$c\overline{c}$ MESONS

$\eta_c(1S)$

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

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

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

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

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

$J/\psi(1S)$

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

Mass $m = 3096.916 \pm 0.011$ MeV

Full width $\Gamma = 93.4 \pm 2.1$ keV

$\Gamma_{ee} = 5.55 \pm 0.14 \pm 0.02$ keV

$J/\psi(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons		(87.7 ± 0.5) %		–
virtual$\gamma \to$ hadrons		(13.50 ± 0.30) %		–
e^+e^-		(5.94 ± 0.06) %		1548
$\mu^+\mu^-$		(5.93 ± 0.06) %		1545
Decays involving hadronic resonances				
$\rho\pi$		(1.69 ± 0.15) %	S=2.4	1448
$\rho^0\pi^0$		$(5.6 \pm0.7) \times 10^{-3}$		1448
$a_2(1320)\rho$		(1.09 ± 0.22) %		1123
$\omega\pi^+\pi^+\pi^-\pi^-$		$(8.5 \pm3.4) \times 10^{-3}$		1392
$\omega\pi^+\pi^+\pi^0$		$(4.0 \pm0.7) \times 10^{-3}$		1418
$\omega\pi^+\pi^-$		$(7.2 \pm1.0) \times 10^{-3}$		1435
$\omega f_2(1270)$		$(4.3 \pm0.6) \times 10^{-3}$		1142
$K^*(892)^0\overline{K}{}^*_2(1430)^0$ + c.c.		$(6.7 \pm2.6) \times 10^{-3}$		1012
$\omega K^*(892)\overline{K}$ + c.c.		$(5.3 \pm2.0) \times 10^{-3}$		1097
$K^+\overline{K}{}^*(892)^-$ + c.c.		$(5.0 \pm0.4) \times 10^{-3}$		1373
$K^0\overline{K}{}^*(892)^0$ + c.c.		$(4.2 \pm0.4) \times 10^{-3}$		1373
$K_1(1400)^{\pm}K^{\mp}$		$(3.8 \pm1.4) \times 10^{-3}$		1171
$\omega\pi^0\pi^0$		$(3.4 \pm0.8) \times 10^{-3}$		1436
$b_1(1235)^{\pm}\pi^{\mp}$	[a]	$(3.0 \pm0.5) \times 10^{-3}$		1300
$\omega K^{\pm}K^0_S\pi^{\mp}$	[a]	$(2.9 \pm0.7) \times 10^{-3}$		1210
$b_1(1235)^0\pi^0$		$(2.3 \pm0.6) \times 10^{-3}$		1300
$\phi K^*(892)\overline{K}$ + c.c.		$(2.04\pm0.28) \times 10^{-3}$		969
$\omega K\overline{K}$		$(1.9 \pm0.4) \times 10^{-3}$		1268
$\omega f_0(1710) \to \omega K\overline{K}$		$(4.8 \pm1.1) \times 10^{-4}$		878
$\phi 2(\pi^+\pi^-)$		$(1.66\pm0.23) \times 10^{-3}$		1318
$\Delta(1232)^{++}\overline{p}\pi^-$		$(1.6 \pm0.5) \times 10^{-3}$		1030
$\omega\eta$		$(1.74\pm0.20) \times 10^{-3}$	S=1.6	1394
$\phi K\overline{K}$		$(1.83\pm0.24) \times 10^{-3}$	S=1.5	1179

$\phi f_0(1710) \to \phi K \overline{K}$		$(3.6 \pm 0.6) \times 10^{-4}$		875
$p \overline{p} \omega$		$(1.30 \pm 0.25) \times 10^{-3}$	S=1.3	768
$\Delta(1232)^{++} \overline{\Delta}(1232)^{--}$		$(1.10 \pm 0.29) \times 10^{-3}$		938
$\Sigma(1385)^{-} \overline{\Sigma}(1385)^{+}$ (or c.c.)	[a]	$(1.03 \pm 0.13) \times 10^{-3}$		697
$p \overline{p} \eta'(958)$		$(9 \pm 4) \times 10^{-4}$	S=1.7	596
$\phi f_2'(1525)$		$(8 \pm 4) \times 10^{-4}$	S=2.7	871
$\phi \pi^+ \pi^-$		$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	1365
$\phi K^{\pm} K^0_S \pi^{\mp}$	[a]	$(7.2 \pm 0.9) \times 10^{-4}$		1114
$\omega f_1(1420)$		$(6.8 \pm 2.4) \times 10^{-4}$		1062
$\phi \eta$		$(7.4 \pm 0.8) \times 10^{-4}$	S=1.5	1320
$\Xi(1530)^{-} \overline{\Xi}^{+}$		$(5.9 \pm 1.5) \times 10^{-4}$		601
$p K^{-} \overline{\Sigma}(1385)^0$		$(5.1 \pm 3.2) \times 10^{-4}$		646
$\omega \pi^0$		$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	1446
$\phi \eta'(958)$		$(4.0 \pm 0.7) \times 10^{-4}$	S=2.1	1192
$\phi f_0(980)$		$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	1182
$\Xi(1530)^0 \overline{\Xi}^0$		$(3.2 \pm 1.4) \times 10^{-4}$		608
$\Sigma(1385)^{-} \overline{\Sigma}^{+}$ (or c.c.)	[a]	$(3.1 \pm 0.5) \times 10^{-4}$		855
$\phi f_1(1285)$		$(2.6 \pm 0.5) \times 10^{-4}$	S=1.1	1032
$\rho \eta$		$(1.93 \pm 0.23) \times 10^{-4}$		1396
$\omega \eta'(958)$		$(1.82 \pm 0.21) \times 10^{-4}$		1279
$\omega f_0(980)$		$(1.4 \pm 0.5) \times 10^{-4}$		1271
$\rho \eta'(958)$		$(1.05 \pm 0.18) \times 10^{-4}$		1281
$p \overline{p} \phi$		$(4.5 \pm 1.5) \times 10^{-5}$		527
$a_2(1320)^{\pm} \pi^{\mp}$	[a]	$< 4.3 \times 10^{-3}$	CL=90%	1263
$K \overline{K}{}^*_2(1430)+$ c.c.		$< 4.0 \times 10^{-3}$	CL=90%	1159
$K_1(1270)^{\pm} K^{\mp}$		$< 3.0 \times 10^{-3}$	CL=90%	1231
$K^*_2(1430)^0 \overline{K}{}^*_2(1430)^0$		$< 2.9 \times 10^{-3}$	CL=90%	604
$K^*(892)^0 \overline{K}{}^*(892)^0$		$< 5 \times 10^{-4}$	CL=90%	1266
$\phi f_2(1270)$		$< 3.7 \times 10^{-4}$	CL=90%	1036
$p \overline{p} \rho$		$< 3.1 \times 10^{-4}$	CL=90%	774
$\phi \eta(1405) \to \phi \eta \pi \pi$		$< 2.5 \times 10^{-4}$	CL=90%	946
$\omega f_2'(1525)$		$< 2.2 \times 10^{-4}$	CL=90%	1003
$\Sigma(1385)^0 \overline{\Lambda}$		$< 2 \times 10^{-4}$	CL=90%	912
$\Delta(1232)^{+} \overline{p}$		$< 1 \times 10^{-4}$	CL=90%	1100
$\Theta(1540) \overline{\Theta}(1540) \to K^0_S p K^{-} \overline{n}+$ c.c.		$< 1.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K^{-} \overline{n} \to K^0_S p K^{-} \overline{n}$		$< 2.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K^0_S \overline{p} \to K^0_S \overline{p} K^{+} n$		$< 1.6 \times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^{+} n \to K^0_S \overline{p} K^{+} n$		$< 5.6 \times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^0_S p \to K^0_S p K^{-} \overline{n}$		$< 1.1 \times 10^{-5}$	CL=90%	–
$\Sigma^0 \overline{\Lambda}$		$< 9 \times 10^{-5}$	CL=90%	1032
$\phi \pi^0$		$< 6.4 \times 10^{-6}$	CL=90%	1377

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$		(3.37 ± 0.26) %		1496
$3(\pi^+\pi^-)\pi^0$		(2.9 ± 0.6) %		1433
$\pi^+\pi^-\pi^0$		(2.02 ± 0.14) %	S=1.7	1533
$\pi^+\pi^-\pi^0 K^+ K^-$		(1.20 ± 0.30) %		1368
$4(\pi^+\pi^-)\pi^0$		$(9.0\pm3.0)\times10^{-3}$		1345
$\pi^+\pi^- K^+ K^-$		$(6.2\pm0.7)\times10^{-3}$		1407
$K\overline{K}\pi$		$(6.1\pm1.0)\times10^{-3}$		1442
$p\overline{p}\pi^+\pi^-$		$(6.0\pm0.5)\times10^{-3}$	S=1.3	1107
$2(\pi^+\pi^-)$		$(3.55\pm0.23)\times10^{-3}$		1517
$3(\pi^+\pi^-)$		$(4.3\pm0.4)\times10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$		(1.62 ± 0.21) %		1468
$2(\pi^+\pi^-)\eta$		$(2.26\pm0.28)\times10^{-3}$		1446
$3(\pi^+\pi^-)\eta$		$(7.2\pm1.5)\times10^{-4}$		1379
$n\overline{n}\pi^+\pi^-$		$(4\pm4)\times10^{-3}$		1106
$\Sigma^0\overline{\Sigma}^0$		$(1.31\pm0.10)\times10^{-3}$		988
$2(\pi^+\pi^-)K^+K^-$		$(4.7\pm0.7)\times10^{-3}$	S=1.3	1320
$p\overline{p}\pi^+\pi^-\pi^0$	[b]	$(2.3\pm0.9)\times10^{-3}$	S=1.9	1033
$p\overline{p}$		$(2.17\pm0.08)\times10^{-3}$		1232
$p\overline{p}\eta$		$(2.09\pm0.18)\times10^{-3}$		949
$p\overline{n}\pi^-$		$(2.00\pm0.10)\times10^{-3}$		1174
$n\overline{n}$		$(2.2\pm0.4)\times10^{-3}$		1231
$\Xi\overline{\Xi}$		$(1.8\pm0.4)\times10^{-3}$	S=1.8	818
$\Lambda\overline{\Lambda}$		$(1.54\pm0.19)\times10^{-3}$	S=2.2	1074
$p\overline{p}\pi^0$		$(1.09\pm0.09)\times10^{-3}$		1176
$\Lambda\overline{\Sigma}^-\pi^+$ (or c.c.)	[a]	$(1.06\pm0.12)\times10^{-3}$		950
$pK^-\overline{\Lambda}$		$(8.9\pm1.6)\times10^{-4}$		876
$2(K^+K^-)$		$(7.8\pm1.4)\times10^{-4}$		1131
$pK^-\overline{\Sigma}^0$		$(2.9\pm0.8)\times10^{-4}$		819
K^+K^-		$(2.37\pm0.31)\times10^{-4}$		1468
$K^0_S K^0_L$		$(1.46\pm0.26)\times10^{-4}$	S=2.7	1466
$\Lambda\overline{\Lambda}\pi^0$		$(2.2\pm0.6)\times10^{-4}$		998
$\pi^+\pi^-$		$(1.47\pm0.23)\times10^{-4}$		1542
$\Lambda\overline{\Sigma}$ + c.c.		$<1.5\times10^{-4}$	CL=90%	1034
$K^0_S K^0_S$		$<1\times10^{-6}$	CL=95%	1466

Radiative decays

$\gamma\eta_c(1S)$		(1.3 ± 0.4) %		114
$\gamma\pi^+\pi^-2\pi^0$		$(8.3\pm3.1)\times10^{-3}$		1518
$\gamma\eta\pi\pi$		$(6.1\pm1.0)\times10^{-3}$		1488
$\gamma\eta(1405/1475)\to\gamma K\overline{K}\pi$	[c]	$(2.8\pm0.6)\times10^{-3}$	S=1.6	1223
$\gamma\eta(1405/1475)\to\gamma\gamma\rho^0$		$(7.8\pm2.0)\times10^{-5}$	S=1.8	1223
$\gamma\eta(1405/1475)\to\gamma\eta\pi^+\pi^-$		$(3.0\pm0.5)\times10^{-4}$		–
$\gamma\eta(1405/1475)\to\gamma\gamma\phi$		$<8.2\times10^{-5}$	CL=95%	–

$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma\eta_2(1870) \to \gamma\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		–
$\gamma\eta'(958)$	$(4.71 \pm 0.27) \times 10^{-3}$	S=1.1	1400
$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517
$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		878
$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		886
$\gamma\omega\omega$	$(1.59 \pm 0.33) \times 10^{-3}$		1336
$\gamma\eta(1405/1475) \to \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223
$\gamma f_2(1270)$	$(1.38 \pm 0.14) \times 10^{-3}$		1286
$\gamma f_0(1710) \to \gamma K\overline{K}$	$(8.5 {}^{+1.2}_{-0.9}) \times 10^{-4}$	S=1.2	1075
$\gamma\eta$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.7	1500
$\gamma f_1(1420) \to \gamma K\overline{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1510) \to \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		–
$\gamma f'_2(1525)$	$(4.5 {}^{+0.7}_{-0.4}) \times 10^{-4}$		1173
$\gamma f_2(1950) \to \gamma K^*(892)\overline{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		–
$\gamma K^*(892)\overline{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		1266
$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166
$\gamma p\overline{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		1232
$\gamma\eta(2225)$	$(2.9 \pm 0.6) \times 10^{-4}$		752
$\gamma\eta(1760) \to \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048
$\gamma X(1835)$	$(2.2 \pm 0.6) \times 10^{-4}$		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
$\gamma\gamma$	$< 5 \times 10^{-4}$	CL=90%	1548
$\gamma\Lambda\overline{\Lambda}$	$< 1.3 \times 10^{-4}$	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
$\gamma f_J(2220) \to \gamma\pi\pi$	$(8 \pm 4) \times 10^{-5}$		–
$\gamma f_J(2220) \to \gamma K\overline{K}$	$(8.1 \pm 3.0) \times 10^{-5}$		–
$\gamma f_J(2220) \to \gamma p\overline{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		–
$\gamma f_0(1500)$	$>(5.7 \pm 0.8) \times 10^{-4}$		1182
$\gamma e^+ e^-$	$(8.8 \pm 1.4) \times 10^{-3}$		1548

Lepton Family number (*LF*) violating modes

$e^{\pm}\mu^{\mp}$	*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 $m = 3414.76 \pm 0.35$ MeV (S = 1.2)
Full width $\Gamma = 10.4 \pm 0.7$ MeV

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

K^+K^-	$(5.4 \pm 0.6) \times 10^{-3}$		1634
$\pi\pi$	$(7.2 \pm 0.6) \times 10^{-3}$		1702
$\eta\eta$	$(1.9 \pm 0.5) \times 10^{-3}$		1617
$\omega\omega$	$(2.3 \pm 0.7) \times 10^{-3}$		1517
$K^+K^-K^0_S K^0_S$	$(1.5 \pm 0.5) \times 10^{-3}$		1331
$K^+K^-K^+K^-$	$(2.1 \pm 0.4) \times 10^{-3}$		1333
$K^0_S K^0_S$	$(2.8 \pm 0.7) \times 10^{-3}$	S=1.9	1633
$K^0_S K^0_S \pi^+\pi^-$	$(6.1 \pm 1.1) \times 10^{-3}$		1579
$K^0_S K^0_S p\overline{p}$	$< 8.8 \times 10^{-4}$	CL=90%	884
$\pi^+\pi^- p\overline{p}$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320
$\phi\phi$	$(9 \pm 5) \times 10^{-4}$		1370
$p\overline{p}$	$(2.16 \pm 0.19) \times 10^{-4}$		1426
$\Lambda\overline{\Lambda}$	$(4.4 \pm 1.5) \times 10^{-4}$		1292
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$< 4.0 \times 10^{-3}$	CL=90%	1153
$\Xi^-\overline{\Xi}^+$	$< 1.03 \times 10^{-3}$	CL=90%	1081
$K^0_S K^+\pi^- +$ c.c.	$< 7 \times 10^{-4}$	CL=90%	1610
Radiative decays			
$\gamma J/\psi(1S)$	(1.30 ± 0.11) %		303
$\gamma\gamma$	$(2.76 \pm 0.33) \times 10^{-4}$		1707

$\chi_{c1}(1P)$

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

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

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2	1683
$2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		1728
$\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		1632
$\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		1657
$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	$(3.2 \pm 2.1) \times 10^{-3}$		1577
$K^*(892)^0\overline{K}^*(892)^0$	$(1.6 \pm 0.4) \times 10^{-3}$		1512
$K^0_S K^+\pi^- +$ c.c.	$(2.3 \pm 0.7) \times 10^{-3}$		1661
$\pi^+\pi^-K^0_S K^0_S$	$(7.7 \pm 3.3) \times 10^{-4}$		1630
$\pi^+\pi^- p\overline{p}$	$(4.9 \pm 1.9) \times 10^{-4}$		1381
$K^+K^-K^+K^-$	$(3.9 \pm 1.7) \times 10^{-4}$		1393
$p\overline{p}$	$(6.7 \pm 0.5) \times 10^{-5}$		1484
$\Lambda\overline{\Lambda}$	$(2.4 \pm 1.0) \times 10^{-4}$		1355
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$< 1.5 \times 10^{-3}$	CL=90%	1223

$K^0_S K^0_S p\overline{p}$	$<$ 4.5	$\times 10^{-4}$	CL=90%	968
$\Xi^- \overline{\Xi}^+$	$<$ 3.4	$\times 10^{-4}$	CL=90%	1156
$\pi^+\pi^- + K^+K^-$	$<$ 2.1	$\times 10^{-3}$		–
$K^0_S K^0_S$	$<$ 7	$\times 10^{-5}$	CL=90%	1683

Radiative decays

$\gamma J/\psi(1S)$	(35.6±1.9) %		389

$\chi_{c2}(1P)$

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

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

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(1.23±0.15) %		1751
$\pi^+\pi^- K^+K^-$	(9.9 ±2.5) $\times 10^{-3}$	S=1.6	1656
$3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$		1707
$\rho^0\pi^+\pi^-$	(7 ±4) $\times 10^{-3}$		1681
$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	(4.8 ±2.8) $\times 10^{-3}$		1602
$K^*(892)^0\overline{K}^*(892)^0$	(3.8 ±0.8) $\times 10^{-3}$		1538
$\phi\phi$	(1.9 ±0.7) $\times 10^{-3}$		1457
$\omega\omega$	(2.0 ±0.7) $\times 10^{-3}$		1597
$\pi\pi$	(2.14±0.25) $\times 10^{-3}$		1773
$\eta\eta$	$<$ 1.2 $\times 10^{-3}$	CL=90%	1692
$\pi^+\pi^- K^0_S K^0_S$	(2.6 ±0.6) $\times 10^{-3}$		1655
$K^+K^-K^+K^-$	(1.41±0.35) $\times 10^{-3}$		1421
$\pi^+\pi^- p\overline{p}$	(1.32±0.34) $\times 10^{-3}$		1410
K^+K^-	(7.7 ±1.4) $\times 10^{-4}$		1708
$K^0_S K^0_S$	(6.7 ±1.1) $\times 10^{-4}$		1707
$K^0_S K^0_S p\overline{p}$	$<$ 7.9 $\times 10^{-4}$	CL=90%	1007
$p\overline{p}$	(6.6 ±0.5) $\times 10^{-5}$		1510
$\Lambda\overline{\Lambda}$	(2.7 ±1.3) $\times 10^{-4}$		1385
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$<$ 3.5 $\times 10^{-3}$	CL=90%	1255
$J/\psi(1S)\pi^+\pi^-\pi^0$	$<$ 1.5 %	CL=90%	185
$K^0_S K^+\pi^- +$ c.c.	$<$ 1.0 $\times 10^{-3}$	CL=90%	1685
$\Xi^-\overline{\Xi}^+$	$<$ 3.7 $\times 10^{-4}$	CL=90%	1190

Radiative decays		
$\gamma J/\psi(1S)$	(20.2 ± 1.0) %	430
$\gamma\gamma$	$(2.59 \pm 0.19) \times 10^{-4}$	1778

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

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

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

$\psi(2S)$

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

Mass $m = 3686.093 \pm 0.034$ MeV (S = 1.4)
Full width $\Gamma = 337 \pm 13$ keV
$\Gamma_{ee} = 2.48 \pm 0.06$ keV

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85 ± 0.13) %		–
virtual $\gamma \to$ hadrons	(1.73 ± 0.14) %	S=1.5	–
e^+e^-	$(7.35 \pm 0.18) \times 10^{-3}$		1843
$\mu^+\mu^-$	$(7.3 \pm 0.8) \times 10^{-3}$		1840
$\tau^+\tau^-$	$(2.8 \pm 0.7) \times 10^{-3}$		489
Decays into $J/\psi(1S)$ and anything			
$J/\psi(1S)$ anything	(56.1 ± 0.9) %		–
$J/\psi(1S)$ neutrals	(23.0 ± 0.4) %		–
$J/\psi(1S)\pi^+\pi^-$	(31.8 ± 0.6) %		477
$J/\psi(1S)\pi^0\pi^0$	(16.46 ± 0.35) %		481
$J/\psi(1S)\eta$	(3.09 ± 0.08) %		200
$J/\psi(1S)\pi^0$	$(1.26 \pm 0.13) \times 10^{-3}$	S=1.3	528
Hadronic decays			
$3(\pi^+\pi^-)\pi^0$	$(3.5 \pm 1.6) \times 10^{-3}$		1746
$2(\pi^+\pi^-)\pi^0$	$(2.66 \pm 0.29) \times 10^{-3}$		1799
$\rho a_2(1320)$	$(2.6 \pm 0.9) \times 10^{-4}$		1500
$p\overline{p}$	$(2.65 \pm 0.22) \times 10^{-4}$	S=1.4	1586
$\Delta^{++}\overline{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		1371
$\Lambda\overline{\Lambda}$	$(2.5 \pm 0.7) \times 10^{-4}$	S=3.1	1467

$\Sigma^+ \overline{\Sigma}^-$	$(2.6 \pm 0.8) \times 10^{-4}$		1408
$\Sigma^0 \overline{\Sigma}^0$	$(2.1 \pm 0.7) \times 10^{-4}$	S=2.0	1405
$\Sigma(1385)^+ \overline{\Sigma}(1385)^-$	$(1.1 \pm 0.4) \times 10^{-4}$		1218
$\Xi^- \overline{\Xi}^+$	$(1.5 \pm 0.7) \times 10^{-4}$	S=3.0	1285
$\Xi^0 \overline{\Xi}^0$	$(2.8 \pm 0.9) \times 10^{-4}$		1292
$\Xi(1530)^0 \overline{\Xi}(1530)^0$	$< 8.1 \times 10^{-5}$	CL=90%	1025
$\Omega^- \overline{\Omega}^+$	$< 7.3 \times 10^{-5}$	CL=90%	774
$\pi^0 p \overline{p}$	$(1.33 \pm 0.17) \times 10^{-4}$		1543
$\eta p \overline{p}$	$(6.0 \pm 1.2) \times 10^{-5}$		1373
$\omega p \overline{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		1247
$\phi p \overline{p}$	$< 2.4 \times 10^{-5}$	CL=90%	1109
$\pi^+ \pi^- p \overline{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		1491
$2(\pi^+ \pi^- \pi^0)$	$(4.5 \pm 1.4) \times 10^{-3}$		1776
$\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	1791
$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		1778
$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		–
$\omega \pi^+ \pi^-$	$(6.6 \pm 1.7) \times 10^{-4}$	S=2.7	1748
$b_1^{\pm} \pi^{\mp}$	$(3.6 \pm 0.6) \times 10^{-4}$		1635
$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		–
$\omega f_2(1270)$	$(2.0 \pm 0.6) \times 10^{-4}$		1515
$\pi^+ \pi^- K^+ K^-$	$(7.2 \pm 0.5) \times 10^{-4}$		1726
$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1616
$K^*(892)^0 \overline{K}{}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		1418
$K^+ K^- 2(\pi^+ \pi^-)$	$(1.8 \pm 0.9) \times 10^{-3}$		1654
$K_1(1270)^{\pm} K^{\mp}$	$(1.00 \pm 0.28) \times 10^{-3}$		1581
$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1724
$\rho^0 p \overline{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		1251
$K^+ \overline{K}^*(892)^0 \pi^- +$ c.c.	$(6.7 \pm 2.5) \times 10^{-4}$		1674
$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	1817
$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	1750
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.24 \pm 0.10) \times 10^{-3}$		1694
$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		–
$K^*(892)^0 K^- \pi^+ \pi^0 +$ c.c.	$(8.6 \pm 2.2) \times 10^{-4}$		–
$K^*(892)^+ K^- \pi^+ \pi^- +$ c.c.	$(9.6 \pm 2.8) \times 10^{-4}$		–
$K^*(892)^+ K^- \rho^0 +$ c.c.	$(7.3 \pm 2.6) \times 10^{-4}$		–
$K^*(892)^0 K^- \rho^+ +$ c.c.	$(6.1 \pm 1.8) \times 10^{-4}$		–
$\eta K^+ K^-$	$< 1.3 \times 10^{-4}$	CL=90%	1664
$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$	S=1.1	1614
$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	1774
$p \overline{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		1435
$K^+ K^-$	$(1.0 \pm 0.7) \times 10^{-4}$		1776
$K_S^0 K_L^0$	$(5.2 \pm 0.7) \times 10^{-5}$		1775
$\pi^+ \pi^- \pi^0$	$(1.68 \pm 0.26) \times 10^{-4}$	S=1.4	1830

$\rho(2150)\pi \to \pi^+\pi^-\pi^0$	$(1.9\ ^{+1.2}_{-0.4})\times10^{-4}$			–
$\rho(770)\pi \to \pi^+\pi^-\pi^0$	$(3.2\ \pm1.2)\times10^{-5}$	S=1.8		–
$\pi^+\pi^-$	$(8\ \pm5)\times10^{-5}$			1838
$K_1(1400)^\pm K^\mp$	$<3.1\times10^{-4}$	CL=90%		1532
$K^+K^-\pi^0$	$<2.96\times10^{-5}$	CL=90%		1754
$K^+\overline{K}^*(892)^-+$ c.c.	$(1.7\ ^{+0.8}_{-0.7})\times10^{-5}$			1698
$K^*(892)^0\overline{K}^0+$ c.c.	$(1.09\pm0.20)\times10^{-4}$			1697
$\phi\pi^+\pi^-$	$(1.13\pm0.29)\times10^{-4}$	S=1.7		1690
$\phi f_0(980) \to \pi^+\pi^-$	$(6.0\ \pm2.2)\times10^{-5}$			–
$2(K^+K^-)$	$(6.0\ \pm1.4)\times10^{-5}$			1499
ϕK^+K^-	$(7.0\ \pm1.6)\times10^{-5}$			1546
$2(K^+K^-)\pi^0$	$(1.10\pm0.28)\times10^{-4}$			1440
$\phi\eta$	$(2.8\ ^{+1.0}_{-0.8})\times10^{-5}$			1654
$\phi\eta'$	$(3.1\ \pm1.6)\times10^{-5}$			1555
$\omega\eta'$	$(3.2\ ^{+2.5}_{-2.1})\times10^{-5}$			1623
$\omega\pi^0$	$(2.1\ \pm0.6)\times10^{-5}$			1757
$\rho\eta'$	$(1.9\ ^{+1.7}_{-1.2})\times10^{-5}$			1625
$\rho\eta$	$(2.2\ \pm0.6)\times10^{-5}$	S=1.1		1717
$\omega\eta$	$<1.1\times10^{-5}$	CL=90%		1715
$\phi\pi^0$	$<4\times10^{-6}$	CL=90%		1699
$p\overline{p}K^+K^-$	$(2.7\ \pm0.7)\times10^{-5}$			1118
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$(2.8\ \pm0.6)\times10^{-4}$			1346
$\Lambda\overline{p}K^+$	$(1.00\pm0.14)\times10^{-4}$			1327
$\Lambda\overline{p}K^+\pi^+\pi^-$	$(1.8\ \pm0.4)\times10^{-4}$			1167
$\phi f_2'(1525)$	$(4.4\ \pm1.6)\times10^{-5}$			1321
$\Theta(1540)\overline{\Theta}(1540) \to K^0_S pK^-\overline{n}+$ c.c.	$<8.8\times10^{-6}$	CL=90%		–
$\Theta(1540)K^-\overline{n} \to K^0_S pK^-\overline{n}$	$<1.0\times10^{-5}$	CL=90%		–
$\Theta(1540)K^0_S\overline{p} \to K^0_S\overline{p}K^+n$	$<7.0\times10^{-6}$	CL=90%		–
$\overline{\Theta}(1540)K^+n \to K^0_S\overline{p}K^+n$	$<2.6\times10^{-5}$	CL=90%		–
$\overline{\Theta}(1540)K^0_S p \to K^0_S pK^-\overline{n}$	$<6.0\times10^{-6}$	CL=90%		–
$K^0_S K^0_S$	$<4.6\times10^{-6}$			1775

Radiative decays

$\gamma\chi_{c0}(1P)$	$(9.2\ \pm0.4)$ %		261
$\gamma\chi_{c1}(1P)$	$(8.7\ \pm0.4)$ %		171
$\gamma\chi_{c2}(1P)$	$(8.1\ \pm0.4)$ %		128
$\gamma\eta_c(1S)$	$(2.6\ \pm0.4)\times10^{-3}$		638
$\gamma\eta_c(2S)$	$<2.0\times10^{-3}$	CL=90%	47
$\gamma\eta'(958)$	$(1.5\ \pm0.4)\times10^{-4}$		1719

$\gamma f_2(1270)$	$(2.1 \pm 0.4) \times 10^{-4}$		1622
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.0 \pm 1.3) \times 10^{-5}$		–
$\gamma f_0(1710) \rightarrow \gamma K \overline{K}$	$(6.0 \pm 1.6) \times 10^{-5}$		–
$\gamma \gamma$	$< 1.3 \times 10^{-4}$	CL=90%	1843
$\gamma \eta$	$< 9 \times 10^{-5}$	CL=90%	1802
$\gamma \eta(1405) \rightarrow \gamma K \overline{K} \pi$	$< 1.2 \times 10^{-4}$	CL=90%	1569

$\psi(3770)$

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

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

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

ψ(3770) DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\overline{D}$	dominant		281
$D^0\overline{D}^0$	seen		281
D^+D^-	seen		247
$J/\psi \pi^+\pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		558
$J/\psi \pi^0\pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		562
$J/\psi \eta$	$(9 \pm 4) \times 10^{-4}$		357
$J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	601
e^+e^-	$(1.05 \pm 0.14) \times 10^{-5}$	S=1.1	1886
$K^0_S K^0_L$	$< 2.1 \times 10^{-4}$	CL=90%	1819
$2(\pi^+\pi^-)$	$< 1.12 \times 10^{-3}$	CL=90%	1860
$2(\pi^+\pi^-)\pi^0$	$< 1.06 \times 10^{-3}$	CL=90%	1842
$\eta \pi^+\pi^-$	$< 1.24 \times 10^{-3}$	CL=90%	1835
$\omega \pi^+\pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	1793
$\eta 3\pi$	$< 1.34 \times 10^{-3}$	CL=90%	1823
$\eta' 3\pi$	$< 2.44 \times 10^{-3}$	CL=90%	1739
$K^+K^-\pi^+\pi^-$	$< 9.0 \times 10^{-4}$	CL=90%	1771
$\phi \pi^+\pi^-$	$< 4.1 \times 10^{-4}$	CL=90%	1736
$\phi f_0(980)$	$< 4.5 \times 10^{-4}$	CL=90%	1599
$K^+K^-\pi^+\pi^-\pi^0$	$< 2.36 \times 10^{-3}$	CL=90%	1740
ηK^+K^-	$< 4.1 \times 10^{-4}$	CL=90%	1711
ωK^+K^-	$< 3.4 \times 10^{-4}$	CL=90%	1663
$2(K^+K^-)$	$< 6.0 \times 10^{-4}$	CL=90%	1550
ϕK^+K^-	$< 7.5 \times 10^{-4}$	CL=90%	1596
$2(K^+K^-)\pi^0$	$< 2.9 \times 10^{-4}$	CL=90%	1492

$p\overline{p}\pi^+\pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	1543
$p\overline{p}\pi^+\pi^-\pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	1489
$\eta p\overline{p}$	< 5.4	$\times 10^{-4}$	CL=90%	1429
$\omega p\overline{p}$	< 2.9	$\times 10^{-4}$	CL=90%	1308
$p\overline{p}K^+K^-$	< 3.2	$\times 10^{-4}$	CL=90%	1184
$\phi p\overline{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1176
$\Lambda\overline{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	1520
$\Lambda\overline{\Lambda}\pi^+\pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	1403
$\Lambda\overline{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	1385
$\Lambda\overline{p}K^+\pi^+\pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	1232
$\phi\eta$	(3.1 ± 0.7)	$\times 10^{-4}$		1702
$\pi^+\pi^-\pi^0$	not seen			1873
$\rho\pi$	not seen			1803
$\omega\pi^0$	not seen			1802
$\phi\pi^0$	not seen			1745
$\rho\eta$	not seen			1762
$\omega\eta$	not seen			1761
$\rho\eta'$	not seen			1673
$\omega\eta'$	not seen			1671
$\phi\eta'$	not seen			1605
$K^{*0}\overline{K}^0$	not seen			1743
$K^{*+}K^-$	not seen			1744
$b_1\pi$	not seen			1682

$X(3872)$

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

Quantum numbers not established.

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

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

$\chi_{c2}(2P)$

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

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

$\psi(4040)$ [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

ψ(4040) DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$(1.07 \pm 0.16) \times 10^{-5}$		2019
$D^0 \overline{D}^0$	seen		776
$D^*(2007)^0 \overline{D}^0$ + c.c.	seen		576
$D^*(2007)^0 \overline{D}^*(2007)^0$	seen		227
$J/\psi \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	794
$J/\psi \pi^0 \pi^0$	$< 2 \times 10^{-3}$	90%	797
$J/\psi \eta$	$< 7 \times 10^{-3}$	90%	675
$J/\psi \pi^0$	$< 2 \times 10^{-3}$	90%	823
$J/\psi \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	90%	746
$\chi_{c1} \gamma$	< 1.1 %	90%	494
$\chi_{c2} \gamma$	< 1.7 %	90%	454
$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1 %	90%	306
$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2 %	90%	233
$\phi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%	1880

$\psi(4160)$ [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

ψ(4160) DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$e^+ e^-$	$(8.1 \pm 0.9) \times 10^{-6}$		2076
$J/\psi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%	888
$J/\psi \pi^0 \pi^0$	$< 3 \times 10^{-3}$	90%	891
$J/\psi K^+ K^-$	$< 2 \times 10^{-3}$	90%	324
$J/\psi \eta$	$< 8 \times 10^{-3}$	90%	786
$J/\psi \pi^0$	$< 1 \times 10^{-3}$	90%	914
$J/\psi \eta'$	$< 5 \times 10^{-3}$	90%	385
$J/\psi \pi^+ \pi^- \pi^0$	$< 1 \times 10^{-3}$	90%	847
$\psi(2S) \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	353
$\chi_{c1} \gamma$	$< 7 \times 10^{-3}$	90%	593
$\chi_{c2} \gamma$	< 1.3 %	90%	554

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

$\psi(4415)$ [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

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