$c\overline{c}$ MESONS

$\eta_c(1S)$

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

Mass $m = 2980.3 \pm 1.2$ MeV (S = 1.7)
Full width $\Gamma = 26.7 \pm 3.0$ MeV (S = 2.0)

$\eta_c(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Decays involving hadronic resonances			
$\eta'(958)\pi\pi$	(4.1 ±1.7) %		1321
$\rho\rho$	(2.0 ±0.7) %		1272
$K^*(892)^0 K^-\pi^+$ + c.c.	(2.0 ±0.7) %		1275
$K^*(892)\overline{K}^*(892)$	(9.2 ±3.4) $\times 10^{-3}$		1194
$K^{*0}\overline{K}^{*0}\pi^+\pi^-$	(1.5 ±0.8) %		1071
$\phi K^+ K^-$	(2.9 ±1.4) $\times 10^{-3}$		1102
$\phi\phi$	(2.7 ±0.9) $\times 10^{-3}$		1087
$\phi 2(\pi^+\pi^-)$	< 4.7 $\times 10^{-3}$	90%	1249
$a_0(980)\pi$	< 2 %	90%	1324
$a_2(1320)\pi$	< 2 %	90%	1194
$K^*(892)\overline{K}$ + c.c.	< 1.28 %	90%	1308
$f_2(1270)\eta$	< 1.1 %	90%	1143
$\omega\omega$	< 3.1 $\times 10^{-3}$	90%	1268
$\omega\phi$	< 1.7 $\times 10^{-3}$	90%	1183
$f_2(1270)f_2(1270)$	(1.0 $^{+0.4}_{-0.5}$) %		771
$f_2(1270)f_2'(1525)$	(8 ±4) $\times 10^{-3}$		508
Decays into stable hadrons			
$K\overline{K}\pi$	(7.0 ±1.2) %		1379
$\eta\pi\pi$	(4.9 ±1.8) %		1427
$\pi^+\pi^- K^+ K^-$	(1.5 ±0.6) %		1343
$K^+ K^- 2(\pi^+\pi^-)$	(10 ±4) $\times 10^{-3}$		1252
$2(K^+ K^-)$	(1.5 ±0.7) $\times 10^{-3}$		1053
$2(\pi^+\pi^-)$	(1.20±0.30) %		1457
$3(\pi^+\pi^-)$	(2.0 ±0.7) %		1405
$p\overline{p}$	(1.3 ±0.4) $\times 10^{-3}$		1158
$\Lambda\overline{\Lambda}$	(1.04±0.31) $\times 10^{-3}$		988
$K\overline{K}\eta$	< 3.1 %	90%	1263
$\pi^+\pi^- p\overline{p}$	< 1.2 %	90%	1024
Radiative decays			
$\gamma\gamma$	(2.4 $^{+1.1}_{-0.9}$) $\times 10^{-4}$		1490

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

$\pi^+\pi^-$	P,CP	$<$ 8.7	$\times 10^{-4}$	90%	1484
$\pi^0\pi^0$	P,CP	$<$ 5.6	$\times 10^{-4}$	90%	1484
K^+K^-	P,CP	$<$ 7.6	$\times 10^{-4}$	90%	1406
$K^0_S K^0_S$	P,CP	$<$ 4.2	$\times 10^{-4}$	90%	1405

$J/\psi(1S)$

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

Mass $m = 3096.916 \pm 0.011$ MeV
Full width $\Gamma = 93.2 \pm 2.1$ keV
$\Gamma_{ee} = 5.55 \pm 0.14 \pm 0.02$ keV

$J/\psi(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons		(87.7 ±0.5) %		–
virtual $\gamma \rightarrow$ hadrons		(13.50±0.30) %		–
e^+e^-		(5.94±0.06) %		1548
$\mu^+\mu^-$		(5.93±0.06) %		1545
Decays involving hadronic resonances				
$\rho\pi$		(1.69±0.15) %	S=2.4	1448
$\rho^0\pi^0$		(5.6 ±0.7) $\times 10^{-3}$		1448
$a_2(1320)\rho$		(1.09±0.22) %		1123
$\omega\pi^+\pi^+\pi^-\pi^-$		(8.5 ±3.4) $\times 10^{-3}$		1392
$\omega\pi^+\pi^-\pi^0$		(4.0 ±0.7) $\times 10^{-3}$		1418
$\omega\pi^+\pi^-$		(8.6 ±0.7) $\times 10^{-3}$	S=1.1	1435
$\omega f_2(1270)$		(4.3 ±0.6) $\times 10^{-3}$		1142
$K^*(892)^0\overline{K}{}^*_2(1430)^0 +$ c.c.		(6.0 ±0.6) $\times 10^{-3}$		1012
$K^*(892)^0\overline{K}_2(1770)^0 +$ c.c. $\rightarrow$ $K^*(892)^0 K^-\pi^+ +$ c.c.		(6.9 ±0.9) $\times 10^{-4}$		–
$\omega K^*(892)\overline{K} +$ c.c.		(6.1 ±0.9) $\times 10^{-3}$		1097
$K^+\overline{K}{}^*(892)^- +$ c.c.		(5.12±0.30) $\times 10^{-3}$		1373
$K^+\overline{K}{}^*(892)^- +$ c.c. $\rightarrow$ $K^+K^-\pi^0$		(1.97±0.20) $\times 10^{-3}$		–
$K^+\overline{K}{}^*(892)^- +$ c.c. $\rightarrow$ $K^0K^\pm\pi^\mp$		(3.0 ±0.4) $\times 10^{-3}$		–
$K^0\overline{K}{}^*(892)^0 +$ c.c.		(4.39±0.31) $\times 10^{-3}$		1373
$K^0\overline{K}{}^*(892)^0 +$ c.c. $\rightarrow$ $K^0K^\pm\pi^\mp$		(3.2 ±0.4) $\times 10^{-3}$		–
$K_1(1400)^\pm K^\mp$		(3.8 ±1.4) $\times 10^{-3}$		1170
$\overline{K}{}^*(892)^0 K^+\pi^- +$ c.c.		seen		1343
$\omega\pi^0\pi^0$		(3.4 ±0.8) $\times 10^{-3}$		1436
$b_1(1235)^\pm\pi^\mp$	[a]	(3.0 ±0.5) $\times 10^{-3}$		1300
$\omega K^\pm K^0_S\pi^\mp$	[a]	(3.4 ±0.5) $\times 10^{-3}$		1210

$b_1(1235)^0\pi^0$		(2.3 ±0.6) × 10^{-3}			1300
$\eta K^\pm K_S^0\pi^\mp$	[a]	(2.2 ±0.4) × 10^{-3}			1278
$\phi K^*(892)\overline{K}$ + c.c.		(2.18±0.23) × 10^{-3}			969
$\omega K\overline{K}$		(1.6 ±0.5) × 10^{-4}			1268
$\omega f_0(1710) \rightarrow \omega K\overline{K}$		(4.8 ±1.1) × 10^{-4}			878
$\phi 2(\pi^+\pi^-)$		(1.66±0.23) × 10^{-3}			1318
$\Delta(1232)^{++}\overline{p}\pi^-$		(1.6 ±0.5) × 10^{-3}			1030
$\omega\eta$		(1.74±0.20) × 10^{-3}		S=1.6	1394
$\phi K\overline{K}$		(1.83±0.24) × 10^{-3}		S=1.5	1179
$\phi f_0(1710) \rightarrow \phi K\overline{K}$		(3.6 ±0.6) × 10^{-4}			875
$\Delta(1232)^{++}\overline{\Delta}(1232)^{--}$		(1.10±0.29) × 10^{-3}			938
$\Sigma(1385)^-\overline{\Sigma}(1385)^+$ (or c.c.)	[a]	(1.03±0.13) × 10^{-3}			697
$\phi f_2'(1525)$		(8 ±4) × 10^{-4}		S=2.7	871
$\phi\pi^+\pi^-$		(9.4 ±0.9) × 10^{-4}		S=1.2	1365
$\phi\pi^0\pi^0$		(5.6 ±1.6) × 10^{-4}			1366
$\phi K^\pm K_S^0\pi^\mp$	[a]	(7.2 ±0.8) × 10^{-4}			1114
$\omega f_1(1420)$		(6.8 ±2.4) × 10^{-4}			1062
$\phi\eta$		(7.5 ±0.8) × 10^{-4}		S=1.5	1320
$\Xi(1530)^-\overline{\Xi}^+$		(5.9 ±1.5) × 10^{-4}			600
$pK^-\overline{\Sigma}(1385)^0$		(5.1 ±3.2) × 10^{-4}			646
$\omega\pi^0$		(4.5 ±0.5) × 10^{-4}		S=1.4	1446
$\phi\eta'(958)$		(4.0 ±0.7) × 10^{-4}		S=2.1	1192
$\phi f_0(980)$		(3.2 ±0.9) × 10^{-4}		S=1.9	1182
$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$		(1.8 ±0.4) × 10^{-4}			–
$\phi f_0(980) \rightarrow \phi\pi^0\pi^0$		(1.7 ±0.7) × 10^{-4}			–
$\Xi(1530)^0\overline{\Xi}^0$		(3.2 ±1.4) × 10^{-4}			608
$\Sigma(1385)^-\overline{\Sigma}^+$ (or c.c.)	[a]	(3.1 ±0.5) × 10^{-4}			855
$\phi f_1(1285)$		(2.6 ±0.5) × 10^{-4}		S=1.1	1032
$\eta\pi^+\pi^-$		(4.0 ±1.7) × 10^{-4}			1487
$\rho\eta$		(1.93±0.23) × 10^{-4}			1396
$\omega\eta'(958)$		(1.82±0.21) × 10^{-4}			1279
$\omega f_0(980)$		(1.4 ±0.5) × 10^{-4}			1271
$\rho\eta'(958)$		(1.05±0.18) × 10^{-4}			1281
$a_2(1320)^\pm\pi^\mp$	[a]	< 4.3 × 10^{-3}		CL=90%	1263
$K\overline{K}_2^*(1430)$ + c.c.		< 4.0 × 10^{-3}		CL=90%	1159
$K_1(1270)^\pm K^\mp$		< 3.0 × 10^{-3}		CL=90%	1231
$K_2^*(1430)^0\overline{K}_2^*(1430)^0$		< 2.9 × 10^{-3}		CL=90%	604
$K^*(892)^0\overline{K}^*(892)^0$		(2.3 ±0.7) × 10^{-4}			1266
$\phi f_2(1270)$		(7.2 ±1.3) × 10^{-4}			1036
$\phi\eta(1405) \rightarrow \phi\eta\pi\pi$		< 2.5 × 10^{-4}		CL=90%	946
$\omega f_2'(1525)$		< 2.2 × 10^{-4}		CL=90%	1003
$\Sigma(1385)^0\overline{\Lambda}$		< 2 × 10^{-4}		CL=90%	912
$\Delta(1232)^+\overline{p}$		< 1 × 10^{-4}		CL=90%	1100

$\Theta(1540)\overline{\Theta}(1540) \rightarrow$ $K^0_S p K^- \overline{n}$ + c.c.		< 1.1	$\times 10^{-5}$	CL=90%	–
$\Theta(1540) K^- \overline{n} \rightarrow K^0_S p K^- \overline{n}$		< 2.1	$\times 10^{-5}$	CL=90%	–
$\Theta(1540) K^0_S \overline{p} \rightarrow K^0_S \overline{p} K^+ n$		< 1.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^+ n \rightarrow K^0_S \overline{p} K^+ n$		< 5.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^0_S p \rightarrow K^0_S p K^- \overline{n}$		< 1.1	$\times 10^{-5}$	CL=90%	–
$\Sigma^0 \overline{\Lambda}$		< 9	$\times 10^{-5}$	CL=90%	1032
$\phi\pi^0$		< 6.4	$\times 10^{-6}$	CL=90%	1377

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$		(4.1 ±0.5) %		S=2.4	1496
$3(\pi^+\pi^-)\pi^0$		(2.9 ±0.6) %			1433
$\pi^+\pi^-\pi^0$		(2.07±0.13) %		S=1.7	1533
$\pi^+\pi^-\pi^0 K^+ K^-$		(1.79±0.29) %		S=2.2	1368
$4(\pi^+\pi^-)\pi^0$		(9.0 ±3.0)	$\times 10^{-3}$		1345
$\pi^+\pi^- K^+ K^-$		(6.6 ±0.5)	$\times 10^{-3}$		1407
$\pi^+\pi^- K^+ K^- \eta$		(1.84±0.28)	$\times 10^{-3}$		1221
$\pi^0\pi^0 K^+ K^-$		(2.45±0.31)	$\times 10^{-3}$		1410
$\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$		(3.2 ±1.0)	$\times 10^{-4}$		–
$K\overline{K}\pi$		(6.1 ±1.0)	$\times 10^{-3}$		1442
$2(\pi^+\pi^-)$		(3.55±0.23)	$\times 10^{-3}$		1517
$3(\pi^+\pi^-)$		(4.3 ±0.4)	$\times 10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$		(1.62±0.21) %			1468
$2(\pi^+\pi^-)\eta$		(2.29±0.24)	$\times 10^{-3}$		1446
$3(\pi^+\pi^-)\eta$		(7.2 ±1.5)	$\times 10^{-4}$		1379
$p\overline{p}$		(2.17±0.07)	$\times 10^{-3}$		1232
$p\overline{p}\pi^0$		(1.09±0.09)	$\times 10^{-3}$		1176
$p\overline{p}\pi^+\pi^-$		(6.0 ±0.5)	$\times 10^{-3}$	S=1.3	1107
$p\overline{p}\pi^+\pi^-\pi^0$	[b]	(2.3 ±0.9)	$\times 10^{-3}$	S=1.9	1033
$p\overline{p}\eta$		(2.09±0.18)	$\times 10^{-3}$		948
$p\overline{p}\rho$		< 3.1	$\times 10^{-4}$	CL=90%	774
$p\overline{p}\omega$		(1.10±0.15)	$\times 10^{-3}$	S=1.3	768
$p\overline{p}\eta'(958)$		(9 ±4)	$\times 10^{-4}$	S=1.7	596
$p\overline{p}\phi$		(4.5 ±1.5)	$\times 10^{-5}$		527
$n\overline{n}$		(2.2 ±0.4)	$\times 10^{-3}$		1231
$n\overline{n}\pi^+\pi^-$		(4 ±4)	$\times 10^{-3}$		1106
$\Sigma^0\overline{\Sigma}^0$		(1.29±0.09)	$\times 10^{-3}$		988
$2(\pi^+\pi^-)K^+K^-$		(4.7 ±0.7)	$\times 10^{-3}$	S=1.3	1320
$p\overline{n}\pi^-$		(2.12±0.09)	$\times 10^{-3}$		1174
$nN(1440)$		seen			978
$nN(1520)$		seen			924
$nN(1535)$		seen			914
$\Xi\overline{\Xi}$		(1.8 ±0.4)	$\times 10^{-3}$	S=1.8	818
$\Lambda\overline{\Lambda}$		(1.61±0.15)	$\times 10^{-3}$	S=2.0	1074

$\Lambda\overline{\Sigma}^-\pi^+$ (or c.c.)	[a]	$(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	950
$pK^-\overline{\Lambda}$		$(8.9 \pm 1.6) \times 10^{-4}$		876
$2(K^+K^-)$		$(7.6 \pm 0.9) \times 10^{-4}$		1131
$pK^-\overline{\Sigma}^0$		$(2.9 \pm 0.8) \times 10^{-4}$		819
K^+K^-		$(2.37 \pm 0.31) \times 10^{-4}$		1468
$K^0_S K^0_L$		$(1.46 \pm 0.26) \times 10^{-4}$	S=2.7	1466
$\Lambda\overline{\Lambda}\eta$		$(2.6 \pm 0.7) \times 10^{-4}$		672
$\Lambda\overline{\Lambda}\pi^0$		$< 6.4 \times 10^{-5}$	CL=90%	998
$\overline{\Lambda}nK^0_S$ + c.c.		$(6.5 \pm 1.1) \times 10^{-4}$		872
$\pi^+\pi^-$		$(1.47 \pm 0.23) \times 10^{-4}$		1542
$\Lambda\overline{\Sigma}$ + c.c.		$< 1.5 \times 10^{-4}$	CL=90%	1034
$K^0_S K^0_S$		$< 1 \times 10^{-6}$	CL=95%	1466

Radiative decays

$\gamma\eta_c(1S)$		(1.3 $\pm$0.4) %		114
$\gamma\pi^+\pi^-2\pi^0$		$(8.3 \pm 3.1) \times 10^{-3}$		1518
$\gamma\eta\pi\pi$		$(6.1 \pm 1.0) \times 10^{-3}$		1487
$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$		$(6.2 \pm 2.4) \times 10^{-4}$		–
$\gamma\eta(1405/1475) \rightarrow \gamma K\overline{K}\pi$	[c]	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$		$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223
$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$		$(3.0 \pm 0.5) \times 10^{-4}$		–
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$		$< 8.2 \times 10^{-5}$	CL=95%	–
$\gamma\rho\rho$		$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma\rho\omega$		$< 5.4 \times 10^{-4}$	CL=90%	1338
$\gamma\rho\phi$		$< 8.8 \times 10^{-5}$	CL=90%	1258
$\gamma\eta'(958)$		$(4.71 \pm 0.27) \times 10^{-3}$	S=1.1	1400
$\gamma 2\pi^+2\pi^-$		$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517
$\gamma f_2(1270) f_2(1270)$		$(9.5 \pm 1.7) \times 10^{-4}$		879
$\gamma f_2(1270) f_2(1270)$ (non resonant)		$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma K^+K^-\pi^+\pi^-$		$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma f_4(2050)$		$(2.7 \pm 0.7) \times 10^{-3}$		891
$\gamma\omega\omega$		$(1.61 \pm 0.33) \times 10^{-3}$		1336
$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$		$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223
$\gamma f_2(1270)$		$(1.43 \pm 0.11) \times 10^{-3}$		1286
$\gamma f_0(1710) \rightarrow \gamma K\overline{K}$		$(8.5 \ ^{+1.2}_{-0.9}) \times 10^{-4}$	S=1.2	1075
$\gamma f_0(1710) \rightarrow \gamma\pi\pi$		$(4.0 \pm 1.0) \times 10^{-4}$		–
$\gamma f_0(1710) \rightarrow \gamma\omega\omega$		$(3.1 \pm 1.0) \times 10^{-4}$		–
$\gamma\eta$		$(9.8 \pm 1.0) \times 10^{-4}$	S=1.7	1500
$\gamma f_1(1420) \rightarrow \gamma K\overline{K}\pi$		$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1285)$		$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$		$(4.5 \pm 1.2) \times 10^{-4}$		–
$\gamma f'_2(1525)$		$(4.5 \ ^{+0.7}_{-0.4}) \times 10^{-4}$		1173

$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		–
$\gamma f_2(1910) \rightarrow \gamma\omega\omega$	$(2.0 \pm 1.4) \times 10^{-4}$		–
$\gamma f_2(1950) \rightarrow \gamma K^*(892)\overline{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		–
$\gamma K^*(892)\overline{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		1266
$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166
$\gamma p\overline{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		1232
$\gamma\eta(2225)$	$(2.9 \pm 0.6) \times 10^{-4}$		752
$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048
$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		–
$\gamma X(1835)$	$(2.2 \pm 0.6) \times 10^{-4}$		1006
$\gamma(K\overline{K}\pi)$ $[J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	1442
$\gamma\pi^0$	$(3.3 \, ^{+0.6}_{-0.4}) \times 10^{-5}$		1546
$\gamma p\overline{p}\pi^+\pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	1107
$\gamma\Lambda\overline{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	1074
3γ	$< 5.5 \times 10^{-5}$	CL=90%	1548
$\gamma f_J(2220)$	$> 2.50 \times 10^{-3}$	CL=99.9%	745
$\gamma f_J(2220) \rightarrow \gamma\pi\pi$	$(8 \pm 4) \times 10^{-5}$		–
$\gamma f_J(2220) \rightarrow \gamma K\overline{K}$	$(8.1 \pm 3.0) \times 10^{-5}$		–
$\gamma f_J(2220) \rightarrow \gamma p\overline{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		–
$\gamma f_0(1500)$	$> (5.7 \pm 0.8) \times 10^{-4}$		1183
$\gamma e^+ e^-$	$(8.8 \pm 1.4) \times 10^{-3}$		1548

Weak decays

$D^- e^+ \nu_e +$ c.c.	$< 1.2 \times 10^{-5}$	CL=90%	984
$\overline{D}^0 e^+ e^- +$ c.c.	$< 1.1 \times 10^{-5}$	CL=90%	987
$D_s^- e^+ \nu_e +$ c.c.	$< 3.6 \times 10^{-5}$	CL=90%	923

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

$\gamma\gamma$	C	$< 2.2 \times 10^{-5}$	CL=90%	1548
$e^\pm\mu^\mp$	LF	$< 1.1 \times 10^{-6}$	CL=90%	1547
$e^\pm\tau^\mp$	LF	$< 8.3 \times 10^{-6}$	CL=90%	1039
$\mu^\pm\tau^\mp$	LF	$< 2.0 \times 10^{-6}$	CL=90%	1035

$\chi_{c0}(1P)$

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

Mass $m = 3414.75 \pm 0.31$ MeV
Full width $\Gamma = 10.2 \pm 0.7$ MeV

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(2.23 ± 0.20) %		1679
$f_0(980)\,f_0(980)$	$(6.9\ \pm2.2\ )\times10^{-4}$		1398
$\pi^+\pi^-K^+K^-$	(1.79 ± 0.16) %		1580
$f_0(980)\,f_0(980)$	$(1.7\ ^{+1.1}_{-0.9}\ )\times10^{-4}$		1398
$f_0(980)\,f_0(2200)$	$(8.3\ ^{+2.1}_{-2.6}\ )\times10^{-4}$		595
$f_0(1370)\,f_0(1370)$	$<2.8\times10^{-4}$	CL=90%	1019
$f_0(1370)\,f_0(1500)$	$<1.8\times10^{-4}$	CL=90%	920
$f_0(1370)\,f_0(1710)$	$(7.0\ ^{+3.7}_{-2.4}\ )\times10^{-4}$		718
$f_0(1500)\,f_0(1370)$	$<1.4\times10^{-4}$	CL=90%	920
$f_0(1500)\,f_0(1500)$	$<5\times10^{-5}$	CL=90%	805
$f_0(1500)\,f_0(1710)$	$<7\times10^{-5}$	CL=90%	553
$\rho^0\pi^+\pi^-$	$(8.7\ \pm2.8\ )\times10^{-3}$		1607
$3(\pi^+\pi^-)$	(1.20 ± 0.18) %		1633
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	$(7.2\ \pm1.6\ )\times10^{-3}$		1523
$K_1(1270)^+K^-$ + c.c. $\to$ $\pi^+\pi^-K^+K^-$	$(6.5\ \pm2.0\ )\times10^{-3}$		–
$K_1(1400)^+K^-$ + c.c. $\to$ $\pi^+\pi^-K^+K^-$	$<2.8\times10^{-3}$	CL=90%	–
$K^*(892)^0\overline{K}^*(892)^0$	$(1.8\ \pm0.6\ )\times10^{-3}$		1456
$K_0^*(1430)^0\overline{K}_0^*(1430)^0\to$ $\pi^+\pi^-K^+K^-$	$(1.02^{+0.38}_{-0.30})\times10^{-3}$		–
$K_0^*(1430)^0\overline{K}_2^*(1430)^0$ + c.c. $\to$ $\pi^+\pi^-K^+K^-$	$(8.3\ ^{+2.1}_{-2.5}\ )\times10^{-4}$		–
$\pi\pi$	$(7.3\ \pm0.6\ )\times10^{-3}$		1702
$\eta\eta$	$(2.4\ \pm0.4\ )\times10^{-3}$		1617
$\eta\pi^+\pi^-$	$<1.1\times10^{-3}$	CL=90%	1651
$\eta\eta'$	$<5\times10^{-4}$	CL=90%	1521
$\eta'\eta'$	$(1.7\ \pm0.4\ )\times10^{-3}$		1414
$\omega\omega$	$(2.3\ \pm0.7\ )\times10^{-3}$		1517
K^+K^-	$(5.7\ \pm0.6\ )\times10^{-3}$		1634
$K_S^0K_S^0$	$(2.82\pm0.28)\times10^{-3}$		1633
$\pi^+\pi^-\eta$	$<2.1\times10^{-4}$		1651
$\pi^+\pi^-\eta'$	$<4\times10^{-4}$		1560
$\overline{K}^0K^+\pi^-$ + c.c.	$<9.8\times10^{-5}$		1610
$K^+K^-\pi^0$	$<6\times10^{-5}$		1611
$K^+K^-\eta$	$<2.4\times10^{-4}$		1512
$K^+K^-K_S^0K_S^0$	$(1.5\ \pm0.5\ )\times10^{-3}$		1331
$K^+K^-K^+K^-$	$(2.81\pm0.30)\times10^{-3}$		1333

$K^+K^-\phi$	$(1.01\pm0.26)\times10^{-3}$		1381
$K^0_S K^0_S \pi^+\pi^-$	$(5.9\ \pm1.1\ )\times10^{-3}$		1579
$\phi\phi$	$(9.3\ \pm2.0\ )\times10^{-4}$		1370
$p\overline{p}$	$(2.15\pm0.19)\times10^{-4}$		1426
$p\overline{p}\pi^0$	$(5.8\ \pm1.2\ )\times10^{-4}$		1379
$p\overline{p}\eta$	$(3.8\ \pm1.1\ )\times10^{-4}$		1187
$\pi^+\pi^- p\overline{p}$	$(2.1\ \pm0.7\ )\times10^{-3}$	S=1.4	1320
$K^0_S K^0_S p\overline{p}$	$< 8.8\ \times10^{-4}$	CL=90%	884
$p\overline{n}\pi^-$	$(1.17\pm0.32)\times10^{-3}$		1376
$\Lambda\overline{\Lambda}$	$(4.4\ \pm1.5\ )\times10^{-4}$		1292
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$< 4.0\ \times10^{-3}$	CL=90%	1153
$K^+\overline{p}\Lambda$ + c.c.	$(1.05\pm0.20)\times10^{-3}$		1132
$\Xi^-\overline{\Xi}^+$	$< 1.03\ \times10^{-3}$	CL=90%	1081
Radiative decays			
$\gamma J/\psi(1S)$	(1.28 ± 0.11) %		303
$\gamma\gamma$	$(2.35\pm0.23)\times10^{-4}$		1707

$\chi_{c1}(1P)$

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

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

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$3(\pi^+\pi^-)$	$(\ 5.8\ \pm1.4\ )\times10^{-3}$	S=1.2	1683
$2(\pi^+\pi^-)$	$(\ 7.6\ \pm2.6\ )\times10^{-3}$		1728
$\pi^+\pi^- K^+K^-$	$(\ 4.5\ \pm1.0\ )\times10^{-3}$		1632
$\pi^+\pi^-\eta$	$(\ 5.2\ \pm0.6\ )\times10^{-3}$		1701
$\pi^+\pi^-\eta'$	$(\ 2.5\ \pm0.5\ )\times10^{-3}$		–
$\rho^0\pi^+\pi^-$	$(\ 3.9\ \pm3.5\ )\times10^{-3}$		1657
$K^+K^-\eta$	$(\ 3.5\ \pm1.1\ )\times10^{-4}$		1566
$K^0K^+\pi^-$ + c.c.	$(\ 7.7\ \pm0.7\ )\times10^{-3}$		1661
$K^+K^-\pi^0$	$(\ 2.01\pm0.28)\times10^{-3}$		1662
$\eta\pi^+\pi^-$	$(\ 5.8\ \pm1.1\ )\times10^{-3}$		1701
$a_0(980)^+\pi^-$ + c.c. $\rightarrow\ \eta\pi^+\pi^-$	$(\ 2.0\ \pm0.7\ )\times10^{-3}$		–
$f_2(1270)\eta$	$(\ 3.0\ \pm0.9\ )\times10^{-3}$		1468
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	$(\ 3.2\ \pm2.1\ )\times10^{-3}$		1577
$K^*(892)^0\overline{K}^*(892)^0$	$(\ 1.6\ \pm0.4\ )\times10^{-3}$		1512
$K^*(892)^0\overline{K}^0$ + c.c.	$(\ 1.1\ \pm0.4\ )\times10^{-3}$		1602
$K^*(892)^+K^-$ + c.c.	$(\ 1.6\ \pm0.7\ )\times10^{-3}$		1602
$K^*_J(1430)^0\overline{K}^0$ + c.c. $\rightarrow$ $K^0_S K^+\pi^-$ + c.c.	$<\ 9\ \times10^{-4}$	CL=90%	–

$K_J^*(1430)^+ K^- +$ c.c. $\rightarrow$ $K_S^0 K^+ \pi^- +$ c.c.	$<$ 2.4	$\times 10^{-3}$	CL=90%	–
$\pi^+\pi^- K_S^0 K_S^0$	(7.6 $\pm$3.2)	$\times 10^{-4}$		1630
$K^+K^- K_S^0 K_S^0$	$<$ 5	$\times 10^{-4}$	CL=90%	1390
$K^+K^- K^+K^-$	(5.8 $\pm$1.2)	$\times 10^{-4}$		1393
$K^+K^- \phi$	(4.5 $\pm$1.7)	$\times 10^{-4}$		1440
$p\overline{p}$	(6.6 $\pm$0.5)	$\times 10^{-5}$		1484
$p\overline{p}\pi^0$	(1.2 $\pm$0.5)	$\times 10^{-4}$		1438
$p\overline{p}\eta$	$<$ 1.6	$\times 10^{-4}$	CL=90%	1254
$\pi^+\pi^- p\overline{p}$	(5.0 $\pm$1.9)	$\times 10^{-4}$		1381
$K_S^0 K_S^0 p\overline{p}$	$<$ 4.5	$\times 10^{-4}$	CL=90%	968
$\Lambda\overline{\Lambda}$	(2.4 $\pm$1.0)	$\times 10^{-4}$		1355
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$<$ 1.5	$\times 10^{-3}$	CL=90%	1223
$K^+\overline{p}\Lambda$	(3.4 $\pm$1.0)	$\times 10^{-4}$		1203
$\Xi^-\overline{\Xi}^+$	$<$ 3.4	$\times 10^{-4}$	CL=90%	1155
$\pi^+\pi^- + K^+K^-$	$<$ 2.1	$\times 10^{-3}$		–
$K_S^0 K_S^0$	$<$ 7	$\times 10^{-5}$	CL=90%	1683

Radiative decays

$\gamma J/\psi(1S)$	(36.0 $\pm$1.9) %	389

$h_c(1P)$

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

Mass $m = 3525.93 \pm 0.27$ MeV (S = 1.5)
Full width $\Gamma < 1$ MeV

$h_c(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi(1S)\pi\pi$	not seen	313
$\eta_c\gamma$	seen	503

$\chi_{c2}(1P)$

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

Mass $m = 3556.20 \pm 0.09$ MeV
Full width $\Gamma = 2.03 \pm 0.12$ MeV

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(1.14±0.12) %		1751
$\pi^+\pi^- K^+ K^-$	(9.4 ±1.1) × 10^{-3}		1656
$3(\pi^+\pi^-)$	(8.6 ±1.8) × 10^{-3}		1707
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(2.3 ±1.3) × 10^{-3}		1602
$K^*(892)^0\overline{K}^*(892)^0$	(2.6 ±0.5) × 10^{-3}		1538
$\phi\phi$	(1.54±0.30) × 10^{-3}		1457
$\omega\omega$	(2.0 ±0.7) × 10^{-3}		1597
$\pi\pi$	(2.17±0.25) × 10^{-3}		1773
$\rho^0\pi^+\pi^-$	(4.1 ±1.8) × 10^{-3}		1681
$\pi^+\pi^-\eta$	(5.5 ±1.5) × 10^{-4}		1724
$\pi^+\pi^-\eta'$	(5.7 ±2.1) × 10^{-4}		1636
$\eta\eta$	< 5 × 10^{-4}	90%	1692
$K^+ K^-$	(7.9 ±1.4) × 10^{-4}		1708
$K^0_S K^0_S$	(6.5 ±0.8) × 10^{-4}		1707
$\overline{K}^0 K^+\pi^-$ + c.c.	(1.40±0.21) × 10^{-3}		1685
$K^+ K^-\pi^0$	(3.5 ±0.9) × 10^{-4}		1686
$K^+ K^-\eta$	< 4 × 10^{-4}	90%	1592
$\eta\pi^+\pi^-$	< 1.7 × 10^{-3}	90%	1724
$\eta\eta'$	< 2.6 × 10^{-4}	90%	1600
$\eta'\eta'$	< 3.5 × 10^{-4}	90%	1498
$\pi^+\pi^- K^0_S K^0_S$	(2.5 ±0.6) × 10^{-3}		1655
$K^+ K^- K^0_S K^0_S$	< 4 × 10^{-4}	90%	1418
$K^+ K^- K^+ K^-$	(1.84±0.24) × 10^{-3}		1421
$K^+ K^-\phi$	(1.63±0.34) × 10^{-3}		1468
$K^0_S K^0_S p\overline{p}$	< 7.9 × 10^{-4}	90%	1007
$p\overline{p}$	(6.7 ±0.5) × 10^{-5}		1510
$p\overline{p}\pi^0$	(4.9 ±1.0) × 10^{-4}		1465
$p\overline{p}\eta$	(2.1 ±0.8) × 10^{-4}		1285
$\pi^+\pi^- p\overline{p}$	(1.32±0.34) × 10^{-3}		1410
$p\overline{n}\pi^-$	(1.2 ±0.4) × 10^{-3}		1463
$\Lambda\overline{\Lambda}$	(2.7 ±1.3) × 10^{-4}		1385
$\Lambda\overline{\Lambda}\pi^+\pi^-$	< 3.5 × 10^{-3}	90%	1255
$K^+\overline{p}\Lambda$ + c.c.	(9.6 ±1.9) × 10^{-4}		1236
$\Xi^-\overline{\Xi}^+$	< 3.7 × 10^{-4}	90%	1189
$J/\psi(1S)\pi^+\pi^-\pi^0$	< 1.5 %	90%	185
Radiative decays			
$\gamma J/\psi(1S)$	(20.0 ±1.0) %		430
$\gamma\gamma$	(2.43±0.18) × 10^{-4}		1778

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

Mass $m = 3637 \pm 4$ MeV (S = 1.7)
Full width $\Gamma = 14 \pm 7$ MeV

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	not seen		–
$K\overline{K}\pi$	seen		1729
$2\pi^+2\pi^-$	not seen		1792
$K^+K^-\pi^+\pi^-$	not seen		1700
$2K^+2K^-$	not seen		1470
$p\overline{p}$	not seen		1558
$\gamma\gamma$	$<5\times10^{-4}$	90%	1819

$\psi(2S)$

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

Mass $m = 3686.09 \pm 0.04$ MeV (S = 1.6)
Full width $\Gamma = 317 \pm 9$ keV
$\Gamma_{ee} = 2.38 \pm 0.04$ keV

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85±0.13) %		–
virtual $\gamma \rightarrow$ hadrons	(1.73±0.14) %	S=1.5	–
e^+e^-	(7.52±0.17) $\times10^{-3}$		1843
$\mu^+\mu^-$	(7.5 ±0.8) $\times10^{-3}$		1840
$\tau^+\tau^-$	(3.0 ±0.4) $\times10^{-3}$		490
Decays into $J/\psi(1S)$ and anything			
$J/\psi(1S)$ anything	(57.4 ±0.9) %		–
$J/\psi(1S)$ neutrals	(23.5 ±0.4) %		–
$J/\psi(1S)\pi^+\pi^-$	(32.6 ±0.5) %		477
$J/\psi(1S)\pi^0\pi^0$	(16.84±0.33) %		481
$J/\psi(1S)\eta$	(3.16±0.07) %		199
$J/\psi(1S)\pi^0$	(1.26±0.13) $\times10^{-3}$	S=1.3	528
Hadronic decays			
$3(\pi^+\pi^-)\pi^0$	(3.5 ±1.6) $\times10^{-3}$		1746
$2(\pi^+\pi^-)\pi^0$	(2.9 ±1.0) $\times10^{-3}$	S=4.6	1799
$\rho a_2(1320)$	(2.6 ±0.9) $\times10^{-4}$		1500
$p\overline{p}$	(2.74±0.12) $\times10^{-4}$		1586
$\Delta^{++}\overline{\Delta}^{--}$	(1.28±0.35) $\times10^{-4}$		1371

$\Lambda\overline{\Lambda}\pi^0$	$<$ 1.2	$\times 10^{-4}$	CL=90%	1412
$\Lambda\overline{\Lambda}\eta$	$<$ 4.9	$\times 10^{-5}$	CL=90%	1197
$\Lambda\overline{p}K^+$	(1.00$\pm$0.14)	$\times 10^{-4}$		1327
$\Lambda\overline{p}K^+\pi^+\pi^-$	(1.8 $\pm$0.4)	$\times 10^{-4}$		1167
$\Lambda\overline{\Lambda}\pi^+\pi^-$	(2.8 $\pm$0.6)	$\times 10^{-4}$		1346
$\Lambda\overline{\Lambda}$	(2.8 $\pm$0.5)	$\times 10^{-4}$	S=2.6	1467
$\Sigma^+\overline{\Sigma}^-$	(2.6 $\pm$0.8)	$\times 10^{-4}$		1408
$\Sigma^0\overline{\Sigma}^0$	(2.2 $\pm$0.4)	$\times 10^{-4}$	S=1.5	1405
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	(1.1 $\pm$0.4)	$\times 10^{-4}$		1218
$\Xi^-\overline{\Xi}^+$	(1.8 $\pm$0.6)	$\times 10^{-4}$	S=2.8	1284
$\Xi^0\overline{\Xi}^0$	(2.8 $\pm$0.9)	$\times 10^{-4}$		1291
$\Xi(1530)^0\overline{\Xi}(1530)^0$	$<$ 8.1	$\times 10^{-5}$	CL=90%	1025
$\Omega^-\overline{\Omega}^+$	$<$ 7.3	$\times 10^{-5}$	CL=90%	774
$\pi^0 p\overline{p}$	(1.33$\pm$0.17)	$\times 10^{-4}$		1543
$\eta p\overline{p}$	(6.0 $\pm$1.2)	$\times 10^{-5}$		1373
$\omega p\overline{p}$	(6.9 $\pm$2.1)	$\times 10^{-5}$		1247
$\phi p\overline{p}$	$<$ 2.4	$\times 10^{-5}$	CL=90%	1109
$\pi^+\pi^- p\overline{p}$	(6.0 $\pm$0.4)	$\times 10^{-4}$		1491
$p\overline{n}\pi^-$ or c.c.	(2.48$\pm$0.17)	$\times 10^{-4}$		–
$p\overline{n}\pi^-\pi^0$	(3.2 $\pm$0.7)	$\times 10^{-4}$		1492
$2(\pi^+\pi^-\pi^0)$	(4.7 $\pm$1.5)	$\times 10^{-3}$		1776
$\eta\pi^+\pi^-$	$<$ 1.6	$\times 10^{-4}$	CL=90%	1791
$\eta\pi^+\pi^-\pi^0$	(9.5 $\pm$1.7)	$\times 10^{-4}$		1778
$2(\pi^+\pi^-)\eta$	(1.2 $\pm$0.6)	$\times 10^{-3}$		1758
$\eta'\pi^+\pi^-\pi^0$	(4.5 $\pm$2.1)	$\times 10^{-4}$		–
$\omega\pi^+\pi^-$	(7.3 $\pm$1.2)	$\times 10^{-4}$	S=2.1	1748
$\quad b_1^{\pm}\pi^{\mp}$	(4.0 $\pm$0.6)	$\times 10^{-4}$	S=1.1	1635
$\quad b_1^0\pi^0$	(2.4 $\pm$0.6)	$\times 10^{-4}$		–
$\quad \omega f_2(1270)$	(2.2 $\pm$0.4)	$\times 10^{-4}$		1515
$\pi^+\pi^- K^+K^-$	(7.5 $\pm$0.9)	$\times 10^{-4}$	S=1.9	1726
$\quad \rho^0 K^+K^-$	(2.2 $\pm$0.4)	$\times 10^{-4}$		1616
$\quad K^*(892)^0\overline{K}_2^*(1430)^0$	(1.9 $\pm$0.5)	$\times 10^{-4}$		1418
$K^+K^-\pi^+\pi^-\eta$	(1.3 $\pm$0.7)	$\times 10^{-3}$		1574
$K^+K^-2(\pi^+\pi^-)\pi^0$	(1.00$\pm$0.31)	$\times 10^{-3}$		1611
$K^+K^-2(\pi^+\pi^-)$	(1.8 $\pm$0.9)	$\times 10^{-3}$		1654
$K_1(1270)^{\pm}K^{\mp}$	(1.00$\pm$0.28)	$\times 10^{-3}$		1581
$K_S^0 K_S^0\pi^+\pi^-$	(2.2 $\pm$0.4)	$\times 10^{-4}$		1724
$\quad \rho^0 p\overline{p}$	(5.0 $\pm$2.2)	$\times 10^{-5}$		1251
$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(6.7 $\pm$2.5)	$\times 10^{-4}$		1674
$2(\pi^+\pi^-)$	(2.4 $\pm$0.6)	$\times 10^{-4}$	S=2.2	1817
$\quad \rho^0\pi^+\pi^-$	(2.2 $\pm$0.6)	$\times 10^{-4}$	S=1.4	1750
$K^+K^-\pi^+\pi^-\pi^0$	(1.26$\pm$0.09)	$\times 10^{-3}$		1694
$\quad \omega f_0(1710) \rightarrow \omega K^+K^-$	(5.9 $\pm$2.2)	$\times 10^{-5}$		–
$\quad K^*(892)^0 K^-\pi^+\pi^0$ + c.c.	(8.6 $\pm$2.2)	$\times 10^{-4}$		–

$K^*(892)^+ K^- \pi^+ \pi^-$ + c.c.	$(9.6 \pm 2.8) \times 10^{-4}$			–
$K^*(892)^+ K^- \rho^0$ + c.c.	$(7.3 \pm 2.6) \times 10^{-4}$			–
$K^*(892)^0 K^- \rho^+$ + c.c.	$(6.1 \pm 1.8) \times 10^{-4}$			–
$\eta K^+ K^-$	$< 1.3 \times 10^{-4}$		CL=90%	1664
$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$		S=1.1	1614
$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$		S=2.8	1774
$p\overline{p}\pi^+\pi^-\pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$			1435
$K^+ K^-$	$(6.3 \pm 0.7) \times 10^{-5}$			1776
$K^0_S K^0_L$	$(5.4 \pm 0.5) \times 10^{-5}$			1775
$\pi^+ \pi^- \pi^0$	$(1.68 \pm 0.26) \times 10^{-4}$		S=1.4	1830
$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	$(1.9 \, {}^{+1.2}_{-0.4}) \times 10^{-4}$			–
$\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$		S=1.8	–
$\pi^+ \pi^-$	$(8 \pm 5) \times 10^{-5}$			1838
$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$		CL=90%	1532
$K^+ K^- \pi^0$	$< 2.96 \times 10^{-5}$		CL=90%	1754
$K^+ \overline{K}^*(892)^-$ + c.c.	$(1.7 \, {}^{+0.8}_{-0.7}) \times 10^{-5}$			1698
$K^*(892)^0 \overline{K}^0$ + c.c.	$(1.09 \pm 0.20) \times 10^{-4}$			1697
$\phi\pi^+\pi^-$	$(1.17 \pm 0.29) \times 10^{-4}$		S=1.7	1690
$\phi f_0(980) \rightarrow \pi^+\pi^-$	$(6.8 \pm 2.4) \times 10^{-5}$		S=1.1	–
$2(K^+ K^-)$	$(6.0 \pm 1.4) \times 10^{-5}$			1499
$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$			1546
$2(K^+ K^-)\pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$			1440
$\phi\eta$	$(2.8 \, {}^{+1.0}_{-0.8}) \times 10^{-5}$			1654
$\phi\eta'$	$(3.1 \pm 1.6) \times 10^{-5}$			1555
$\omega\eta'$	$(3.2 \, {}^{+2.5}_{-2.1}) \times 10^{-5}$			1623
$\omega\pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$			1757
$\rho\eta'$	$(1.9 \, {}^{+1.7}_{-1.2}) \times 10^{-5}$			1625
$\rho\eta$	$(2.2 \pm 0.6) \times 10^{-5}$		S=1.1	1717
$\omega\eta$	$< 1.1 \times 10^{-5}$		CL=90%	1715
$\phi\pi^0$	$< 4 \times 10^{-6}$		CL=90%	1699
$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$		CL=90%	–
$p\overline{p}K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$			1118
$\overline{\Lambda} n K^0_S$ + c.c.	$(8.1 \pm 1.8) \times 10^{-5}$			1324
$\phi f'_2(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$			1321
$\Theta(1540)\overline{\Theta}(1540) \rightarrow K^0_S p K^- \overline{n}$ + c.c.	$< 8.8 \times 10^{-6}$		CL=90%	–
$\Theta(1540) K^- \overline{n} \rightarrow K^0_S p K^- \overline{n}$	$< 1.0 \times 10^{-5}$		CL=90%	–
$\Theta(1540) K^0_S \overline{p} \rightarrow K^0_S \overline{p} K^+ n$	$< 7.0 \times 10^{-6}$		CL=90%	–
$\overline{\Theta}(1540) K^+ n \rightarrow K^0_S \overline{p} K^+ n$	$< 2.6 \times 10^{-5}$		CL=90%	–
$\overline{\Theta}(1540) K^0_S p \rightarrow K^0_S p K^- \overline{n}$	$< 6.0 \times 10^{-6}$		CL=90%	–
$K^0_S K^0_S$	$< 4.6 \times 10^{-6}$			1775

Radiative decays

$\gamma\chi_{c0}(1P)$	(9.4 ±0.4) %			261
$\gamma\chi_{c1}(1P)$	(8.8 ±0.4) %			171
$\gamma\chi_{c2}(1P)$	(8.3 ±0.4) %			128
$\gamma\eta_c(1S)$	(3.0 ±0.5) $\times 10^{-3}$			638
$\gamma\eta_c(2S)$	$<$ 2.0	$\times 10^{-3}$	CL=90%	48
$\gamma\pi^0$	$<$ 5.4	$\times 10^{-3}$	CL=95%	1841
$\gamma\eta'(958)$	(1.36±0.24) $\times 10^{-4}$			1719
$\gamma f_2(1270)$	(2.1 ±0.4) $\times 10^{-4}$			1622
$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	(3.0 ±1.3) $\times 10^{-5}$			–
$\gamma f_0(1710) \rightarrow \gamma K\overline{K}$	(6.0 ±1.6) $\times 10^{-5}$			–
$\gamma\gamma$	$<$ 1.4	$\times 10^{-4}$	CL=90%	1843
$\gamma\eta$	$<$ 9	$\times 10^{-5}$	CL=90%	1802
$\gamma\eta\pi^+\pi^-$	(8.7 ±2.1) $\times 10^{-4}$			1791
$\gamma\eta(1405) \rightarrow \gamma K\overline{K}\pi$	$<$ 9	$\times 10^{-5}$	CL=90%	1569
$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	(3.6 ±2.5) $\times 10^{-5}$			–
$\gamma\eta(1475) \rightarrow K\overline{K}\pi$	$<$ 1.4	$\times 10^{-4}$	CL=90%	–
$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	$<$ 8.8	$\times 10^{-5}$	CL=90%	–
$\gamma 2(\pi^+\pi^-)$	(4.0 ±0.6) $\times 10^{-4}$			1817
$\gamma K^{*0} K^+\pi^-$ + c.c.	(3.7 ±0.9) $\times 10^{-4}$			1674
$\gamma K^{*0}\overline{K}^{*0}$	(2.4 ±0.7) $\times 10^{-4}$			1613
$\gamma K^0_S K^+\pi^-$ + c.c.	(2.6 ±0.5) $\times 10^{-4}$			1753
$\gamma K^+ K^-\pi^+\pi^-$	(1.9 ±0.5) $\times 10^{-4}$			1726
$\gamma p\overline{p}$	(2.9 ±0.6) $\times 10^{-5}$			1586
$\gamma\pi^+\pi^- p\overline{p}$	(2.8 ±1.4) $\times 10^{-5}$			1491
$\gamma 2(\pi^+\pi^-) K^+ K^-$	$<$ 2.2	$\times 10^{-4}$	CL=90%	1654
$\gamma 3(\pi^+\pi^-)$	$<$ 1.7	$\times 10^{-4}$	CL=90%	1774
$\gamma K^+ K^- K^+ K^-$	$<$ 4	$\times 10^{-5}$	CL=90%	1499

$\psi(3770)$

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

Mass $m = 3772.92 \pm 0.35$ MeV (S = 1.1)
Full width $\Gamma = 27.3 \pm 1.0$ MeV
$\Gamma_{ee} = 0.265 \pm 0.018$ keV (S = 1.3)

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

$\psi(3770)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\overline{D}$	(85.3 ±3.2) %		285
$D^0\overline{D}^0$	(48.7 ±3.2) %		285
D^+D^-	(36.1 ±2.8) %		251
$J/\psi\pi^+\pi^-$	(1.93±0.28) × 10^{-3}		560
$J/\psi\pi^0\pi^0$	(8.0 ±3.0) × 10^{-4}		564
$J/\psi\eta$	(9 ±4) × 10^{-4}		359
$J/\psi\pi^0$	< 2.8 × 10^{-4}	CL=90%	603
$\gamma\chi_{c0}$	(7.3 ±0.9) × 10^{-3}		–
$\gamma\chi_{c1}$	(2.9 ±0.6) × 10^{-3}		–
$\gamma\chi_{c2}$	< 9 × 10^{-4}	CL=90%	–
e^+e^-	(9.7 ±0.7) × 10^{-6}	S=1.2	1886
$K^0_S K^0_L$	< 1.2 × 10^{-5}	CL=90%	1820
$2(\pi^+\pi^-)$	< 1.12 × 10^{-3}	CL=90%	1861
$2(\pi^+\pi^-)\pi^0$	< 1.06 × 10^{-3}	CL=90%	1843
$\omega\pi^+\pi^-$	< 6.0 × 10^{-4}	CL=90%	1794
$3(\pi^+\pi^-)$	< 9.1 × 10^{-3}		1819
$3(\pi^+\pi^-)\pi^0$	< 1.37 %		1792
$\eta\pi^+\pi^-$	< 1.24 × 10^{-3}	CL=90%	1836
$\rho^0\pi^+\pi^-$	< 6.9 × 10^{-3}	CL=90%	1796
$\eta 3\pi$	< 1.34 × 10^{-3}	CL=90%	1824
$\eta 2(\pi^+\pi^-)$	< 2.43 %		1804
$\eta' 3\pi$	< 2.44 × 10^{-3}	CL=90%	1740
$K^+K^-\pi^+\pi^-$	< 9.0 × 10^{-4}	CL=90%	1772
$\phi\pi^+\pi^-$	< 4.1 × 10^{-4}	CL=90%	1737
$\phi\pi^0$	not seen		1746
$\phi\eta$	(3.1 ±0.7) × 10^{-4}		1703
$4(\pi^+\pi^-)$	< 1.67 %	CL=90%	1757
$4(\pi^+\pi^-)\pi^0$	< 3.06 %	CL=90%	1720
$\phi f_0(980)$	< 4.5 × 10^{-4}	CL=90%	1600
$K^+K^-\pi^+\pi^-\pi^0$	< 2.36 × 10^{-3}	CL=90%	1741
$K^+K^-\rho^0\pi^0$	< 8 × 10^{-4}	CL=90%	1624
$K^+K^-\rho^+\pi^-$	< 1.46 %	CL=90%	1622
ωK^+K^-	< 3.4 × 10^{-4}	CL=90%	1664
$\phi\pi^+\pi^-\pi^0$	< 3.8 × 10^{-3}	CL=90%	1722
$K^{*0}K^-\pi^+\pi^0$ + c.c.	< 1.62 %	CL=90%	1693
$K^{*+}K^-\pi^+\pi^-$ + c.c.	< 3.23 %	CL=90%	1692
$K^+K^-2(\pi^+\pi^-)$	< 1.03 %	CL=90%	1702

$K^+K^-2(\pi^+\pi^-)\pi^0$	$<$	3.60	%	CL=90%	1660
ηK^+K^-	$<$	4.1	$\times 10^{-4}$	CL=90%	1711
$\rho^0 K^+K^-$	$<$	5.0	$\times 10^{-3}$	CL=90%	1665
$2(K^+K^-)$	$<$	6.0	$\times 10^{-4}$	CL=90%	1551
ϕK^+K^-	$<$	7.5	$\times 10^{-4}$	CL=90%	1597
$2(K^+K^-)\pi^0$	$<$	2.9	$\times 10^{-4}$	CL=90%	1493
$2(K^+K^-)\pi^+\pi^-$	$<$	3.2	$\times 10^{-3}$	CL=90%	1425
$K^{*0}K^-\pi^+$ + c.c.	$<$	9.7	$\times 10^{-3}$	CL=90%	1721
$p\overline{p}\pi^0$	$<$	1.2	$\times 10^{-3}$		1595
$p\overline{p}\pi^+\pi^-$	$<$	5.8	$\times 10^{-4}$	CL=90%	1544
$\Lambda\overline{\Lambda}$	$<$	1.2	$\times 10^{-4}$	CL=90%	1521
$p\overline{p}\pi^+\pi^-\pi^0$	$<$	1.85	$\times 10^{-3}$	CL=90%	1490
$\omega p\overline{p}$	$<$	2.9	$\times 10^{-4}$	CL=90%	1309
$\Lambda\overline{\Lambda}\pi^0$	$<$	1.2	$\times 10^{-3}$	CL=90%	1468
$p\overline{p}2(\pi^+\pi^-)$	$<$	2.6	$\times 10^{-3}$	CL=90%	1425
$\eta p\overline{p}$	$<$	5.4	$\times 10^{-4}$	CL=90%	1430
$\rho^0 p\overline{p}$	$<$	1.7	$\times 10^{-3}$	CL=90%	1313
$p\overline{p}K^+K^-$	$<$	3.2	$\times 10^{-4}$	CL=90%	1185
$\phi p\overline{p}$	$<$	1.3	$\times 10^{-4}$	CL=90%	1178
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$<$	2.5	$\times 10^{-4}$	CL=90%	1404
$\Lambda\overline{p}K^+$	$<$	2.8	$\times 10^{-4}$	CL=90%	1387
$\Lambda\overline{p}K^+\pi^+\pi^-$	$<$	6.3	$\times 10^{-4}$	CL=90%	1234
$\pi^+\pi^-\pi^0$	not seen				1874
$\rho\pi$	not seen				1804
$\omega\pi^0$	not seen				1803
$\rho\eta$	not seen				1763
$\omega\eta$	not seen				1762
$\rho\eta'$	not seen				1674
$\omega\eta'$	not seen				1672
$\phi\eta'$	not seen				1606
$K^{*0}\overline{K}^0$	not seen				1744
$K^{*+}K^-$	not seen				1745
$b_1\pi$	not seen				1683

$X(3872)$

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

Quantum numbers not established.

Mass $m = 3872.2 \pm 0.8$ MeV (S = 2.5)
$m_{X(3872)^\pm} - m_{J/\psi} = 775 \pm 4$ MeV
$m_{X(3872)^\pm} - m_{\psi(2S)}$
Full width $\Gamma = 3.0^{+2.1}_{-1.7}$ MeV

***X*(3872) DECAY MODES**	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^- J/\psi(1S)$	seen	650
$\rho^0 J/\psi(1S)$	seen	†
$D^0\overline{D}^0$	not seen	520
D^+D^-	not seen	503
$D^0\overline{D}^0\pi^0$	seen	121

$\psi(4040)$ [d]

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

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

$\psi(4040)$ **DECAY MODES**	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	$(1.07\pm0.16)\times10^{-5}$		2019
$D^0\overline{D}^0$	seen		775
$D^*(2007)^0\overline{D}^0$ + c.c.	seen		575
$D^*(2007)^0\overline{D}^*(2007)^0$	seen		225
$J/\psi\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%	794
$J/\psi\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%	797
$J/\psi\eta$	$< 7 \times 10^{-3}$	90%	675
$J/\psi\pi^0$	$< 2 \times 10^{-3}$	90%	823
$J/\psi\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%	746
$\chi_{c1}\gamma$	< 1.1 %	90%	494
$\chi_{c2}\gamma$	< 1.7 %	90%	454
$\chi_{c1}\pi^+\pi^-\pi^0$	< 1.1 %	90%	306
$\chi_{c2}\pi^+\pi^-\pi^0$	< 3.2 %	90%	233
$\phi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	1880

$\psi(4160)$ [d]

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

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

$\psi(4160)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$(8.1\pm0.9)\times10^{-6}$		2076
$J/\psi\pi^+\pi^-$	< 3 $\times10^{-3}$	90%	888
$J/\psi\pi^0\pi^0$	< 3 $\times10^{-3}$	90%	891
$J/\psi K^+ K^-$	< 2 $\times10^{-3}$	90%	324
$J/\psi\eta$	< 8 $\times10^{-3}$	90%	786
$J/\psi\pi^0$	< 1 $\times10^{-3}$	90%	914
$J/\psi\eta'$	< 5 $\times10^{-3}$	90%	385
$J/\psi\pi^+\pi^-\pi^0$	< 1 $\times10^{-3}$	90%	847
$\psi(2S)\pi^+\pi^-$	< 4 $\times10^{-3}$	90%	353
$\chi_{c1}\gamma$	< 7 $\times10^{-3}$	90%	593
$\chi_{c2}\gamma$	< 1.3 %	90%	554
$\chi_{c1}\pi^+\pi^-\pi^0$	< 2 $\times10^{-3}$	90%	452
$\chi_{c2}\pi^+\pi^-\pi^0$	< 8 $\times10^{-3}$	90%	398
$\phi\pi^+\pi^-$	< 2 $\times10^{-3}$	90%	1941

$X(4260)$

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

Mass $m = 4263^{+8}_{-9}$ MeV (S = 1.1)
Full width $\Gamma = 95 \pm 14$ MeV

$X(4260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\pi^+\pi^-$	seen	976
$J/\psi\pi^0\pi^0$	[*e*] seen	978
$J/\psi K^+ K^-$	[*e*] seen	530
$J/\psi\eta$	[*e*] not seen	886
$J/\psi\pi^0$	[*e*] not seen	999
$J/\psi\eta'$	[*e*] not seen	569
$J/\psi\pi^+\pi^-\pi^0$	[*e*] not seen	939
$J/\psi\eta\eta$	[*e*] not seen	339
$\psi(2S)\pi^+\pi^-$	[*e*] not seen	470
$\psi(2S)\eta$	[*e*] not seen	167
$\chi_{c0}\omega$	[*e*] not seen	284
$\chi_{c1}\gamma$	[*e*] not seen	686
$\chi_{c2}\gamma$	[*e*] not seen	648
$\chi_{c1}\pi^+\pi^-\pi^0$	[*e*] not seen	571
$\chi_{c2}\pi^+\pi^-\pi^0$	[*e*] not seen	524
$\phi\pi^+\pi^-$	[*e*] not seen	1999
$D\overline{D}$	not seen	1032

$\psi(4415)$ [d]

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

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

$\psi(4415)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	dominant		–
$(D^0 D^- \pi^+)_{non-res}$	< 2.3 %	90%	–
$D\overline{D}_2^*(2460) \rightarrow D^0 D^- \pi^+$	(10 $\pm$4) %		–
$e^+ e^-$	(9.4$\pm$3.2) $\times 10^{-6}$		2210

NOTES

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

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

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

[d] 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.

[e] See COAN 06 for details.