \times 10^{-4}$		752
$\gamma f_2(1270)$	$(1.63 \pm 0.12) \times 10^{-3}$	S=1.3	1286
$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.58 \pm 0.60 - 0.22) \times 10^{-5}$		—
$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1285) \rightarrow \gamma\gamma\phi$	$(2.9 \pm 1.1 - 0.9) \times 10^{-7}$		—
$\gamma f_1(1285) \rightarrow \gamma\pi^0 f_0(980) \rightarrow \gamma\pi^0\pi^0\pi^0$	$(5.6 \pm 0.9 - 3.1) \times 10^{-7}$		—
$\gamma f_1(1285) \rightarrow \gamma a_0(980)^0\pi^0 \rightarrow \gamma K_S^0 K_S^0\pi^0$	$(8.6 \pm 3.4 - 1.1) \times 10^{-6}$		—
$\gamma f_0(1370) \rightarrow \gamma K\bar{K}$	$(4.2 \pm 1.5) \times 10^{-4}$		—
$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.1 \pm 0.4) \times 10^{-5}$		—
$\gamma f_1(1420) \rightarrow \gamma K\bar{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1420) \rightarrow \gamma K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0\pi^0$	$(7.2 \pm 0.7 - 1.3) \times 10^{-5}$		—

$\gamma f_1(1420) \rightarrow \gamma a_0(980)^0 \pi^0 \rightarrow$ $\gamma K_S^0 K_S^0 \pi^0$	$(4.6 \begin{smallmatrix} + 2.4 \\ - 2.0 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_1(1420) \rightarrow \gamma \gamma \phi$	$(5.5 \pm 1.9) \times 10^{-7}$		—
$\gamma f_1(1420) \rightarrow \gamma \pi^0 f_0(980) \rightarrow$ $\gamma \pi^0 \pi^0 \pi^0$	$(2.23 \begin{smallmatrix} + 0.26 \\ - 1.20 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	$(1.09 \pm 0.24) \times 10^{-4}$		1183
$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	$(1.7 \begin{smallmatrix} + 0.6 \\ - 1.4 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \begin{smallmatrix} + 0.24 \\ - 0.60 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		—
$\gamma f_1(1510) \rightarrow \gamma \gamma \phi$	$(7.8 \begin{smallmatrix} + 3.5 \\ - 3.1 \end{smallmatrix}) \times 10^{-7}$		—
$\gamma f'_2(1525)$	$(5.7 \begin{smallmatrix} + 0.8 \\ - 0.5 \end{smallmatrix}) \times 10^{-4}$	S=1.5	1177
$\gamma f'_2(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \begin{smallmatrix} + 0.7 \\ - 0.5 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f'_2(1525) \rightarrow$ $\gamma K^*(892)^0 K_S^0 \rightarrow$ $\gamma K_S^0 K_S^0 \pi^0$	$(9.5 \begin{smallmatrix} + 1.6 \\ - 0.8 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f'_2(1525) \rightarrow \gamma \eta \eta$	$(3.4 \pm 1.4) \times 10^{-5}$		—
$\gamma f'_2(1525) \rightarrow \gamma \gamma \phi$	$(2.8 \begin{smallmatrix} + 0.9 \\ - 0.6 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_2(1640) \rightarrow \gamma \omega \omega$	$(2.8 \pm 1.8) \times 10^{-4}$		—
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.8 \pm 0.5) \times 10^{-4}$		—
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(9.5 \begin{smallmatrix} + 0.9 \\ - 0.5 \end{smallmatrix}) \times 10^{-4}$	S=1.4	1075
$\gamma f_0(1710) \rightarrow \gamma \omega \omega$	$(3.1 \pm 1.0) \times 10^{-4}$		—
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$(2.4 \begin{smallmatrix} + 1.2 \\ - 0.7 \end{smallmatrix}) \times 10^{-4}$		—
$\gamma f_0(1710) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$		—
$\gamma f_0(1810) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \begin{smallmatrix} + 0.20 \\ - 0.33 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f_2(1810) \rightarrow \gamma \eta \eta$	$(5.4 \begin{smallmatrix} + 3.5 \\ - 2.4 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma \eta_1(1855) \rightarrow \gamma \eta \eta'$	$(2.7 \begin{smallmatrix} + 0.4 \\ - 0.5 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$		—
$\gamma f_2(1950) \rightarrow$ $\gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		—
$\gamma f_2(1950) \rightarrow \gamma \gamma \phi$	$(10.0 \begin{smallmatrix} + 3.5 \\ - 2.2 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_2(2010) \rightarrow \gamma \gamma \phi$	$(4.6 \pm 1.5) \times 10^{-6}$		—
$\gamma f_0(2020) \rightarrow \gamma \eta' \eta'$	$(2.63 \begin{smallmatrix} + 0.32 \\ - 0.50 \end{smallmatrix}) \times 10^{-4}$		—
$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		891
$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \begin{smallmatrix} + 0.60 \\ - 0.30 \end{smallmatrix}) \times 10^{-4}$		—

$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$		—
$\gamma f_0(2200)$	seen		776
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$		—
$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	$(2.72 \begin{smallmatrix} + 0.19 \\ - 0.50 \end{smallmatrix}) \times 10^{-4}$		—
$\gamma f_0(2200) \rightarrow \gamma \gamma \phi$	$(2.0 \begin{smallmatrix} + 0.6 \\ - 0.8 \end{smallmatrix}) \times 10^{-7}$		—
$\gamma f_J(2220)$	seen		745
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 3.9	$\times 10^{-5}$	CL=90% —
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 4.1	$\times 10^{-5}$	CL=90% —
$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		—
$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	$(4.9 \pm 0.7) \times 10^{-5}$		—
$\gamma f_0(2330) \rightarrow \gamma \eta' \eta'$	$(6.1 \begin{smallmatrix} + 4.0 \\ - 1.8 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \begin{smallmatrix} + 2.4 \\ - 2.2 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	$(5.5 \begin{smallmatrix} + 4.0 \\ - 1.5 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma f_2(2340) \rightarrow \gamma \eta' \eta'$	$(8.7 \begin{smallmatrix} + 0.9 \\ - 1.8 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma f_0(2470) \rightarrow \gamma \eta' \eta'$	$(8.2 \begin{smallmatrix} + 4.0 \\ - 2.8 \end{smallmatrix}) \times 10^{-7}$		—
$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.7 \begin{smallmatrix} + 0.6 \\ - 0.8 \end{smallmatrix}) \times 10^{-4}$	S=1.6	1006
$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \begin{smallmatrix} + 1.5 \\ - 0.9 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \begin{smallmatrix} + 2.0 \\ - 1.3 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma X(1835) \rightarrow \gamma \gamma \phi(1020)$	$(3.4 \begin{smallmatrix} + 0.8 \\ - 1.1 \end{smallmatrix}) \times 10^{-6}$		—
$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	< 3.56	$\times 10^{-6}$	CL=90% —
$\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \begin{smallmatrix} + 0.7 \\ - 0.8 \end{smallmatrix}) \times 10^{-5}$		—
$\gamma \eta(2370) \rightarrow \gamma K^+ K^- \eta'$	$(1.8 \pm 0.7) \times 10^{-5}$		—
$\gamma \eta(2370) \rightarrow \gamma K_S^0 K_S^0 \eta'$	$(1.2 \pm 0.5) \times 10^{-5}$		—
$\gamma \eta(2370) \rightarrow \gamma \eta \eta \eta'$	< 9.2	$\times 10^{-6}$	CL=90% —
$\gamma D^0 + \text{c.c.}$	< 9.1	$\times 10^{-8}$	CL=90% 987
$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		1232
$\gamma p \bar{p} \pi^+ \pi^-$	< 7.9	$\times 10^{-4}$	CL=90% 1107
$\gamma \Lambda \bar{\Lambda}$	< 1.3	$\times 10^{-4}$	CL=90% 1074
$\gamma A^0 \rightarrow \gamma \text{invisible}$	[e] < 1.7	$\times 10^{-6}$	CL=90% —
$\gamma A^0 \rightarrow \gamma \gamma \gamma$	< 4.9	$\times 10^{-7}$	CL=95% —
$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	[f] < 7.8	$\times 10^{-7}$	CL=90% —

Dalitz decays

$\pi^0 e^+ e^-$	$(8.1 \pm 0.5) \times 10^{-7}$	1546
$\eta e^+ e^-$	$(1.42 \pm 0.08) \times 10^{-5}$	1500
$\eta'(958) e^+ e^-$	$(6.59 \pm 0.18) \times 10^{-5}$	1400

$\eta(1405)e^+e^- \rightarrow$	$(2.04 \pm 0.22) \times 10^{-7}$	—
$f_0(980)\pi^0 e^+e^- \rightarrow$		
$\pi^+\pi^-\pi^0 e^+e^-$		
$X(1835)e^+e^-, X \rightarrow$	$(3.58 \pm 0.25) \times 10^{-6}$	—
$\pi^+\pi^-\eta'$		
$X(2120)e^+e^-, X \rightarrow$	$(8.2 \pm 1.3) \times 10^{-7}$	—
$\pi^+\pi^-\eta'$		
$\eta(2370)e^+e^-, \eta \rightarrow \pi^+\pi^-\eta'$	$(1.08 \pm 0.17) \times 10^{-6}$	—
$\eta U \rightarrow \eta e^+e^-$	$[g] < 9.11$	$\times 10^{-7}$ CL=90% —
$\eta'(958)U \rightarrow \eta'(958)e^+e^-$	$[g] < 2.0$	$\times 10^{-7}$ CL=90% —
ϕe^+e^-	< 1.2	$\times 10^{-7}$ CL=90% 1381

Weak decays

$D^- e^+ \nu_e + \text{c.c.}$	< 7.1	$\times 10^{-8}$	CL=90%	984
$D^- \mu^+ \nu_\mu + \text{c.c.}$	< 5.6	$\times 10^{-7}$	CL=90%	980
$\bar{D}^0 e^+ e^- + \text{c.c.}$	< 8.5	$\times 10^{-8}$	CL=90%	987
$D^0 \mu^+ \mu^- + \text{c.c.}$	< 1.1	$\times 10^{-7}$	CL=90%	971
$D_s^- e^+ \nu_e + \text{c.c.}$	< 1.3	$\times 10^{-6}$	CL=90%	923
$D_s^{*-} e^+ \nu_e + \text{c.c.}$	< 1.8	$\times 10^{-6}$	CL=90%	828
$D^- \pi^+ + \text{c.c.}$	< 7.0	$\times 10^{-8}$	CL=90%	977
$D^- \rho^+ + \text{c.c.}$	< 6.0	$\times 10^{-7}$	CL=90%	—
$\bar{D}^0 \pi^0 + \text{c.c.}$	< 4.7	$\times 10^{-7}$	CL=90%	—
$\bar{D}^0 \bar{K}^0 + \text{c.c.}$	< 1.7	$\times 10^{-4}$	CL=90%	898
$\bar{D}^0 \bar{K}^{*0} + \text{c.c.}$	< 2.5	$\times 10^{-6}$	CL=90%	670
$\bar{D}^0 \eta + \text{c.c.}$	< 6.8	$\times 10^{-7}$	CL=90%	—
$\bar{D}^0 \rho^0 + \text{c.c.}$	< 5.2	$\times 10^{-7}$	CL=90%	—
$D_s^- \pi^+ + \text{c.c.}$	< 4.1	$\times 10^{-7}$	CL=90%	915
$D_s^- \rho^+ + \text{c.c.}$	< 8.0	$\times 10^{-7}$	CL=90%	663

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

$\gamma\gamma$	C	< 2.7	$\times 10^{-7}$	CL=90%	1548
$\gamma\phi$	C	< 1.4	$\times 10^{-6}$	CL=90%	1381
$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90%	1547
$e^\pm \tau^\mp$	LF	< 7.5	$\times 10^{-8}$	CL=90%	1039
$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90%	1035
$K^+ K^+ e^- e^- + \text{c.c.}$	L	< 2.1	$\times 10^{-9}$	CL=90%	1467
$pe^- + \text{c.c.}$	L, B	< 3.1	$\times 10^{-8}$	CL=90%	1406
$\Lambda_c^+ e^- + \text{c.c.}$		< 6.9	$\times 10^{-8}$	CL=90%	704

Other decays

invisible		< 7	$\times 10^{-4}$	CL=90%	—
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$\chi_{c0}(1P)$

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

$$\text{Mass } m = 3415.50 \pm 0.19 \text{ MeV} \quad (S = 1.7)$$

$$\text{Full width } \Gamma = 12.40 \pm 0.27 \text{ MeV} \quad (S = 1.6)$$

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	$(2.10 \pm 0.10) \%$	S=1.2	1679
$\rho^0\pi^+\pi^-$	$(8.2 \pm 2.6) \times 10^{-3}$		1607
$f_0(980)f_0(980)$	$(6.5 \pm 2.1) \times 10^{-4}$		1392
$\pi^+\pi^-\pi^0\pi^0$	$(3.2 \pm 0.4) \%$		1680
$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(2.8 \pm 0.4) \%$		1608
$4\pi^0$	$(3.2 \pm 0.4) \times 10^{-3}$		1681
$\pi^+\pi^-K^+K^-$	$(1.73 \pm 0.15) \%$	S=1.1	1581
$K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow$ $\pi^+\pi^-K^+K^-$	$(9.6 \begin{smallmatrix} +3.5 \\ -2.8 \end{smallmatrix}) \times 10^{-4}$		—
$K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$(7.8 \begin{smallmatrix} +1.9 \\ -2.4 \end{smallmatrix}) \times 10^{-4}$		—
$K_1(1270)^+K^- + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$(6.1 \pm 1.8) \times 10^{-3}$		—
$K_1(1400)^+K^- + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$< 2.6 \times 10^{-3}$	CL=90%	—
$f_0(980)f_0(980)$	$(1.6 \begin{smallmatrix} +1.0 \\ -0.9 \end{smallmatrix}) \times 10^{-4}$		1392
$f_0(980)f_0(2200)$	$(7.7 \begin{smallmatrix} +2.0 \\ -2.4 \end{smallmatrix}) \times 10^{-4}$		587
$f_0(1370)f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	1020
$f_0(1370)f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	908
$f_0(1370)f_0(1710)$	$(6.5 \begin{smallmatrix} +3.4 \\ -2.3 \end{smallmatrix}) \times 10^{-4}$		720
$f_0(1500)f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	908
$f_0(1500)f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	775
$f_0(1500)f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	532
$K^+K^-\pi^+\pi^-\pi^0$	$(8.6 \pm 0.9) \times 10^{-3}$		1546
$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	$(4.1 \pm 0.4) \times 10^{-3}$		1544
$K^+K^-\pi^0\pi^0$	$(5.4 \pm 0.9) \times 10^{-3}$		1583
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.42 \pm 0.32) \%$		1581
$\rho^+K^-K^0 + \text{c.c.}$	$(1.17 \pm 0.20) \%$		1459
$K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(4.5 \pm 1.1) \times 10^{-3}$		—
$K_S^0K_S^0\pi^+\pi^-$	$(5.5 \pm 1.0) \times 10^{-3}$		1579
$K^+K^-\eta\pi^0$	$(2.9 \pm 0.7) \times 10^{-3}$		1468
$3(\pi^+\pi^-)$	$(1.97 \pm 0.22) \%$	S=3.0	1633
$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(7.0 \pm 1.5) \times 10^{-3}$		1524

$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		1456
$\pi\pi$	$(8.76 \pm 0.26) \times 10^{-3}$	S=1.4	1702
$\pi^0\eta$	$< 1.7 \times 10^{-4}$		1661
$\pi^0\eta'$	$< 1.1 \times 10^{-3}$		1570
$\pi^0\eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	384
$\eta\eta$	$(2.94 \pm 0.22) \times 10^{-3}$	S=1.2	1617
$\eta\eta'$	$(8.9 \pm 1.1) \times 10^{-5}$		1522
$\eta'\eta'$	$(2.11 \pm 0.12) \times 10^{-3}$		1414
$\omega\omega$	$(1.02 \pm 0.05) \times 10^{-3}$		1518
$\omega\phi$	$(1.21 \pm 0.10) \times 10^{-4}$	S=1.4	1447
$\omega K^+ K^-$	$(1.87 \pm 0.20) \times 10^{-3}$		1458
$K^+ K^-$	$(6.15 \pm 0.19) \times 10^{-3}$	S=1.4	1635
$K_S^0 K_S^0$	$(3.08 \pm 0.18) \times 10^{-3}$	S=1.1	1634
$\pi^+ \pi^- \eta$	$< 1.9 \times 10^{-4}$	CL=90%	1652
$2\pi^+ 2\pi^- \eta$	$(4.4 \pm 0.4) \times 10^{-3}$		1616
$\pi^+ \pi^- \eta'$	$< 3.5 \times 10^{-4}$	CL=90%	1560
$\eta\eta\eta'$	$< 2.5 \times 10^{-5}$	CL=90%	1364
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	1610
$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	1612
$K^+ K^- \eta$	$< 2.2 \times 10^{-4}$	CL=90%	1513
$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		1331
$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.6 \pm 0.5) \times 10^{-4}$		1328
$K^+ K^- K^+ K^-$	$(2.7 \pm 0.4) \times 10^{-3}$	S=1.5	1334
$K^+ K^- \phi$	$(9.4 \pm 2.4) \times 10^{-4}$		1382
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		1326
$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		1330
$K_S^0 K_S^0 K_S^0 K_S^0 \pi^\pm$	$(7.7 \pm 0.8) \times 10^{-5}$		1261
$3(K^+ K^-)$	$(1.04 \pm 0.21) \times 10^{-5}$		694
$\phi\pi^+ \pi^- \pi^0$	$(1.14 \pm 0.14) \times 10^{-3}$		1525
$\phi\phi$	$(8.3 \pm 0.4) \times 10^{-4}$	S=1.1	1370
$\phi\phi\eta$	$(8.2 \pm 0.9) \times 10^{-4}$		1101
$p\bar{p}$	$(2.35 \pm 0.12) \times 10^{-4}$	S=1.9	1427
$p\bar{p}\pi^0$	$(6.8 \pm 0.7) \times 10^{-4}$	S=1.3	1379
$p\bar{p}\eta$	$(3.4 \pm 0.4) \times 10^{-4}$		1187
$p\bar{p}\omega$	$(5.1 \pm 0.6) \times 10^{-4}$		1043
$p\bar{p}\pi^+ \pi^-$	$(1.9 \pm 1.1) \times 10^{-3}$	S=2.3	1320
$p\bar{p}\pi^0 \pi^0$	$(1.01 \pm 0.27) \times 10^{-3}$		1324
$p\bar{p}\eta\pi^0$	$(2.35 \pm 0.20) \times 10^{-4}$		1108
$p\bar{p}\eta\eta$	$(5.6 \pm 0.7) \times 10^{-5}$		797
$p\bar{p}K^+ K^-$	$(2.48 \pm 0.17) \times 10^{-4}$		891
$p\bar{p}K^+ K^- (\text{non-resonant})$	$(1.19 \pm 0.26) \times 10^{-4}$		891
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		860
$\Lambda(1520) \bar{\Lambda}(1520)$	$(3.0 \pm 1.2) \times 10^{-4}$		780
$p\bar{p}\phi$	$(5.9 \pm 1.4) \times 10^{-5}$		876

$p\bar{p}K_S^0 K_S^0$	$< 8 \times 10^{-4}$	CL=90%	884
$p\bar{p}K_S^0 K^- \pi^+ + \text{c.c.}$	$(2.5 \pm 0.4) \times 10^{-5}$		764
$p\bar{n}\pi^-$	$(1.23 \pm 0.11) \times 10^{-3}$		1377
$\bar{p}n\pi^+$	$(1.33 \pm 0.12) \times 10^{-3}$		1377
$p\bar{n}\pi^- \pi^0$	$(2.28 \pm 0.20) \times 10^{-3}$		1322
$\bar{p}n\pi^+ \pi^0$	$(2.15 \pm 0.18) \times 10^{-3}$		1322
$\Lambda\bar{\Lambda}$	$(3.50 \pm 0.17) \times 10^{-4}$	S=1.1	1293
$\Lambda\bar{\Lambda}\pi^+ \pi^-$	$(1.15 \pm 0.12) \times 10^{-3}$		1154
$\Lambda\bar{\Lambda}\pi^+ \pi^- (\text{non-resonant})$	$< 5 \times 10^{-4}$	CL=90%	1154
$\Sigma(1385)^+ \bar{\Lambda}\pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	1084
$\Sigma(1385)^- \bar{\Lambda}\pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	1084
$\Lambda\bar{\Lambda}\eta$	$(2.2 \pm 0.4) \times 10^{-4}$		980
$\Lambda\bar{\Lambda}\eta'$	$(7.3 \pm 1.6) \times 10^{-5}$		587
$\Lambda\bar{\Lambda}\omega$	$(2.31 \pm 0.33) \times 10^{-4}$		782
$\Lambda\bar{\Lambda}\phi$	$(2.9 \pm 1.2) \times 10^{-5}$		500
$K^+ \bar{p}\Lambda + \text{c.c.}$	$(1.21 \pm 0.12) \times 10^{-3}$	S=1.3	1133
$nK_S^0 \bar{\Lambda} + \text{c.c.}$	$(6.5 \pm 0.5) \times 10^{-4}$		1129
$K^*(892)^+ \bar{p}\Lambda + \text{c.c.}$	$(4.7 \pm 0.9) \times 10^{-4}$		845
$\bar{p}\Lambda(1520)K_S^0 \pi^+ + \text{c.c.}$	$(1.6 \pm 0.7) \times 10^{-5}$		723
$\Sigma^0 \bar{\Sigma}^0$	$(4.56 \pm 0.32) \times 10^{-4}$		1222
$\Sigma^+ \bar{p}K_S^0 + \text{c.c.}$	$(3.43 \pm 0.27) \times 10^{-4}$		1090
$\Sigma^0 \bar{p}K^+ + \text{c.c.}$	$(2.95 \pm 0.20) \times 10^{-4}$		1090
$\Sigma^+ \bar{\Sigma}^-$	$(4.5 \pm 0.8) \times 10^{-4}$	S=2.6	1225
$\Sigma^+ \bar{\Sigma}^- \eta$	$(1.23 \pm 0.23) \times 10^{-4}$		869
$\Sigma^- \bar{\Sigma}^+$	$(5.0 \pm 0.5) \times 10^{-4}$		1218
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		1002
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(2.3 \pm 0.6) \times 10^{-4}$		1002
$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.89 \pm 0.34) \times 10^{-4}$		874
$\Xi^0 \bar{\Xi}^0$	$(4.3 \pm 0.5) \times 10^{-4}$	S=1.7	1090
$\Xi^- \bar{\Xi}^+$	$(4.34 \pm 0.20) \times 10^{-4}$		1081
$\Omega^- \bar{\Omega}^+$	$(3.4 \pm 0.6) \times 10^{-5}$		345
$\eta_c \pi^+ \pi^-$	$< 7 \times 10^{-4}$	CL=90%	308

Radiative decays

$\gamma J/\psi(1S)$	$(1.35 \pm 0.09) \%$	S=1.8	304
$\gamma \rho^0$	$< 9 \times 10^{-6}$	CL=90%	1620
$\gamma \omega$	$< 8 \times 10^{-6}$	CL=90%	1618
$\gamma \phi$	$< 6 \times 10^{-6}$	CL=90%	1556
$\gamma \gamma$	$(1.96 \pm 0.08) \times 10^{-4}$	S=1.1	1708
$e^+ e^- J/\psi(1S)$	$(1.29 \pm 0.29) \times 10^{-4}$		304
$\mu^+ \mu^- J/\psi(1S)$	$< 1.8 \times 10^{-5}$	CL=90%	227

$\chi_{c1}(1P)$

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

Mass $m = 3510.67 \pm 0.05$ MeV (S = 1.2)

Full width $\Gamma = 0.82 \pm 0.04$ MeV (S = 1.1)

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$e^+ e^-$	$(1.5^{+1.6}_{-1.0}) \times 10^{-7}$		1755
Hadronic decays			
$3(\pi^+ \pi^-)$	$(1.06 \pm 0.11) \%$	S=3.0	1683
$2(\pi^+ \pi^-)$	$(6.6 \pm 0.7) \times 10^{-3}$	S=2.4	1728
$\rho^0 \pi^+ \pi^-$	$(1.6 \pm 1.3) \times 10^{-3}$		1658
$\pi^+ \pi^- \pi^0 \pi^0$	$(1.18 \pm 0.15) \%$		1729
$\rho^+ \pi^- \pi^0 + \text{c.c.}$	$(1.44 \pm 0.24) \%$		1658
$4\pi^0$	$(5.3 \pm 0.8) \times 10^{-4}$		1729
$\pi^+ \pi^- K^+ K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		1632
$K^+ K^- \pi^0 \pi^0$	$(1.10 \pm 0.27) \times 10^{-3}$		1634
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.07 \pm 0.12) \%$		1598
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(7.0 \pm 0.7) \times 10^{-3}$		1596
$K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(8.5 \pm 1.3) \times 10^{-3}$		1632
$\rho^- K^+ \bar{K}^0 + \text{c.c.}$	$(5.0 \pm 1.2) \times 10^{-3}$		1514
$K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(2.3 \pm 0.6) \times 10^{-3}$		—
$K^+ K^- \eta \pi^0$	$(1.10 \pm 0.34) \times 10^{-3}$		1523
$\pi^+ \pi^- K_S^0 K_S^0$	$(6.8 \pm 2.9) \times 10^{-4}$		1630
$K^+ K^- \eta$	$(3.1 \pm 1.0) \times 10^{-4}$		1566
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(6.9 \pm 0.6) \times 10^{-3}$	S=1.1	1661
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.04 \pm 0.15) \times 10^{-3}$		1602
$K^*(892)^+ K^- + \text{c.c.}$	$(1.22 \pm 0.23) \times 10^{-3}$		1602
$K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%	—
$K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 2.1 \times 10^{-3}$	CL=90%	—
$K^+ K^- \pi^0$	$(1.80 \pm 0.24) \times 10^{-3}$		1662
$\eta \pi^+ \pi^-$	$(4.57 \pm 0.23) \times 10^{-3}$		1701
$a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$(3.2 \pm 0.4) \times 10^{-3}$	S=2.1	—
$a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$(1.74 \pm 0.24) \times 10^{-4}$		—
$a_2(1700)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$(4.6 \pm 0.7) \times 10^{-5}$		—
$f_2(1270) \eta \rightarrow \eta \pi^+ \pi^-$	$(3.5 \pm 0.6) \times 10^{-4}$		—
$f_4(2050) \eta \rightarrow \eta \pi^+ \pi^-$	$(2.5 \pm 0.9) \times 10^{-5}$		—
$\pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 4 \times 10^{-5}$	CL=90%	—

$\pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 1.5 \times 10^{-5}$	CL=90%	—
$\pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 8 \times 10^{-6}$	CL=90%	—
$2\pi^+ 2\pi^- \eta$	$(8.0 \pm 0.8) \times 10^{-3}$		1666
$f_2(1270)\eta$	$(6.6 \pm 1.1) \times 10^{-4}$		1467
$\pi^+ \pi^- \eta'$	$(2.2 \pm 0.4) \times 10^{-3}$		1612
$K^+ K^- \eta'(958)$	$(8.4 \pm 0.5) \times 10^{-4}$		1461
$K_0^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \eta'(958)$	$(6.4 \begin{smallmatrix} +2.2 \\ -2.8 \end{smallmatrix}) \times 10^{-4}$		—
$f_0(980)\eta'(958) \rightarrow$ $K^+ K^- \eta'(958)$	$(1.6 \begin{smallmatrix} +1.4 \\ -0.7 \end{smallmatrix}) \times 10^{-4}$		—
$f_0(1710)\eta'(958) \rightarrow$ $K^+ K^- \eta'(958)$	$(7 \begin{smallmatrix} +7 \\ -5 \end{smallmatrix}) \times 10^{-5}$		—
$f_2'(1525)\eta'(958) \rightarrow$ $K^+ K^- \eta'(958)$	$(9 \pm 6) \times 10^{-5}$		—
$\eta \eta \eta'$	$(1.39 \pm 0.16) \times 10^{-4}$		1423
$K_2^*(1430)^+ K^- + \text{c.c.}$	$(1.63 \pm 0.31) \times 10^{-3}$		1416
$K_2^*(1430) \bar{K}^0 + \text{c.c.}$	$(1.18 \pm 0.20) \times 10^{-3}$		1416
$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$		—
$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(1.6 \pm 0.9) \times 10^{-3}$		1577
$K^*(892)^0 \bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$		1512
$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	1390
$K_S^0 K_S^0 K_S^0 K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$		1387
$K^+ K^- K^+ K^-$	$(5.3 \pm 1.1) \times 10^{-4}$		1393
$K^+ K^- \phi$	$(4.1 \pm 1.5) \times 10^{-4}$		1440
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		1387
$K^+ K^- \pi^0 \phi$	$(1.62 \pm 0.30) \times 10^{-3}$		1390
$K_S^0 K_S^0 K_S^0 K_S^0 K^\pm \pi^\mp$	$(2.60 \pm 0.22) \times 10^{-4}$		1322
$3(K^+ K^-)$	$(4.2 \pm 1.1) \times 10^{-6}$		779
$\phi \pi^+ \pi^- \pi^0$	$(7.0 \pm 0.9) \times 10^{-4}$		1578
$\omega \omega$	$(6.25 \pm 0.30) \times 10^{-4}$		1571
$\omega K^+ K^-$	$(7.3 \pm 0.8) \times 10^{-4}$		1513
$\omega \phi$	$(2.13 \pm 0.30) \times 10^{-5}$	S=1.5	1503
$\phi \phi$	$(4.22 \pm 0.20) \times 10^{-4}$		1429
$\phi \phi \eta$	$(2.9 \pm 0.5) \times 10^{-4}$		1172
$p \bar{p}$	$(7.97 \pm 0.29) \times 10^{-5}$	S=1.3	1484
$p \bar{p} \pi^0$	$(1.54 \pm 0.18) \times 10^{-4}$		1438
$p \bar{p} \eta$	$(1.44 \pm 0.24) \times 10^{-4}$		1254
$p \bar{p} \omega$	$(2.10 \pm 0.30) \times 10^{-4}$		1117
$p \bar{p} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		1381
$p \bar{p} \pi^0 \pi^0$	$< 5 \times 10^{-4}$	CL=90%	1385
$p \bar{p} \eta \pi^0$	$(1.93 \pm 0.13) \times 10^{-4}$		1179

$p\bar{p}\eta\eta$	$(1.4 \pm 0.4) \times 10^{-5}$		887
$p\bar{p}K^+K^-$	$(1.86 \pm 0.12) \times 10^{-4}$		974
$p\bar{p}K^+K^-$ (non-resonant)	$(1.26 \pm 0.22) \times 10^{-4}$		974
$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		951
$\Lambda(1520)\bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%	880
$p\bar{p}\phi$	$< 1.7 \times 10^{-5}$	CL=90%	962
$p\bar{p}K_S^0K_S^0$	$< 4 \times 10^{-4}$	CL=90%	968
$p\bar{p}K_S^0K^- + \pi^+ + \text{c.c.}$	$(4.1 \pm 0.5) \times 10^{-5}$		857
$p\bar{n}\pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		1435
$\bar{p}n\pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		1435
$p\bar{n}\pi^-\pi^0$	$(1.02 \pm 0.12) \times 10^{-3}$		1383
$\bar{p}n\pi^+\pi^0$	$(9.9 \pm 1.2) \times 10^{-4}$		1383
$\Lambda\bar{\Lambda}$	$(1.26 \pm 0.09) \times 10^{-4}$	S=1.1	1355
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		1223
$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(2.4 \pm 0.6) \times 10^{-4}$		1223
$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157
$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157
$\Lambda\bar{\Lambda}\eta$	$(5.8 \pm 1.5) \times 10^{-5}$		1059
$\Lambda\bar{\Lambda}\eta'$	$(1.5 \pm 0.5) \times 10^{-5}$		706
$\Lambda\bar{\Lambda}\omega$	$(9.9 \pm 1.5) \times 10^{-5}$		877
$\Lambda\bar{\Lambda}\phi$	$(5.9 \pm 1.0) \times 10^{-5}$		634
$K^+\bar{p}\Lambda + \text{c.c.}$	$(4.1 \pm 0.4) \times 10^{-4}$	S=1.2	1203
$nK_S^0\bar{\Lambda} + \text{c.c.}$	$(1.64 \pm 0.17) \times 10^{-4}$		1200
$\bar{p}\Lambda(1520)K_S^0\pi^+ + \text{c.c.}$	$(4.0 \pm 0.9) \times 10^{-5}$		829
$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		935
$\Sigma^0\bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$		1288
$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(1.51 \pm 0.12) \times 10^{-4}$		1163
$\Sigma^0\bar{p}K^+ + \text{c.c.}$	$(1.44 \pm 0.10) \times 10^{-4}$		1163
$\Sigma^+\bar{\Sigma}^-$	$(3.6 \pm 0.6) \times 10^{-5}$		1291
$\Sigma^+\bar{\Sigma}^-\eta$	$(5.0 \pm 1.4) \times 10^{-5}$		958
$\Sigma^-\bar{\Sigma}^+$	$(5.6 \pm 1.5) \times 10^{-5}$		1283
$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%	1081
$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	1081
$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(1.34 \pm 0.24) \times 10^{-4}$		963
$\Xi^0\bar{\Xi}^0$	$(7.4 \pm 1.2) \times 10^{-5}$		1163
$\Xi^-\bar{\Xi}^+$	$(5.9 \pm 0.6) \times 10^{-5}$		1155
$\Omega^-\bar{\Omega}^+$	$(1.47 \pm 0.25) \times 10^{-5}$		533
$\pi^+\pi^- + K^+K^-$	$< 1.5 \times 10^{-3}$	CL=90%	—
$K_S^0K_S^0$	$< 6 \times 10^{-5}$	CL=90%	1683
$\eta_c\pi^+\pi^-$	$< 3.1 \times 10^{-4}$	CL=90%	413

Radiative decays

$\gamma J/\psi(1S)$	$(33.9 \pm 1.2) \%$	S=1.3	389
$\gamma\rho^0$	$(2.14 \pm 0.17) \times 10^{-4}$		1670

$\gamma\omega$	$(6.7 \pm 0.8) \times 10^{-5}$	1668
$\gamma\phi$	$(2.4 \pm 0.5) \times 10^{-5}$	1607
$\gamma\gamma$	$< 6 \times 10^{-6}$	CL=90% 1755
$e^+ e^- J/\psi(1S)$	$(3.42 \pm 0.23) \times 10^{-3}$	389
$\mu^+ \mu^- J/\psi(1S)$	$(2.30 \pm 0.29) \times 10^{-4}$	335

$h_c(1P)$

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

Mass $m = 3525.37 \pm 0.14$ MeV (S = 1.2)

Full width $\Gamma = 0.78 \pm 0.28$ MeV

$h_c(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	ρ (MeV/c)
$J/\psi(1S)\pi^0$	$< 5 \times 10^{-4}$	CL=90%	382
$J/\psi(1S)\pi\pi$	$< 9 \times 10^{-5}$	CL=90%	312
$J/\psi(1S)\pi^+\pi^-$	$< 9 \times 10^{-4}$	CL=90%	305
$p\bar{p}$	$< 4 \times 10^{-5}$	CL=90%	1492
$p\bar{p}\pi^0$	$< 8 \times 10^{-4}$	CL=90%	1447
$p\bar{p}\pi^+\pi^-$	$(3.3 \pm 0.6) \times 10^{-3}$		1390
$p\bar{p}\pi^0\pi^0$	$< 6 \times 10^{-4}$	CL=90%	1394
$p\bar{p}\pi^+\pi^-\pi^0$	$(4.4 \pm 1.3) \times 10^{-3}$		1331
$p\bar{p}\eta$	$(7.4 \pm 2.2) \times 10^{-4}$		1264
$\pi^+\pi^-\pi^0$	$(1.57 \pm 0.13) \times 10^{-3}$		1749
$\pi^+\pi^-\eta$	$< 5 \times 10^{-4}$	CL=90%	1709
$\pi^+\pi^-\pi^0\eta$	$(8.3 \pm 2.4) \times 10^{-3}$		1695
$2\pi^+2\pi^-\pi^0\eta$	$(7.2 \pm 1.7) \times 10^{-3}$		1648
$2\pi^+2\pi^-\pi^0$	$(9.4 \pm 1.7) \times 10^{-3}$		1716
$2\pi^+2\pi^-\eta$	$< 6 \times 10^{-4}$	CL=90%	1674
$3\pi^+3\pi^-\pi^0$	$(9.1 \pm 1.5) \times 10^{-3}$		1661
$2\pi^+2\pi^-\omega$	$(3.9 \pm 1.0) \times 10^{-3}$		1627
$K^+K^-\pi^+\pi^-$	$< 7 \times 10^{-4}$	CL=90%	1640
$K^+K^-\pi^+\pi^-\pi^0$	$(3.8 \pm 0.8) \times 10^{-3}$		1606
$K^+K^-\pi^+\pi^-\eta$	$< 2.7 \times 10^{-3}$	CL=90%	1480
$K^+K^-\pi^0$	$(3.8 \pm 0.9) \times 10^{-4}$		1670
$K^+K^-\pi^0\eta$	$< 2.4 \times 10^{-3}$	CL=90%	1532
$K^+K^-\eta$	$(3.6 \pm 1.2) \times 10^{-4}$		1574
$2K^+2K^-\pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	1339
$K_S^0 K^\pm \pi^\mp$	$(7.1 \pm 1.9) \times 10^{-4}$		1668
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-3}$		1604

Radiative decays

$\gamma\eta$	$(3.8 \pm 0.6) \times 10^{-4}$	1720
$\gamma\eta'(958)$	$(1.41 \pm 0.15) \times 10^{-3}$	1633
$\gamma\pi^0$	$< 5 \times 10^{-5}$	1760

$\gamma\eta_c(1S)$	(64 ± 5) %	S=1.2	500
$\gamma\pi^+\pi^-$	(3.0 ± 0.7) × 10 ⁻⁴		1757
$\gamma\pi^+\pi^-\eta$	(3.5 ± 0.6) × 10 ⁻³		1709
$\gamma 2\pi^+ 2\pi^-$	(2.18 ± 0.30) × 10 ⁻³		1735
$\gamma\rho\bar{\rho}$	(3.3 ± 0.7) × 10 ⁻⁴		1492
$e^+e^-\eta_c(1S)$	(3.8 ± 0.8) × 10 ⁻³		500
$\gamma f_2(1270) \rightarrow \gamma\pi^+\pi^-$	(1.8 ± 0.4) × 10 ⁻⁴		—

 $\chi_{c2}(1P)$

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

 Mass $m = 3556.17 \pm 0.07$ MeV

 Full width $\Gamma = 1.94 \pm 0.09$ MeV (S = 1.1)

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
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Hadronic decays

$2(\pi^+\pi^-)$	(1.11 ± 0.07) %	S=1.2	1751
$\pi^+\pi^-\pi^0\pi^0$	(1.81 ± 0.23) %		1752
$\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.16 ± 0.34) %		1682
$4\pi^0$	(1.10 ± 0.15) × 10 ⁻³		1752
$K^+K^-\pi^0\pi^0$	(2.0 ± 0.4) × 10 ⁻³		1658
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(1.37 ± 0.19) %		1657
$\rho^-K^+\bar{K}^0 + \text{c.c.}$	(4.1 ± 1.2) × 10 ⁻³		1540
$K^*(892)^0K^-\pi^+ \rightarrow$ $K^-\pi^+K^0\pi^0 + \text{c.c.}$	(2.9 ± 0.8) × 10 ⁻³		—
$K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.8 ± 0.9) × 10 ⁻³		—
$K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.7 ± 0.8) × 10 ⁻³		—
$K^*(892)^+\bar{K}^0\pi^- \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(2.9 ± 0.8) × 10 ⁻³		—
$K^+K^-\eta\pi^0$	(1.3 ± 0.4) × 10 ⁻³		1549
$K^+K^-\pi^+\pi^-$	(8.4 ± 1.1) × 10 ⁻³	S=1.2	1656
$K^+K^-\pi^+\pi^-\pi^0$	(1.06 ± 0.11) %		1623
$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	(6.6 ± 0.7) × 10 ⁻³		1621
$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	(2.1 ± 1.1) × 10 ⁻³		1602
$K^*(892)^0\bar{K}^*(892)^0$	(2.3 ± 0.9) × 10 ⁻³	S=2.1	1538
$3(\pi^+\pi^-)$	(1.51 ± 0.17) %	S=3.3	1707
$\phi\phi$	(1.22 ± 0.07) × 10 ⁻³	S=1.6	1457
$\phi\phi\eta$	(5.3 ± 0.6) × 10 ⁻⁴		1206
$\omega\omega$	(8.6 ± 0.4) × 10 ⁻⁴		1597
ωK^+K^-	(6.6 ± 0.8) × 10 ⁻⁴		1540
$\omega\phi$	(9.8 ± 1.3) × 10 ⁻⁶		1529
$\pi\pi$	(2.33 ± 0.06) × 10 ⁻³	S=1.2	1773

$\rho^0 \pi^+ \pi^-$	$(3.9 \pm 1.6) \times 10^{-3}$		1682
$\pi^+ \pi^- \pi^0$ (non-resonant)	$(2.0 \pm 0.4) \times 10^{-5}$		1765
$\rho(770)^\pm \pi^\mp$	$(6 \pm 4) \times 10^{-6}$		—
$\pi^+ \pi^- \eta$	$(4.7 \pm 1.3) \times 10^{-4}$		1724
$2\pi^+ 2\pi^- \eta$	$(5.7 \pm 0.6) \times 10^{-3}$		1690
$\pi^+ \pi^- \eta'$	$(4.9 \pm 1.8) \times 10^{-4}$		1636
$\eta \eta$	$(5.4 \pm 0.4) \times 10^{-4}$		1692
$K^+ K^-$	$(1.16 \pm 0.05) \times 10^{-3}$	S=1.7	1708
$K_S^0 K_S^0$	$(5.2 \pm 0.4) \times 10^{-4}$		1707
$K^*(892)^\pm K^\mp$	$(1.42 \pm 0.21) \times 10^{-4}$		1627
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.23 \pm 0.27) \times 10^{-4}$		1627
$K_2^*(1430)^\pm K^\mp$	$(1.47 \pm 0.12) \times 10^{-3}$		—
$K_2^*(1430)^0 \bar{K}^0 + \text{c.c.}$	$(1.23 \pm 0.17) \times 10^{-3}$		1443
$K_3^*(1780)^\pm K^\mp$	$(5.1 \pm 0.8) \times 10^{-4}$		—
$K_3^*(1780)^0 \bar{K}^0 + \text{c.c.}$	$(5.6 \pm 2.1) \times 10^{-4}$		1274
$a_2(1320)^0 \pi^0$	$(1.28 \pm 0.34) \times 10^{-3}$		—
$a_2(1320)^\pm \pi^\mp$	$(1.7 \pm 0.6) \times 10^{-3}$		1530
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(1.27 \pm 0.18) \times 10^{-3}$		1685
$K^+ K^- \pi^0$	$(3.0 \pm 0.8) \times 10^{-4}$		1686
$K^+ K^- \eta$	$< 3.2 \times 10^{-4}$	CL=90%	1592
$K^+ K^- \eta'(958)$	$(1.51 \pm 0.09) \times 10^{-4}$		1488
$\eta \eta'$	$(2.1 \pm 0.5) \times 10^{-5}$		1600
$\eta' \eta'$	$(4.5 \pm 0.6) \times 10^{-5}$		1498
$\eta \eta \eta'$	$(4.1 \pm 0.9) \times 10^{-5}$		1451
$\pi^+ \pi^- K_S^0 K_S^0$	$(2.2 \pm 0.5) \times 10^{-3}$		1655
$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	1418
$K_S^0 K_S^0 K_S^0 K_S^0$	$(1.12 \pm 0.18) \times 10^{-4}$		1415
$K^+ K^- K^+ K^-$	$(1.64 \pm 0.22) \times 10^{-3}$	S=1.1	1421
$K^+ K^- \phi$	$(1.41 \pm 0.29) \times 10^{-3}$		1468
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		1416
$K^+ K^- \pi^0 \phi$	$(2.7 \pm 0.5) \times 10^{-3}$		1419
$K_S^0 K_S^0 K_S^0 K^\pm \pi^\mp$	$(1.70 \pm 0.16) \times 10^{-4}$		1351
$3(K^+ K^-)$	$(7.1 \pm 1.4) \times 10^{-6}$		818
$\phi \pi^+ \pi^- \pi^0$	$(8.4 \pm 1.0) \times 10^{-4}$		1603
$p \bar{p}$	$(8.06 \pm 0.33) \times 10^{-5}$	S=1.6	1510
$p \bar{p} \pi^0$	$(4.6 \pm 0.4) \times 10^{-4}$		1465
$p \bar{p} \eta$	$(1.72 \pm 0.25) \times 10^{-4}$		1285
$p \bar{p} \omega$	$(3.6 \pm 0.4) \times 10^{-4}$		1152
$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		1410
$p \bar{p} \pi^0 \pi^0$	$(7.8 \pm 2.3) \times 10^{-4}$		1414
$p \bar{p} \eta \pi^0$	$(1.29 \pm 0.09) \times 10^{-4}$		1212
$p \bar{p} \eta \eta$	$(2.6 \pm 0.5) \times 10^{-5}$		929
$p \bar{p} K^+ K^-$	$(2.52 \pm 0.17) \times 10^{-4}$		1013

$p\bar{p}K^+K^-$ (non-resonant)	$(1.89 \pm 0.32) \times 10^{-4}$		1013
$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(2.8 \pm 0.7) \times 10^{-4}$		992
$\Lambda(1520)\bar{\Lambda}(1520)$	$(4.6 \pm 1.4) \times 10^{-4}$		924
$p\bar{p}\phi$	$(2.8 \pm 0.9) \times 10^{-5}$		1002
$p\bar{p}K_S^0K_S^0$	$< 8 \times 10^{-4}$	CL=90%	1007
$p\bar{p}K_S^0K^-\pi^+ + \text{c.c.}$	$(5.6 \pm 0.5) \times 10^{-5}$		900
$p\bar{n}\pi^-$	$(8.4 \pm 0.9) \times 10^{-4}$		1463
$\bar{p}n\pi^+$	$(8.8 \pm 0.8) \times 10^{-4}$		1463
$p\bar{n}\pi^-\pi^0$	$(2.15 \pm 0.18) \times 10^{-3}$		1411
$\bar{p}n\pi^+\pi^0$	$(2.09 \pm 0.18) \times 10^{-3}$		1411
$\Lambda\bar{\Lambda}$	$(1.81 \pm 0.16) \times 10^{-4}$		1384
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.24 \pm 0.15) \times 10^{-3}$		1255
$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(6.5 \pm 1.5) \times 10^{-4}$		1255
$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	CL=90%	1192
$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	CL=90%	1192
$\Lambda\bar{\Lambda}\eta$	$(1.04 \pm 0.25) \times 10^{-4}$		1096
$\Lambda\bar{\Lambda}\eta'$	$(3.0 \pm 0.7) \times 10^{-5}$		758
$\Lambda\bar{\Lambda}\omega$	$(1.38 \pm 0.21) \times 10^{-4}$		921
$\Lambda\bar{\Lambda}\phi$	$(7.1 \pm 0.9) \times 10^{-5}$		691
$K^+\bar{p}\Lambda + \text{c.c.}$	$(7.7 \pm 0.5) \times 10^{-4}$		1236
$nK_S^0\bar{\Lambda} + \text{c.c.}$	$(3.54 \pm 0.28) \times 10^{-4}$		1233
$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(8.1 \pm 1.1) \times 10^{-4}$		976
$\bar{p}\Lambda(1520)K_S^0\pi^+ + \text{c.c.}$	$(4.0 \pm 0.9) \times 10^{-5}$		876
$\Sigma^0\bar{\Sigma}^0$	$(3.6 \pm 0.6) \times 10^{-5}$		1319
$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(8.2 \pm 0.9) \times 10^{-5}$		1197
$\Sigma^0\bar{p}K^+ + \text{c.c.}$	$(9.0 \pm 0.8) \times 10^{-5}$		1197
$\Sigma^+\bar{\Sigma}^-$	$(3.3 \pm 0.7) \times 10^{-5}$		1322
$\Sigma^+\bar{\Sigma}^-\eta$	$(5.4 \pm 1.3) \times 10^{-5}$		998
$\Sigma^-\bar{\Sigma}^+$	$(4.4 \pm 1.8) \times 10^{-5}$		1314
$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 1.5 \times 10^{-4}$	CL=90%	1118
$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	CL=90%	1118
$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(1.75 \pm 0.31) \times 10^{-4}$		1004
$\Xi^0\bar{\Xi}^0$	$(1.81 \pm 0.22) \times 10^{-4}$		1197
$\Xi^-\bar{\Xi}^+$	$(1.42 \pm 0.12) \times 10^{-4}$		1189
$\Omega^-\bar{\Omega}^+$	$(4.47 \pm 0.30) \times 10^{-5}$		604
$J/\psi(1S)\pi^+\pi^-\pi^0$	$< 1.5 \%$	CL=90%	185
$\pi^0\eta_c$	$< 3.2 \times 10^{-3}$	CL=90%	511
$\eta_c(1S)\pi^+\pi^-$	$< 5 \times 10^{-3}$	CL=90%	459

Radiative decays

$\gamma J/\psi(1S)$	$(19.0 \pm 0.8) \%$	S=1.5	430
$\gamma\rho^0$	$< 1.9 \times 10^{-5}$	CL=90%	1694
$\gamma\omega$	$< 6 \times 10^{-6}$	CL=90%	1692

$\gamma\phi$	$< 7 \times 10^{-6}$	CL=90%	1632
$\gamma\gamma$	$(2.88 \pm 0.10) \times 10^{-4}$	S=1.1	1778
$e^+e^- J/\psi(1S)$	$(2.14 \pm 0.15) \times 10^{-3}$		430
$\mu^+\mu^- J/\psi(1S)$	$(2.01 \pm 0.33) \times 10^{-4}$		381

 $\eta_c(2S)$

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

Quantum numbers are quark model predictions.

$$\text{Mass } m = 3637.8 \pm 0.6 \text{ MeV} \quad (S = 1.1)$$

$$\text{Full width } \Gamma = 11.6 \pm 1.4 \text{ MeV}$$

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
hadrons	seen		—
$K\bar{K}\pi$	$(1.9^{+1.2}_{-1.0})\%$		1729
$K\bar{K}\eta$	$(7^{+5}_{-4}) \times 10^{-3}$		1637
$K\bar{K}\eta'$	$(2.1 \pm 1.6) \times 10^{-3}$		1537
$2\pi^+2\pi^-$	$< 2.6 \times 10^{-3}$	90%	1792
$a_0(1450)\pi$	seen		1531
$a_2(1700)\pi$	seen		1415
$a_0(1710)\pi$	seen		1412
$\rho^0\rho^0$	$< 2.3 \times 10^{-3}$	90%	1645
$3\pi^+3\pi^-$	$(1.7^{+0.9}_{-1.1})\%$		1749
$K^+K^-\pi^+\pi^-$	$< 2.5 \times 10^{-3}$	90%	1700
$K^{*0}\bar{K}^{*0}$	$< 4 \times 10^{-3}$	90%	1585
$K^+K^-\pi^+\pi^-\pi^0$	$(1.5^{+1.0}_{-0.9})\%$		1668
$K^+K^-\pi^+\pi^-$	$< 1.8\%$	90%	1627
$K_S^0K^-\pi^+\pi^- + \text{c.c.}$	$(1.4^{+0.8}_{-1.0})\%$		1666
$2K^+2K^-$	$< 1.4 \times 10^{-3}$	90%	1470
$K_2^*(1430)\bar{K} + \text{c.c.}$	seen		1493
$K_0^*(1950)\bar{K} + \text{c.c.}$	seen		1231
$K_0^*(2600)\bar{K} + \text{c.c.}$	seen		—
$\phi\phi$	$< 1.4 \times 10^{-3}$	90%	1506
$\omega\omega$	$< 1.9 \times 10^{-3}$	90%	1642
$\omega\phi$	$< 3.4 \times 10^{-4}$	90%	1577
$p\bar{p}$	$< 3.2 \times 10^{-4}$	90%	1558
$p\bar{p}\pi^+\pi^-$	seen		1461
$p\bar{p}K^+K^-$	$(3.6 \pm 2.9) \times 10^{-4}$		1079
$\gamma\gamma$	$(1.8^{+1.0}_{-1.1}) \times 10^{-4}$		1819

$\gamma J/\psi(1S)$	< 1.8	%	90%	501
$\pi^+ \pi^- \eta$	$(5.5^{+3.3}_{-4.0}) \times 10^{-3}$			1766
$2\pi^+ 2\pi^- \eta$	$(1.6^{+0.9}_{-1.0})$	%		1733
$\pi^+ \pi^- \eta'$	$(2.7^{+2.0}_{-1.8}) \times 10^{-3}$			1680
$\pi^+ \pi^- \eta_c(1S)$	< 4	%	90%	537

$\psi(2S)$

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

Mass $m = 3686.097 \pm 0.011$ MeV (S = 1.1)

Full width $\Gamma = 293 \pm 9$ keV (S = 1.2)

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85 ± 0.13) %		—
virtual $\gamma \rightarrow$ hadrons	(1.79 ± 0.04) %		—
ggg	(10.6 ± 1.6) %		—
γgg	(1.03 ± 0.29) %		—
light hadrons	(15.4 ± 1.5) %		—
K_S^0 anything	(16.1 ± 1.1) %		—
$e^+ e^-$	$(7.95 \pm 0.22) \times 10^{-3}$	S=1.3	1843
$\mu^+ \mu^-$	$(8.0 \pm 0.6) \times 10^{-3}$		1840
$\tau^+ \tau^-$	$(3.1 \pm 0.4) \times 10^{-3}$		489

Decays into $J/\psi(1S)$ and anything

$J/\psi(1S)$ anything	(61.6 ± 0.7) %	S=1.3	—
$J/\psi(1S)$ neutrals	(25.4 ± 0.5) %	S=1.6	—
$J/\psi(1S) \pi^+ \pi^-$	(34.78 ± 0.33) %	S=1.1	477
$J/\psi(1S) \pi^0 \pi^0$	(18.3 ± 0.5) %	S=1.6	481
$J/\psi(1S) \eta$	(3.38 ± 0.06) %	S=1.2	199
$J/\psi(1S) \pi^0$	$(1.268 \pm 0.032) \times 10^{-3}$		528

Hadronic decays

$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$		1838
$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7	1830
$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	—
$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9^{+1.2}_{-0.4}) \times 10^{-4}$		—
$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	1817
$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	1750
$2(\pi^+ \pi^-) \pi^0$	$(2.9 \pm 1.0) \times 10^{-3}$	S=4.7	1799
$\rho a_2(1320)$	$(2.6 \pm 0.9) \times 10^{-4}$		1500
$\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	$(5.3 \pm 1.0) \times 10^{-3}$		1800
$\rho^\pm \pi^\mp \pi^0 \pi^0$	$< 2.7 \times 10^{-3}$	CL=90%	1737

$\pi^+ \pi^- 4\pi^0$	$(1.4 \pm 1.0) \times 10^{-3}$		1778
$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	1774
$2(\pi^+ \pi^- \pi^0)$	$(4.8 \pm 1.5) \times 10^{-3}$		1776
$3(\pi^+ \pi^-) \pi^0$	$(3.5 \pm 1.6) \times 10^{-3}$		1746
$2(\pi^+ \pi^-) 3\pi^0$	$(1.42 \pm 0.31) \%$		1748
$\eta \pi^+ \pi^-$	< 1.6	$\times 10^{-4}$ CL=90%	1791
$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		1778
$\eta 2(\pi^+ \pi^-)$	$(1.2 \pm 0.6) \times 10^{-3}$		1758
$\eta \pi^+ \pi^- \pi^0 \pi^0$	< 4	$\times 10^{-4}$ CL=90%	1760
$\eta \pi^+ \pi^- 3\pi^0$	< 2.1	$\times 10^{-3}$ CL=90%	1736
$\eta 2(\pi^+ \pi^- \pi^0)$	< 2.1	$\times 10^{-3}$ CL=90%	1705
$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	1717
$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		1692
$\eta' \rho$	$(1.9 \begin{smallmatrix} +1.7 \\ -1.2 \end{smallmatrix}) \times 10^{-5}$		1625
$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		1757
$\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	1748
$\omega \pi^+ \pi^- 2\pi^0$	$(8.7 \pm 2.4) \times 10^{-3}$		1715
$b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	1635
$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		1515
$\omega \pi^0 \pi^0$	$(1.11 \pm 0.35) \times 10^{-3}$		1749
$\omega 3\pi^0$	< 8	$\times 10^{-4}$ CL=90%	1736
$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		—
$\omega \eta$	< 1.1	$\times 10^{-5}$ CL=90%	1715
$\omega \eta'$	$(3.2 \begin{smallmatrix} +2.5 \\ -2.1 \end{smallmatrix}) \times 10^{-5}$		1623
$\omega(782) \eta \eta$	$(1.65 \pm 0.21) \times 10^{-5}$		1580
$\phi \pi^0$	< 4	$\times 10^{-7}$ CL=90%	1699
$\phi \pi^+ \pi^-$	$(1.18 \pm 0.26) \times 10^{-4}$	S=1.5	1690
$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(7.5 \pm 3.3) \times 10^{-5}$	S=1.6	—
$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$		1654
$\eta \phi(2170), \phi(2170) \rightarrow$ $\phi f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 2.2	$\times 10^{-6}$ CL=90%	—
$\phi \eta'$	$(1.54 \pm 0.20) \times 10^{-5}$		1555
$\phi \eta \eta'$	$(3.14 \pm 0.29) \times 10^{-5}$		1331
$h_1(1900) \eta \rightarrow \phi \eta \eta'$	$(3.8 \pm 2.1) \times 10^{-6}$		—
$\phi(2170) \eta \rightarrow \phi \eta \eta'$	$(3.3 \pm 1.8) \times 10^{-6}$		—
$\phi(2170) \eta' \rightarrow \phi \eta \eta'$	$(3.8 \pm 1.0) \times 10^{-6}$		—
$h_1(2300) \eta \rightarrow \phi \eta \eta'$	$(2.2 \pm 1.0) \times 10^{-6}$		—
$h_1(2300) \eta' \rightarrow \phi \eta \eta'$	$(4.8 \pm 1.5) \times 10^{-6}$		—
$\phi \phi \phi$	$(1.46 \pm 0.18) \times 10^{-5}$		989
$\phi f_1(1285)$	$(3.0 \pm 1.3) \times 10^{-5}$		1436
$\phi \eta(1405) \rightarrow \phi \pi^+ \pi^- \eta$	$(8.5 \pm 1.7) \times 10^{-6}$		—
$\phi f'_2(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		1325
$K^+ K^-$	$(7.5 \pm 0.5) \times 10^{-5}$		1776

$K^+ K^- \pi^+ \pi^-$	$(7.3 \pm 0.5) \times 10^{-4}$	1726
$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$	1754
$K_S^0 K_S^0$	$< 1.1 \times 10^{-8}$	CL=90% 1775
$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$	1775
$K_S^0 K_L^0 \pi^0$	$< 3.0 \times 10^{-4}$	CL=90% 1753
$K^+ K^- \pi^0 \pi^0$	$(2.6 \pm 1.3) \times 10^{-4}$	1728
$K^+ K^- \pi^0 \pi^0 \pi^0$	$(6.6 \pm 2.8) \times 10^{-4}$	1696
$K_S^0 K^\pm \pi^\mp \pi^0 \pi^0$	$(1.7 \pm 0.6) \times 10^{-3}$	1694
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-3}$	1692
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$	1694
$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$	—
$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$	—
$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$	—
$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$	—
$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$	—
$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$	1724
$K_S^0 K_L^0 \pi^0 \pi^0$	$(1.3 \pm 0.6) \times 10^{-3}$	1726
$K_S^0 K^*(892)^0 \pi^0 \pi^0$	$(3.1 \pm 1.3) \times 10^{-4}$	1645
$K_S^0 K^\pm \rho(770)^\mp \pi^0$	$< 7 \times 10^{-4}$	CL=90% —
$K_S^0 K^\pm \pi^\mp \rho(770)^0$	$< 7 \times 10^{-4}$	CL=90% —
$K^\mp K^*(892)^\pm \pi^0 \pi^0$	$(7.0 \pm 2.9) \times 10^{-4}$	1646
$K^*(892)^+ K^*(892)^- \pi^0$	$(3.6 \pm 1.8) \times 10^{-3}$	1573
$K_S^0 K_L^0 \eta$	$(1.3 \pm 0.5) \times 10^{-3}$	1661
$K^+ K^- \rho^0$	$(2.2 \pm 0.4) \times 10^{-4}$	1616
$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$	1417
$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$	1574
$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$	1654
$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$	1611
$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2 1698
$2(K^+ K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$	1499
$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$	1440
$K^+ K^- \phi$	$(7.0 \pm 1.6) \times 10^{-5}$	1546
$K_S^0 K_S^0 \phi$	$(3.53 \pm 0.29) \times 10^{-5}$	1543
$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$	1587
$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$	1674
$\eta K^+ K^-$, no $\eta \phi$	$(3.49 \pm 0.17) \times 10^{-5}$	1664
$\eta K^+ K^-$	$< 2.6 \times 10^{-4}$	CL=90% 1664
$X(1750) \eta \rightarrow K^+ K^- \eta$	$(4.8 \pm 2.8) \times 10^{-6}$	—
$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90% 1532
$K_2^*(1430)^\pm K^\mp$	$(7.1 \begin{smallmatrix} +1.3 \\ -0.9 \end{smallmatrix}) \times 10^{-5}$	—
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$	1697
$\omega K^+ K^-$	$(1.62 \pm 0.11) \times 10^{-4}$	S=1.1 1614

$\omega K_S^0 K_S^0$	$(7.0 \pm 0.5) \times 10^{-5}$		1612
$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \pm 0.26) \times 10^{-4}$		1482
$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \pm 1.2) \times 10^{-5}$		1252
$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$		1481
$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		1250
$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-5}$		—
$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		—
$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(3.0 \pm 1.0) \times 10^{-6}$		—
$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$		—
$p\bar{p}$	$(2.95 \pm 0.09) \times 10^{-4}$	S=1.3	1586
$n\bar{n}$	$(3.06 \pm 0.15) \times 10^{-4}$		1586
$p\bar{p}\pi^0$	$1.2 \times 10^{-4} \text{ to } 2.4 \times 10^{-4}$		1543
$N(940)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(1.14 \pm 0.12) \times 10^{-4}$		—
$N(1440)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(7.5 \pm 1.1) \times 10^{-5}$	S=1.7	—
$N(1520)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(6.6 \pm 2.0) \times 10^{-6}$		—
$N(1535)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(1.7 \pm 0.4) \times 10^{-5}$		—
$N(1650)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(9.1 \pm 3.3) \times 10^{-6}$		—
$N(1710)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(4 \pm 4) \times 10^{-6}$		—
$N(1720)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(6.2 \pm 2.5) \times 10^{-6}$		—
$N(2100)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(8 \pm 4) \times 10^{-6}$		—
$N(2300)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(3.6 \pm 3.1) \times 10^{-6}$		—
$N(2570)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0$	$(1.9 \pm 1.5) \times 10^{-5}$		—
$p\bar{p}\pi^+\pi^-$	$(6.0 \pm 0.4) \times 10^{-4}$		1491
$p\bar{p}K^+K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		1118
$p\bar{p}\eta$	$5.5 \times 10^{-5} \text{ to } 9.1 \times 10^{-5}$		1373
$N(1535)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\eta$	$(4.7 \pm 0.5) \times 10^{-5}$		—
$N(1710)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\eta$	$(7.8 \pm 3.2) \times 10^{-6}$		—
$p\bar{p}\pi^+\pi^-\pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		1435
$p\bar{p}\rho^0$	$(5.0 \pm 2.2) \times 10^{-5}$		1252
$p\bar{p}\omega$	$(6.9 \pm 2.1) \times 10^{-5}$		1247
$p\bar{p}\eta'$	$(1.10 \pm 0.13) \times 10^{-5}$		1141
$p\bar{p}\phi$	$(6.1 \pm 0.6) \times 10^{-6}$		1109
$\phi X(1835) \rightarrow p\bar{p}\phi$	$< 1.82 \times 10^{-7}$	CL=90%	—
$p\bar{n}\pi^- \text{ or c.c.}$	$(2.48 \pm 0.17) \times 10^{-4}$		—
$p\bar{n}\pi^-\pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		1492
$\Lambda\bar{\Lambda}$	$(3.81 \pm 0.13) \times 10^{-4}$	S=1.4	1467
$\Lambda\bar{\Lambda}\pi^0$	$(1.4 \pm 0.7) \times 10^{-6}$		1412
$\Lambda\bar{\Lambda}\eta$	$(2.43 \pm 0.32) \times 10^{-5}$		1197
$\Lambda(1670)\bar{\Lambda} \rightarrow \Lambda\bar{\Lambda}\eta$	$(1.3 \pm 0.7) \times 10^{-5}$		—
$\Lambda\bar{\Lambda}\eta'$	$(7.3 \pm 1.0) \times 10^{-6}$		892
$\Lambda\bar{\Lambda}\omega(782)$	$(3.3 \pm 0.4) \times 10^{-5}$		1037
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$		1346

$\Lambda \bar{p} K^+$	$(1.00 \pm 0.14) \times 10^{-4}$		1327
$\Lambda \bar{p} K^*(892)^+ + \text{c.c.}$	$(6.3 \pm 0.7) \times 10^{-5}$		1087
$\Lambda \bar{p} K^+ \pi^+ \pi^-$	$(1.8 \pm 0.4) \times 10^{-4}$		1167
$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		1324
$\Delta^{++} \bar{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		1371
$\Lambda \bar{\Sigma}^+ \pi^- + \text{c.c.}$	$(1.40 \pm 0.13) \times 10^{-4}$		1376
$\Lambda \bar{\Sigma}^- \pi^+ + \text{c.c.}$	$(1.54 \pm 0.14) \times 10^{-4}$		1379
$\Lambda \bar{\Sigma}^0 + \text{c.c.}$	$(1.6 \pm 0.7) \times 10^{-6}$		1437
$\Lambda \bar{\Sigma}^0 \pi^0 + \text{c.c.}$	$(1.54 \pm 0.07) \times 10^{-4}$		1380
$\Lambda(1520) \bar{\Xi}^+ K^- + \text{c.c.},$ $\Lambda(1520) \rightarrow p K^-$	$(9.5 \pm 1.2) \times 10^{-7}$		—
$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(1.67 \pm 0.18) \times 10^{-5}$		1291
$\Sigma^+ \bar{\Sigma}^-$	$(2.43 \pm 0.10) \times 10^{-4}$	S=1.4	1408
$\Sigma^0 \bar{\Sigma}^0$	$(2.35 \pm 0.09) \times 10^{-4}$	S=1.1	1405
$\Sigma^- \bar{\Sigma}^+$	$(2.82 \pm 0.09) \times 10^{-4}$		1401
$\Sigma^+ \bar{\Sigma}^- \eta$	$(9.6 \pm 2.4) \times 10^{-6}$		1108
$\Sigma^+ \bar{\Sigma}^- \omega$	$(1.89 \pm 0.28) \times 10^{-5}$		926
$\Sigma^0 \bar{\Sigma}^0 \omega(782)$	$(1.24 \pm 0.19) \times 10^{-5}$		921
$\Sigma^+ \bar{\Sigma}^- \phi$	$(3.0 \pm 0.7) \times 10^{-6}$		686
$\Sigma^0 \bar{\Sigma}^0 \phi$	$(2.64 \pm 0.34) \times 10^{-6}$		679
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(8.5 \pm 0.7) \times 10^{-5}$		1218
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(8.5 \pm 0.8) \times 10^{-5}$		1218
$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(6.9 \pm 0.7) \times 10^{-5}$		1218
$\Xi^- \bar{\Xi}^+$	$(2.87 \pm 0.11) \times 10^{-4}$	S=1.1	1284
$\Xi^0 \bar{\Xi}^0$	$(2.3 \pm 0.4) \times 10^{-4}$	S=4.2	1291
$\Xi(1530)^0 \bar{\Xi}(1530)^0$	$(6.8 \pm 0.4) \times 10^{-5}$		1025
$\Lambda \bar{\Xi}^+ K^- + \text{c.c.}$	$(3.67 \pm 0.22) \times 10^{-5}$		1114
$\Xi(1690)^- \bar{\Xi}^+ \rightarrow K^- \Lambda \bar{\Xi}^+ +$ c.c.	$(6.2 \pm 2.1) \times 10^{-6}$	S=1.5	—
$\Xi(1820)^- \bar{\Xi}^+ \rightarrow K^- \Lambda \bar{\Xi}^+ +$ c.c.	$(1.48 \pm 0.29) \times 10^{-5}$	S=1.2	—
$\Xi(1530)^- \bar{\Xi}(1530)^+$	$(1.15 \pm 0.07) \times 10^{-4}$		1025
$\Xi(1530)^- \bar{\Xi}^+$	$(7.0 \pm 1.2) \times 10^{-6}$		1165
$\Xi(1530)^0 \bar{\Xi}^0$	$(5.3 \pm 0.5) \times 10^{-6}$		1169
$\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		1060
$\Omega^- K^+ \bar{\Xi}^0 + \text{c.c.}$	$(2.8 \pm 0.4) \times 10^{-6}$		606
$\bar{\Omega}^+ K_S^0 \bar{\Xi}^- + \text{c.c.}$	$(2.9 \pm 0.6) \times 10^{-6}$		590
$\Omega^- \bar{\Omega}^+$	$(5.66 \pm 0.30) \times 10^{-5}$	S=1.3	774
$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	512
$h_c(1P) \pi^0$	$(7.4 \pm 0.5) \times 10^{-4}$		85
$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	$< 1.7 \times 10^{-6}$	CL=90%	830
$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	[c] $< 8.8 \times 10^{-6}$	CL=90%	—
$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	[c] $< 1.0 \times 10^{-5}$	CL=90%	—

$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$[c] < 7.0$	$\times 10^{-6}$	CL=90%	—
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$[c] < 2.6$	$\times 10^{-5}$	CL=90%	—
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$[c] < 6.0$	$\times 10^{-6}$	CL=90%	—

Radiative decays

$\gamma \chi_{c0}(1P)$	$(10.06 \pm 0.27) \%$	S=1.4	261
$\gamma \chi_{c1}(1P)$	$(9.85 \pm 0.26) \%$	S=1.2	171
$\gamma \chi_{c2}(1P)$	$(9.63 \pm 0.23) \%$	S=1.2	128
$\gamma \eta_c(1S)$	$(3.6 \pm 0.5) \times 10^{-3}$	S=1.3	635
$\gamma \eta_c(2S)$	$(5.4 \pm_{-2.9}^{+3.4}) \times 10^{-4}$		48
$\gamma 2(\pi^+ \pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		1817
$\gamma 3(\pi^+ \pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%	1774
$\gamma \eta'(958)$	$(1.24 \pm 0.04) \times 10^{-4}$		1719
$\gamma f_2(1270)$	$(2.73 \pm_{-0.25}^{+0.29}) \times 10^{-4}$	S=1.8	1622
$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.1 \pm 0.9) \times 10^{-6}$		—
$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(3.1 \pm 1.7) \times 10^{-5}$		1588
$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.2 \pm_{-1.7}^{+3.2}) \times 10^{-6}$		—
$\gamma f_0(1500)$	$(9.3 \pm 1.9) \times 10^{-5}$		1529
$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.7 \pm_{-1.2}^{+1.7}) \times 10^{-6}$		—
$\gamma f_2'(1525)$	$(3.3 \pm 0.8) \times 10^{-5}$		1531
$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(1.4 \pm 0.6) \times 10^{-6}$		—
$\gamma f_0(1710)$	seen		1440
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.5 \pm 0.6) \times 10^{-5}$		—
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(6.6 \pm 0.7) \times 10^{-5}$		—
$\gamma f_0(1710) \rightarrow \gamma K_S^0 K_S^0$	$(1.83 \pm_{-0.27}^{+0.32}) \times 10^{-5}$		—
$\gamma f_2(1950) \rightarrow \gamma K_S^0 K_S^0$	$(1.2 \pm_{-0.8}^{+1.0}) \times 10^{-6}$		—
$\gamma f_0(2020) \rightarrow \gamma K_S^0 K_S^0$	$(4.6 \pm 1.5) \times 10^{-6}$		—
$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(4.8 \pm 1.0) \times 10^{-6}$		1244
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(3.2 \pm 1.0) \times 10^{-6}$		1193
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 5.8 \times 10^{-6}$	CL=90%	1168
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 9.5 \times 10^{-6}$	CL=90%	1168
$\gamma \eta$	$(9.2 \pm 1.8) \times 10^{-7}$		1802
$\gamma \eta \pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		1791
$\gamma \eta(1405)$	seen		1574
$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	$< 9 \times 10^{-5}$	CL=90%	1569
$\gamma \eta(1405) \rightarrow \gamma \eta \pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		—
$\gamma \eta(1405) \rightarrow \gamma f_0(980) \pi^0 \rightarrow \gamma \pi^+ \pi^- \pi^0$	$< 5.0 \times 10^{-7}$	CL=90%	—
$\gamma \eta(1475)$	seen		1548
$\gamma \eta(1475) \rightarrow \gamma K \bar{K} \pi$	$< 1.4 \times 10^{-4}$	CL=90%	—

$\gamma\eta(1475) \rightarrow \gamma\eta\pi^+\pi^-$	< 8.8	$\times 10^{-5}$	CL=90%	—
$\gamma K^{*0} K^+\pi^- + \text{c.c.}$	(3.7 ± 0.9)	$\times 10^{-4}$		1674
$\gamma K^{*0} \bar{K}^{*0}$	(2.4 ± 0.7)	$\times 10^{-4}$		1613
$\gamma K_S^0 K^+\pi^- + \text{c.c.}$	(2.6 ± 0.5)	$\times 10^{-4}$		1753
$\gamma K^+ K^-\pi^+\pi^-$	(1.9 ± 0.5)	$\times 10^{-4}$		1726
$\gamma K^+ K^- 2(\pi^+\pi^-)$	< 2.2	$\times 10^{-4}$	CL=90%	1654
$\gamma 2(K^+ K^-)$	< 4	$\times 10^{-5}$	CL=90%	1499
$\gamma p\bar{p}$	(3.9 ± 0.5)	$\times 10^{-5}$	S=2.0	1586
$\gamma f_2(1950) \rightarrow \gamma p\bar{p}$	(1.20 ± 0.22)	$\times 10^{-5}$		—
$\gamma f_2(2150) \rightarrow \gamma p\bar{p}$	(7.2 ± 1.8)	$\times 10^{-6}$		—
$\gamma X(1835) \rightarrow \gamma p\bar{p}$	$(4.6 \begin{smallmatrix} +1.8 \\ -4.0 \end{smallmatrix})$	$\times 10^{-6}$		—
$\gamma X \rightarrow \gamma p\bar{p}$	$[h] < 2$	$\times 10^{-6}$	CL=90%	—
$\gamma p\bar{p}\pi^+\pi^-$	(2.8 ± 1.4)	$\times 10^{-5}$		1491
$\gamma\gamma$	< 1.5	$\times 10^{-4}$	CL=90%	1843
$\gamma\gamma J/\psi$	$(3.1 \begin{smallmatrix} +1.0 \\ -1.2 \end{smallmatrix})$	$\times 10^{-4}$		542
$e^+e^-\eta'$	(1.90 ± 0.26)	$\times 10^{-6}$		1719
$e^+e^-\eta_c(1S)$	(3.8 ± 0.4)	$\times 10^{-5}$		635
$e^+e^-\chi_{c0}(1P)$	(1.10 ± 0.26)	$\times 10^{-3}$		261
$e^+e^-\chi_{c1}(1P)$	(8.6 ± 0.7)	$\times 10^{-4}$		171
$e^+e^-\chi_{c2}(1P)$	(7.0 ± 0.8)	$\times 10^{-4}$		128

Weak decays

$D^0 e^+e^- + \text{c.c.}$	< 1.4	$\times 10^{-7}$	CL=90%	1371
$\Lambda_c^+ \bar{\Sigma}^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%	586

Other decays

invisible	< 1.6	%	CL=90%	—
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$\psi(3770)$

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

Mass $m = 3773.7 \pm 0.7$ MeV (S = 2.3)

Full width $\Gamma = 27.2 \pm 1.0$ MeV

$\psi(3770)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\bar{D}$	$(93 \begin{smallmatrix} +8 \\ -9 \end{smallmatrix})$ %	S=2.0	287
$D^0\bar{D}^0$	$(52 \begin{smallmatrix} +4 \\ -5 \end{smallmatrix})$ %	S=2.0	287
D^+D^-	(41 ± 4) %	S=2.0	254
$J/\psi X$	$(5.0 \pm 2.2) \times 10^{-3}$		—
$J/\psi\pi^+\pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		561
$J/\psi\pi^0\pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		565
$J/\psi\eta$	$(8.7 \pm 1.2) \times 10^{-4}$		361
$J/\psi\pi^0$	< 2.8	$\times 10^{-4}$ CL=90%	604

$e^+ e^-$	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	1887
Decays to light hadrons			
$b_1(1235)\pi$	$< 1.4 \times 10^{-5}$	CL=90%	1684
$\phi\eta'$	$< 2.3 \times 10^{-5}$	CL=90%	1607
$\omega\eta'$	$< 4 \times 10^{-4}$	CL=90%	1672
$\rho^0\eta'$	$< 6 \times 10^{-4}$	CL=90%	1674
$\phi\eta$	$(3.1 \pm 0.7) \times 10^{-4}$		1703
$\omega\eta$	$< 1.4 \times 10^{-5}$	CL=90%	1762
$\rho^0\eta$	$< 5 \times 10^{-4}$	CL=90%	1764
$\phi\pi^0$	$< 3 \times 10^{-5}$	CL=90%	1746
$\omega\pi^0$	$< 6 \times 10^{-4}$	CL=90%	1803
$\pi^+\pi^-\pi^0$	$< 5 \times 10^{-6}$	CL=90%	1874
$\rho\pi$	$< 5 \times 10^{-6}$	CL=90%	1805
K^+K^-	not seen		1821
$K^*(892)^+K^- + \text{c.c.}$	$< 1.4 \times 10^{-5}$	CL=90%	1745
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$< 1.2 \times 10^{-3}$	CL=90%	1745
$K_S^0 K_L^0$	$(2.6 \begin{smallmatrix} +1.4 \\ -1.6 \end{smallmatrix}) \times 10^{-5}$		1820
$2(\pi^+\pi^-)$	$< 1.12 \times 10^{-3}$	CL=90%	1861
$2(\pi^+\pi^-)\pi^0$	$< 1.06 \times 10^{-3}$	CL=90%	1844
$2(\pi^+\pi^-\pi^0)$	$< 5.85 \%$	CL=90%	1821
$\omega\pi^+\pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	1794
$3(\pi^+\pi^-)$	$< 9.1 \times 10^{-3}$	CL=90%	1820
$3(\pi^+\pi^-)\pi^0$	$< 1.37 \%$	CL=90%	1792
$3(\pi^+\pi^-)2\pi^0$	$< 11.74 \%$	CL=90%	1760
$\eta\pi^+\pi^-$	$< 1.24 \times 10^{-3}$	CL=90%	1836
$\pi^+\pi^-2\pi^0$	$< 8.9 \times 10^{-3}$	CL=90%	1862
$\rho^0\pi^+\pi^-$	$< 6.9 \times 10^{-3}$	CL=90%	1796
$\eta 3\pi$	$< 1.34 \times 10^{-3}$	CL=90%	1824
$\eta 2(\pi^+\pi^-)$	$< 2.43 \%$	CL=90%	1804
$\eta\rho^0\pi^+\pi^-$	$< 1.45 \%$	CL=90%	1708
$\eta' 3\pi$	$< 2.44 \times 10^{-3}$	CL=90%	1741
$K^+K^-\pi^+\pi^-$	$< 9.0 \times 10^{-4}$	CL=90%	1773
$\phi\pi^+\pi^-$	$< 4.1 \times 10^{-4}$	CL=90%	1737
$K^+K^-2\pi^0$	$< 4.2 \times 10^{-3}$	CL=90%	1774
$4(\pi^+\pi^-)$	$< 1.67 \%$	CL=90%	1757
$4(\pi^+\pi^-)\pi^0$	$< 3.06 \%$	CL=90%	1720
$\phi f_0(980)$	$< 4.5 \times 10^{-4}$	CL=90%	1597
$K^+K^-\pi^+\pi^-\pi^0$	$< 2.36 \times 10^{-3}$	CL=90%	1741
$K^+K^-\rho^0\pi^0$	$< 8 \times 10^{-4}$	CL=90%	1624
$K^+K^-\rho^+\pi^-$	$< 1.46 \%$	CL=90%	1623
ωK^+K^-	$< 3.4 \times 10^{-4}$	CL=90%	1664
$\phi\pi^+\pi^-\pi^0$	$< 3.8 \times 10^{-3}$	CL=90%	1723
$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	$< 1.62 \%$	CL=90%	1694

$K^{*+}K^{-}\pi^{+}\pi^{-} + \text{c.c.}$	< 3.23	%	CL=90%	1692
$K^{+}K^{-}\pi^{+}\pi^{-}2\pi^{0}$	< 2.67	%	CL=90%	1705
$K^{+}K^{-}2(\pi^{+}\pi^{-})$	< 1.03	%	CL=90%	1702
$K^{+}K^{-}2(\pi^{+}\pi^{-})\pi^{0}$	< 3.60	%	CL=90%	1661
$\eta K^{+}K^{-}$	< 4.1	$\times 10^{-4}$	CL=90%	1712
$\eta K^{+}K^{-}\pi^{+}\pi^{-}$	< 1.24	%	CL=90%	1624
$\rho^{0}K^{+}K^{-}$	< 5.0	$\times 10^{-3}$	CL=90%	1666
$2(K^{+}K^{-})$	< 6.0	$\times 10^{-4}$	CL=90%	1552
$\phi K^{+}K^{-}$	< 7.5	$\times 10^{-4}$	CL=90%	1598
$2(K^{+}K^{-})\pi^{0}$	< 2.9	$\times 10^{-4}$	CL=90%	1494
$2(K^{+}K^{-})\pi^{+}\pi^{-}$	< 3.2	$\times 10^{-3}$	CL=90%	1426
$K_{S}^{0}K^{-}\pi^{+}$	< 3.2	$\times 10^{-3}$	CL=90%	1799
$K_{S}^{0}K^{-}\pi^{+}\pi^{0}$	< 1.33	%	CL=90%	1773
$K_{S}^{0}K^{-}\rho^{+}$	< 6.6	$\times 10^{-3}$	CL=90%	1665
$K_{S}^{0}K^{-}2\pi^{+}\pi^{-}$	< 8.7	$\times 10^{-3}$	CL=90%	1740
$K_{S}^{0}K^{-}\pi^{+}\rho^{0}$	< 1.6	%	CL=90%	1621
$K_{S}^{0}K^{-}\pi^{+}\eta$	< 1.3	%	CL=90%	1670
$K_{S}^{0}K^{-}2\pi^{+}\pi^{-}\pi^{0}$	< 4.18	%	CL=90%	1703
$K_{S}^{0}K^{-}2\pi^{+}\pi^{-}\eta$	< 4.8	%	CL=90%	1570
$K_{S}^{0}K^{-}\pi^{+}2(\pi^{+}\pi^{-})$	< 1.22	%	CL=90%	1658
$K_{S}^{0}K^{-}\pi^{+}2\pi^{0}$	< 2.65	%	CL=90%	1742
$K_{S}^{0}K^{-}K^{+}K^{-}\pi^{+}$	< 4.9	$\times 10^{-3}$	CL=90%	1491
$K_{S}^{0}K^{-}K^{+}K^{-}\pi^{+}\pi^{0}$	< 3.0	%	CL=90%	1427
$K_{S}^{0}K^{-}K^{+}K^{-}\pi^{+}\eta$	< 2.2	%	CL=90%	1214
$K^{*0}K^{-}\pi^{+} + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	1722
$p\bar{p}$	not seen			1637
$p\bar{p}\pi^{0}$	< 4	$\times 10^{-5}$	CL=90%	1595
$p\bar{p}\pi^{+}\pi^{-}$	< 5.8	$\times 10^{-4}$	CL=90%	1544
$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	1522
$p\bar{p}\pi^{+}\pi^{-}\pi^{0}$	< 1.85	$\times 10^{-3}$	CL=90%	1490
$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	1310
$\Lambda\bar{\Lambda}\pi^{0}$	< 7	$\times 10^{-5}$	CL=90%	1469
$p\bar{p}2(\pi^{+}\pi^{-})$	< 2.6	$\times 10^{-3}$	CL=90%	1426
$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	1431
$\eta p\bar{p}\pi^{+}\pi^{-}$	< 3.3	$\times 10^{-3}$	CL=90%	1284
$\rho^{0}p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	1314
$p\bar{p}K^{+}K^{-}$	< 3.2	$\times 10^{-4}$	CL=90%	1186
$\eta p\bar{p}K^{+}K^{-}$	< 6.9	$\times 10^{-3}$	CL=90%	737
$\pi^{0}p\bar{p}K^{+}K^{-}$	< 1.2	$\times 10^{-3}$	CL=90%	1094
$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1178
$\Lambda\bar{\Lambda}\pi^{+}\pi^{-}$	< 2.5	$\times 10^{-4}$	CL=90%	1405
$\Lambda\bar{p}K^{+}$	< 2.8	$\times 10^{-4}$	CL=90%	1387
$\Lambda\bar{p}K^{+}\pi^{+}\pi^{-}$	< 6.3	$\times 10^{-4}$	CL=90%	1234

$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	1263
$\Sigma^+\bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	1465
$\Sigma^0\bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	1462
$\Xi^0\bar{\Xi}^0$	< 3.4	$\times 10^{-4}$	CL=90%	1353
$\Xi^-\bar{\Xi}^+$	$(1.4 \pm 0.4) \times 10^{-4}$			1347
$\Lambda\bar{\Xi}^+ K^- + \text{c.c.}$	< 1.0	$\times 10^{-4}$	CL=90%	1185
$\Sigma^0\bar{\Xi}^+ K^- + \text{c.c.}$	< 3.4	$\times 10^{-4}$	CL=90%	1134
$pK^- K^- \bar{\Xi}^+ + \text{c.c.}$	< 7	$\times 10^{-5}$	CL=90%	949

Radiative decays

$\gamma\chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	211
$\gamma\chi_{c1}$	$(2.49 \pm 0.23) \times 10^{-3}$			254
$\gamma\chi_{c0}$	$(7.1 \pm 0.6) \times 10^{-3}$			341
$\gamma\eta_c$	< 8	$\times 10^{-4}$	CL=90%	707
$\gamma\eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	133
$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	1765
$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	1847
$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%	1884

$\psi_2(3823)$

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

I, J, P need confirmation.

was $\psi(3823)$, $X(3823)$

Mass $m = 3823.51 \pm 0.34$ MeV

Full width $\Gamma < 2.9$ MeV, CL = 90%

Branching fractions are given relative to the one **DEFINED AS 1**.

$\psi_2(3823)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$J/\psi(1S)\pi^+\pi^-$	<0.06	90%	607
$J/\psi(1S)\pi^0\pi^0$	<0.11	90%	610
$J/\psi(1S)\pi^0$	<0.030	90%	646
$J/\psi(1S)\eta$	<0.14	90%	431
$\chi_{c0}\gamma$	<0.24	90%	386
$\chi_{c1}\gamma$	DEFINED AS 1		300
$\chi_{c2}\gamma$	$0.28^{+0.14}_{-0.11}$		258

$\psi_3(3842)$

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

J, P need confirmation.

Mass $m = 3842.71 \pm 0.20$ MeV

Full width $\Gamma = 2.8 \pm 0.6$ MeV

$\psi_3(3842)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+ D^-$	seen	443
$D^0 \bar{D}^0$	seen	463

$\chi_{c1}(3872)$

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

also known as $X(3872)$

T-Matrix Pole \sqrt{s} relative to $D^0 D^{*+}$ threshold = $(0.01 \pm 0.15_{-0.08}^{+0.07} \pm 0.07) - i(0.19 \pm 0.08_{-0.19}^{+0.14})$ MeV

T-Matrix Pole $\sqrt{s} = (3871.70 \pm 0.15_{-0.08}^{+0.07}) - i(0.19 \pm 0.08_{-0.19}^{+0.14})$ MeV

Mass $m = 3871.64 \pm 0.06$ MeV

Full width $\Gamma = 1.19 \pm 0.21$ MeV ($S = 1.1$)

$\chi_{c1}(3872)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$< 2.7 \times 10^{-7}$	90%	1936
$\pi^+ \pi^- \pi^0$	< 1.0 %	90%	1924
$\pi^+ \pi^- J/\psi(1S)$	(4.3 ± 1.4) %		650
$\pi^+ \pi^- \pi^0 J/\psi(1S)$	not seen		588
$\omega \eta_c(1S)$	< 40 %	90%	368
$\rho(770)^0 J/\psi(1S)$	(3.4 ± 1.1) %		—
$\omega J/\psi(1S)$	(5.0 ± 1.9) %		†
$\phi \phi$	not seen		1646
$D^0 \bar{D}^0 \pi^0$	(55 ± 28) %		116
$\bar{D}^{*0} D^0$	(46 ± 16) %		†
$\gamma \gamma$	< 13 %	90%	1936
$D^0 \bar{D}^0$	< 32 %	90%	519
$D^+ D^-$	< 22 %	90%	502
$\pi^0 \chi_{c2}$	< 5 %	90%	273
$\pi^0 \chi_{c1}$	$(3.8_{-1.7}^{+1.9})$ %		319
$\pi^0 \chi_{c0}$	< 16 %	90%	410
$\pi^+ \pi^- \eta_c(1S)$	< 16 %	90%	745
$\pi^0 \pi^0 \chi_{c0}$	< 7 %	90%	346
$\pi^0 \pi^0 \chi_{c1}$	< 5 %	90%	228
$\pi^0 \pi^0 \chi_{c2}$	< 2.2 %	90%	156
$\pi^+ \pi^- \chi_{c0}$	< 2.4 %	90%	339
$\pi^+ \pi^- \chi_{c1}$	$< 8 \times 10^{-3}$	90%	218
$p \bar{p}$	$< 2.7 \times 10^{-5}$	95%	1693
$\pi^+ \pi^- \eta$	$< 5 \times 10^{-3}$	90%	1887

Radiative decays

$\gamma D^+ D^-$	< 4	%	90%	502
$\gamma \bar{D}^0 D^0$	< 7	%	90%	519
$\gamma J/\psi$	(10 ± 4)	$\times 10^{-3}$		697
$\gamma \chi_{c1}$	< 1.0	%	90%	344
$\gamma \chi_{c2}$	< 4	%	90%	303
$\gamma \psi(2S)$	possibly seen			181
$\gamma \psi_2(3823)$	< 3.3	$\times 10^{-3}$	90%	48

C-violating decays

$\eta J/\psi$	< 2.1	%	90%	491
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 $\chi_{c0}(3915)$

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

was $X(3915)$

Mass $m = 3922.1 \pm 1.8$ MeV (S = 1.5)

Full width $\Gamma = 20 \pm 4$ MeV (S = 1.1)

$\chi_{c0}(3915)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega J/\psi$	seen	232
$\bar{D}^{*0} D^0$	not seen	313
$D^+ D^-$	seen	592
$D_s^+ D_s^-$	seen	†
$\pi^+ \pi^- \eta_c(1S)$	not seen	788
$\eta_c \eta$	not seen	668
$\eta_c \pi^0$	not seen	817
$K \bar{K}$	not seen	1898
$\gamma \gamma$	seen	1961
$\gamma \psi(2S)$	not seen	229
$\pi^0 \chi_{c1}$	not seen	368

 $\chi_{c2}(3930)$

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

Mass $m = 3922.5 \pm 1.0$ MeV (S = 1.7)

Full width $\Gamma = 35.2 \pm 2.2$ MeV (S = 1.2)

$\chi_{c2}(3930)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma \gamma$	seen	1961
$K \bar{K} \pi$	not seen	1878
$K^+ K^- \pi^+ \pi^- \pi^0$	not seen	1822
$D \bar{D}$	seen	607
$D^+ D^-$	seen	592

$D^0 \bar{D}^0$	seen	607
$\pi^+ \pi^- \eta_c(1S)$	not seen	788
$K \bar{K}$	not seen	1898

$\psi(4040)$ [i]

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

Mass $m = 4040 \pm 4$ MeV

Full width $\Gamma = 84 \pm 12$ MeV

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

$\psi(4040)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$e^+ e^-$	$(1.02 \pm 0.17) \times 10^{-5}$		2020
$D \bar{D}$	seen		776
$D^0 \bar{D}^0$	seen		776
$D^+ D^-$	seen		764
$D^* \bar{D} + \text{c.c.}$	seen		570
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen		576
$D^*(2010)^+ D^- + \text{c.c.}$	seen		562
$D^* \bar{D}^*$	seen		196
$D^*(2007)^0 \bar{D}^*(2007)^0$	seen		228
$D^*(2010)^+ D^*(2010)^-$	seen		196
$D \bar{D} \pi$ (excl. $D^* \bar{D}$)	not seen		–
$D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+ D^- + \text{c.c.}$)	not seen		–
$D \bar{D}^* \pi$ (excl. $D^* \bar{D}^*$)	not seen		–
$D^0 \bar{D}^{*-} \pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+ D^*(2010)^-$)	seen		–
$D_s^+ D_s^-$	seen		453
$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	seen		1979
$J/\psi(1S)$ hadrons	seen		–
$J/\psi \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	795
$J/\psi \pi^0 \pi^0$	$< 2 \times 10^{-3}$	90%	797
$J/\psi \eta$	$(5.2 \pm 0.7) \times 10^{-3}$		676
$J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	90%	824
$J/\psi \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	90%	747
$\chi_{c1} \gamma$	$< 3.4 \times 10^{-3}$	90%	494
$\chi_{c2} \gamma$	$< 5 \times 10^{-3}$	90%	455
$\chi_{c1} \pi^+ \pi^- \pi^0$	$< 1.1 \%$	90%	307
$\chi_{c2} \pi^+ \pi^- \pi^0$	$< 3.2 \%$	90%	234

$h_c(1P)\pi^+\pi^-$	< 3	$\times 10^{-3}$	90%	404
$\phi\pi^+\pi^-$	< 3	$\times 10^{-3}$	90%	1880
$\Lambda\bar{\Lambda}\pi^+\pi^-$	< 2.9	$\times 10^{-4}$	90%	1579
$\Lambda\bar{\Lambda}\pi^0$	< 9	$\times 10^{-5}$	90%	1636
$\Lambda\bar{\Lambda}\eta$	< 3.0	$\times 10^{-4}$	90%	1452
$\Lambda\bar{\Lambda}$	< 6	$\times 10^{-6}$	90%	1684
$\Sigma^+\bar{\Sigma}^-$	< 1.3	$\times 10^{-4}$	90%	1632
$\Sigma^0\bar{\Sigma}^0$	< 7	$\times 10^{-5}$	90%	1630
$\Xi^+\bar{\Xi}^-$	< 1.6	$\times 10^{-4}$	90%	1527
$\Xi^0\bar{\Xi}^0$	< 1.8	$\times 10^{-4}$	90%	1533
$\Xi^-\bar{\Xi}^+$	< 6	$\times 10^{-5}$	90%	1527
$\Lambda\bar{\Xi}^+K^- + \text{c.c.}$	< 7	$\times 10^{-5}$	90%	1386
$\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$	< 1.5	$\times 10^{-5}$	90%	1343
$pK^-K^-\bar{\Xi}^+ + \text{c.c.}$	< 4	$\times 10^{-5}$	90%	1188
$\mu^+\mu^-$	(9 ± 6)	$\times 10^{-6}$		2017

$\chi_{c1}(4140)$

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

was $X(4140)$

$$\text{Mass } m = 4146.5 \pm 3.0 \text{ MeV} \quad (S = 1.3)$$

$$\text{Full width } \Gamma = 19^{+7}_{-5} \text{ MeV}$$

$\chi_{c1}(4140)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\phi$	seen	216
$\gamma\gamma$	not seen	2073

$\psi(4160)$ [i]

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

$$\text{Mass } m = 4191 \pm 5 \text{ MeV}$$

$$\text{Full width } \Gamma = 69 \pm 10 \text{ MeV}$$

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

$\psi(4160)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	$(6.9 \pm 3.3) \times 10^{-6}$		2096
$\mu^+\mu^-$	seen		2093
$D\bar{D}$	seen		956
$D^0\bar{D}^0$	seen		956

$D^+ D^-$	seen			947
$D^* \bar{D} + \text{c.c.}$	seen			798
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen			802
$D^*(2010)^+ D^- + \text{c.c.}$	seen			792
$D^* \bar{D}^*$	seen			592
$D^*(2007)^0 \bar{D}^*(2007)^0$	seen			604
$D^*(2010)^+ D^*(2010)^-$	seen			592
$D^0 D^- \pi^+ + \text{c.c. (excl.}$	not seen			—
$D^*(2010)^+ D^- + \text{c.c.)}$				
$D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)$	seen			—
$D^0 D^{*-} \pi^+ + \text{c.c. (excl.}$	not seen			—
$D^*(2010)^+ D^*(2010)^-$				
$D_s^+ D_s^-$	not seen			719
$D_s^{*+} D_s^- + \text{c.c.}$	seen			478
$J/\psi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	919
$J/\psi \pi^0 \pi^0$	< 3	$\times 10^{-3}$	90%	921
$J/\psi K^+ K^-$	< 2	$\times 10^{-3}$	90%	407
$J/\psi \eta$	< 8	$\times 10^{-3}$	90%	821
$J/\psi \pi^0$	< 1	$\times 10^{-3}$	90%	944
$J/\psi \eta'$	< 5	$\times 10^{-3}$	90%	456
$J/\psi \pi^+ \pi^- \pi^0$	< 1	$\times 10^{-3}$	90%	879
$\psi(2S) \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	395
$\chi_{c1} \gamma$	< 5	$\times 10^{-3}$	90%	625
$\chi_{c2} \gamma$	< 1.3	%	90%	587
$\chi_{c1} \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	496
$\chi_{c2} \pi^+ \pi^- \pi^0$	< 8	$\times 10^{-3}$	90%	444
$h_c(1P) \pi^+ \pi^-$	< 5	$\times 10^{-3}$	90%	556
$h_c(1P) \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	560
$h_c(1P) \eta$	< 2	$\times 10^{-3}$	90%	348
$h_c(1P) \pi^0$	< 4	$\times 10^{-4}$	90%	600
$\omega \pi^+ \pi^-$	seen			2013
$\phi \pi^+ \pi^-$	< 2	$\times 10^{-3}$	90%	1961
$\gamma \chi_{c1}(3872)$	< 1.6	$\times 10^{-3}$	90%	307
$\gamma \chi_{c0}(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.36	$\times 10^{-4}$	90%	—
$\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.18	$\times 10^{-4}$	90%	—
$\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.47	$\times 10^{-4}$	90%	—
$\gamma \chi_{c0}(3915) \rightarrow \gamma \gamma J/\psi$	< 1.26	$\times 10^{-4}$	90%	—
$\gamma X(3930) \rightarrow \gamma \gamma J/\psi$	< 8.8	$\times 10^{-5}$	90%	—
$\gamma X(3940) \rightarrow \gamma \gamma J/\psi$	< 1.79	$\times 10^{-4}$	90%	—
$\omega \pi^0$	not seen			2020
$\omega \eta$	not seen			1984
$K^+ K^-$	not seen			2037
$K_S^0 K^\pm \pi^\mp$	seen			2017
$p \bar{p} p \bar{p}$	not seen			834

$\Lambda\bar{\Lambda}$	< 1.5	$\times 10^{-6}$	90%	1774
$\Sigma^+\bar{\Sigma}^-$	< 2.0	$\times 10^{-4}$	90%	1725
$\Sigma^0\bar{\Sigma}^0$	< 5	$\times 10^{-5}$	90%	1723
$\Xi^0\bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	90%	1632
$\Xi^-\bar{\Xi}^+$	< 8	$\times 10^{-5}$	90%	1626
$pK^-\bar{\Lambda} + \text{c.c.}$	< 6	$\times 10^{-6}$	90%	1659
$\Lambda\bar{\Xi}^+K^- + \text{c.c.}$	seen			1494
$\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$	< 3.1	$\times 10^{-6}$	90%	1454
$pK^-K^-\bar{\Xi}^+ + \text{c.c.}$	< 1.1	$\times 10^{-4}$	90%	1311

$\psi(4230)$

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

also known as $Y(4230)$; was $\psi(4260)$

$$\text{Mass } m = 4221.7 \pm 2.5 \text{ MeV} \quad (S = 1.9)$$

$$\text{Full width } \Gamma = 51 \pm 7 \text{ MeV} \quad (S = 3.4)$$

$\psi(4230)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\mu^+\mu^-$	$(3.0 \pm 2.7) \times 10^{-5}$	2107
$\eta_c(1S)\pi^+\pi^-$	not seen	1027
$\eta_c(1S)\pi^+\pi^-\pi^0$	seen	992
$J/\psi\pi^+\pi^-$	seen	942
$J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	seen	—
$T_{c\bar{c}1}(3900)^\pm \pi^\mp, T_{c\bar{c}1}^\pm \rightarrow$	seen	—
$J/\psi\pi^\pm$		
$J/\psi\pi^0\pi^0$	seen	944
$J/\psi K^+K^-$	seen	460
$J/\psi K_S^0 K_S^0$	not seen	447
$J/\psi\eta$	seen	848
$J/\psi\pi^0$	not seen	966
$J/\psi\eta'$	seen	504
$J/\psi\pi^+\pi^-\pi^0$	not seen	904
$J/\psi\eta\pi^0$	not seen	770
$J/\psi\eta\eta$	not seen	211
$\psi(2S)\pi^+\pi^-$	seen	426
$\psi(2S)\eta$	not seen	†
$\chi_{c0}\omega$	seen	168
$\chi_{c1}\pi^+\pi^-\pi^0$	not seen	527
$\chi_{c2}\pi^+\pi^-\pi^0$	not seen	477
$h_c(1P)\pi^+\pi^-$	seen	583
$h_c(1P)\eta$	seen	391
$\phi\pi^+\pi^-$	not seen	1976
$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$	not seen	—

$\phi K^+ K^-$	not seen	1856
$\phi K_S^0 K_S^0$	not seen	1854
$\phi \eta$	not seen	1947
$\phi \eta'$	not seen	1864
$D \bar{D}$	not seen	987
$D^0 \bar{D}^0$	possibly seen	987
$D^+ D^-$	possibly seen	978
$D^* \bar{D} + \text{c.c.}$	not seen	835
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	not seen	839
$D^*(2010)^+ D^- + \text{c.c.}$	not seen	829
$D^* \bar{D}^*$	not seen	641
$D^*(2007)^0 \bar{D}^*(2007)^0$	not seen	652
$D^*(2010)^+ D^*(2010)^-$	not seen	641
$D \bar{D} \pi + \text{c.c.}$	not seen	847
$D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0 \bar{D}^{*0} + \text{c.c.}$, $D^*(2010)^+ D^- + \text{c.c.}$)	not seen	—
$D \bar{D}^* \pi + \text{c.c.}$ (excl. $D^* \bar{D}^*$)	not seen	723
$D^0 D^*(2010)^- \pi^+ + \text{c.c.}$	seen	650
$D_1(2420) \bar{D} + \text{c.c.}$	not seen	†
$D^* \bar{D}^* \pi$	seen	367
$D^{*0} D^{*-} \pi^+$	seen	364
$D_s^+ D_s^-$	not seen	760
$D_s^{*+} D_s^{*-} + \text{c.c.}$	not seen	538
$D_s^{*+} D_s^{*-}$	not seen	†
$p \bar{p}$	not seen	1890
$p \bar{p} \pi^0$	not seen	1854
$p \bar{p} \eta$	not seen	1712
$\omega \pi^+ \pi^-$	seen	2028
$p \bar{p} \omega$	not seen	1610
$\Xi^- \Xi^+$	not seen	1645
$\pi^+ \pi^+ \pi^- \pi^-$	not seen	2087
$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	not seen	2071
$\omega \pi^0$	not seen	2035
$\omega \eta$	not seen	1999
$K_S^0 K^\pm \pi^\mp$	not seen	2032
$K_S^0 K^\pm \pi^\mp \pi^0$	not seen	2009
$K_S^0 K^\pm \pi^\mp \eta$	not seen	1917
$K^+ K^- \pi^0$	not seen	2033
$K^+ K^- \pi^+ \pi^-$	not seen	2008
$K^+ K^- \pi^+ \pi^- \pi^0$	not seen	1981
$K^+ K^+ K^- K^-$	not seen	1813
$K^+ K^+ K^- K^- \pi^0$	not seen	1762
$p \bar{p} \pi^+ \pi^-$	not seen	1810

$p\bar{p}\pi^+\pi^-\pi^0$	not seen	1764
$p\bar{p}p\bar{p}$	not seen	864
$\Lambda\bar{\Lambda}$	not seen	1791
$\Sigma^+\bar{\Sigma}^-$	not seen	1743
$pK^-\bar{\Lambda} + \text{c.c.}$	not seen	1677
$\Lambda\bar{\Xi}^+K^- + \text{c.c.}$	not seen	1514
$\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$	not seen	1474

Radiative decays

$\eta_c(1S)\gamma$	possibly seen	1055
$\eta_c(1S)\pi^0\gamma$	not seen	1048
$\eta_c(1S)\eta\gamma$	not seen	943
$\eta_c(1S)\eta'\gamma$	not seen	661
$\chi_{c1}\gamma$	not seen	650
$\chi_{c2}\gamma$	not seen	612
$\chi_{c1}(3872)\gamma$	seen	334

$\chi_{c1}(4274)$

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

was $X(4274)$

$$\text{Mass } m = 4290 \pm 6 \text{ MeV} \quad (S = 1.5)$$

$$\text{Full width } \Gamma = 54 \pm 8 \text{ MeV} \quad (S = 1.2)$$

$\chi_{c1}(4274)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\phi$	seen	529

$\psi(4360)$

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

also known as $Y(4360)$; was $X(4360)$

$$\text{Mass } m = 4373 \pm 7 \text{ MeV} \quad (S = 2.3)$$

$$\text{Full width } \Gamma = 124 \pm 13 \text{ MeV} \quad (S = 2.4)$$

$\psi(4360)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	seen	2187
$h_c\pi^+\pi^-$	seen	722
$J/\psi\pi^+\pi^-$	seen	1063
$\psi(2S)\pi^+\pi^-$	seen	578
$\psi(3770)\pi^+\pi^-$	possibly seen	494
$\psi_2(3823)\pi^+\pi^-$	seen	443
$J/\psi\eta$	seen	982
$D^0D^{*-}\pi^+$	not seen	867

$D^+ D^- \pi^+ \pi^-$	seen	861
$D_1(2420) \bar{D} + \text{c.c.}$	possibly seen	429
$\phi \eta$	not seen	2029
$\omega \pi^0$	not seen	2114
$\omega \eta$	not seen	2080
$p \bar{p} \eta$	not seen	1805
$p \bar{p} \omega$	not seen	1708
$\chi_{c1} \gamma$	not seen	777
$\chi_{c2} \gamma$	not seen	741
$\Sigma^+ \bar{\Sigma}^-$	not seen	1835
$\Xi^- \bar{\Xi}^+$	not seen	1742
$p K^- \bar{\Lambda} + \text{c.c.}$	not seen	1772
$\Lambda \bar{\Xi}^+ K^- + \text{c.c.}$	not seen	1619
$\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$	not seen	1582

$\psi(4415)$ [i]

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

Mass $m = 4415 \pm 5$ MeV

Full width $\Gamma = 110 \pm 13$ MeV ($S = 1.6$)

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

$\psi(4415)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$D \bar{D}$	seen		1181
$D^0 \bar{D}^0$	seen		1181
$D^+ D^-$	seen		1173
$D^* \bar{D} + \text{c.c.}$	seen		1057
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen		1060
$D^*(2010)^+ D^- + \text{c.c.}$	seen		1052
$D^* \bar{D}^*$	seen		911
$D^*(2007)^0 \bar{D}^*(2007)^0 + \text{c.c.}$	seen		919
$D^*(2010)^+ D^*(2010)^- + \text{c.c.}$	seen		911
$D^0 D^- \pi^+ (\text{excl. } D^*(2010)^+ D^- + \text{c.c.})$	< 2.3 %	90%	–
$D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.}$	(10 ± 4) %		–
$D^0 D^{*-} \pi^+ + \text{c.c.}$	< 31 %	90%	918
$D_1(2420) \bar{D} + \text{c.c.}$	possibly seen		523
$D_s^+ D_s^-$	not seen		999
$\omega \chi_{c2}$	$(9 \pm 4) \times 10^{-3}$		317
$D_s^{*+} D_s^- + \text{c.c.}$	seen		842

$D_s^{*+} D_s^{*-}$	seen			641
$\psi_2(3823)\pi^+\pi^-$	possibly seen			486
$\psi(3770)\pi^+\pi^-$	possibly seen			535
$J/\psi\eta$	< 1.0	%	90%	1017
$\chi_{c1}\gamma$	< 1.3	$\times 10^{-3}$	90%	811
$\chi_{c2}\gamma$	< 7	$\times 10^{-3}$	90%	775
$\Lambda\bar{\Lambda}$	< 5	$\times 10^{-6}$	90%	1905
$\Sigma^+\bar{\Sigma}^-$	< 1.8	$\times 10^{-4}$	90%	1859
$\Sigma^0\bar{\Sigma}^0$	< 4	$\times 10^{-5}$	90%	1857
$\Xi^0\bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	90%	1773
$\Xi^-\bar{\Xi}^+$	< 6	$\times 10^{-5}$	90%	1768
$pK^-\bar{\Lambda} + \text{c.c.}$	< 1.0	$\times 10^{-5}$	90%	1798
$\Lambda\bar{\Xi}^+K^- + \text{c.c.}$	< 4	$\times 10^{-5}$	90%	1647
$\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$	< 2.5	$\times 10^{-4}$	90%	1610
$pK^-K^-\bar{\Xi}^+ + \text{c.c.}$	< 8	$\times 10^{-5}$	90%	1481
$\omega\pi^0$	not seen			2136
$\omega\eta$	not seen			2102
e^+e^-	$(3.2 \pm 1.2) \times 10^{-6}$			2207
$\mu^+\mu^-$	$(1.1 \pm 0.4) \times 10^{-5}$			2205

$\chi_{c0}(4500)$

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

was $X(4500)$

$$\text{Mass } m = 4484 \pm 12 \text{ MeV} \quad (S = 3.4)$$

$$\text{Full width } \Gamma = 87_{-24}^{+30} \text{ MeV} \quad (S = 2.9)$$

$\chi_{c0}(4500)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\phi$	seen	788
$\psi(2S)\pi^+\pi^-$	seen	681

$\psi(4660)$

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

also known as $Y(4660)$; was $X(4660)$

$$\text{Mass } m = 4623 \pm 10 \text{ MeV} \quad (S = 3.7)$$

$$\text{Full width } \Gamma = 55 \pm 9 \text{ MeV} \quad (S = 1.9)$$

$\psi(4660)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	not seen	2311
$\psi(2S)\pi^+\pi^-$	seen	803
$J/\psi\eta$	not seen	1186
$D^0 D^{*-}\pi^+$	not seen	1146

$D^{*0} D^{*-} \pi^+$	seen	1011
$\psi_2(3823) \pi^+ \pi^-$	seen	684
$\chi_{c0} \phi$	not seen	557
$\chi_{c1} \gamma$	not seen	978
$\chi_{c1} \phi$	not seen	387
$\chi_{c2} \gamma$	not seen	943
$\chi_{c2} \phi$	seen	275
$\Lambda_c^+ \Lambda_c^-$	seen	338
$D_s^+ D_{s1}(2536)^-$	seen	517
$D_s^+ D_{s2}^*(2573)^-$	seen	—
$\omega \pi^0$	not seen	2243
$\omega \eta$	not seen	2211
$\Sigma^+ \bar{\Sigma}^-$	not seen	1982
$\Xi^0 \bar{\Xi}^0$	not seen	1901
$\Xi^- \bar{\Xi}^+$	not seen	1896
$p K^- \bar{\Lambda} + \text{c.c.}$	not seen	1924
$\Lambda \bar{\Xi}^+ K^- + \text{c.c.}$	not seen	1784
$\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$	not seen	1749

NOTES

- [a] For $E_\gamma > 100$ MeV.
- [b] The value is for the sum of the charge states or particle/antiparticle states indicated.
- [c] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54 \text{ GeV}/c^2$ mass and a width of less than $25 \text{ MeV}/c^2$.
- [d] Includes $p \bar{p} \pi^+ \pi^- \gamma$ and excludes $p \bar{p} \eta, p \bar{p} \omega, p \bar{p} \eta'$.
- [e] For a narrow state A with mass less than 960 MeV.
- [f] For a narrow scalar or pseudoscalar A^0 with mass 0.21–3.0 GeV.
- [g] For a dark photon U with mass between 100 and 2100 MeV.
- [h] For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.
- [i] 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.