$\Upsilon(1S)$

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

$\Upsilon(1S)$ MASS

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
9460.40±0.09±0.04	[1]	SHAMOV	23	RVUE	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9460.11±0.11±0.07	[2]	SHAMOV	23	RVUE	$e^+e^- \to$ hadrons
9460.51±0.09±0.05	[3,4]	ARTAMONOV	00	MD1	$e^+e^- \to$ hadrons
9460.60±0.09±0.05	[5,6]	BARU	92B	MD1	$e^+e^- \to$ hadrons
9460.59±0.12		BARU	86	MD1	$e^+e^- \to$ hadrons
9460.6 ±0.4	[6,7]	ARTAMONOV	84	MD1	$e^+e^- \to$ hadrons
9459.97±0.11±0.07	[8]	MACKAY	84	CUSB	$e^+e^- \to$ hadrons

[1] Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.
[2] Obtained by reanalysing CUSB data (MACKAY 84), but not authored by the CUSB collaboration.
[3] Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).
[4] Superseded by SHAMOV 23.
[5] Supersedes BARU 86.
[6] Superseded by ARTAMONOV 00.
[7] Value includes data of ARTAMONOV 82.
[8] Reanalysed by SHAMOV 23.

$\Upsilon(1S)$ WIDTH

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

$\Upsilon(1S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\tau^+\tau^-$	(2.60 ±0.10) %	
Γ_2	e^+e^-	(2.39 ±0.08) %	
Γ_3	$\mu^+\mu^-$	(2.48 ±0.04) %	
	Hadronic decays		
Γ_4	ggg	(81.7 ±0.7) %	
Γ_5	γgg	(2.2 ±0.6) %	
Γ_6	$\eta'(958)$ anything	(2.94 ±0.24) %	
Γ_7	$J/\psi(1S)$ anything	(5.4 ±0.4) $\times 10^{-4}$	S=1.4
Γ_8	$J/\psi(1S)\eta_c$	< 2.2 $\times 10^{-6}$	CL=90%
Γ_9	$J/\psi(1S)\chi_{c0}$	< 3.4 $\times 10^{-6}$	CL=90%
Γ_{10}	$J/\psi(1S)\chi_{c1}$	(3.9 ±1.2) $\times 10^{-6}$	
Γ_{11}	$J/\psi(1S)\chi_{c2}$	< 1.4 $\times 10^{-6}$	CL=90%

Γ_{12}	$J/\psi(1S)\eta_c(2S)$	< 2.2	$\times 10^{-6}$	CL=90%
Γ_{13}	$J/\psi(1S)X(3940)$	< 5.4	$\times 10^{-6}$	CL=90%
Γ_{14}	$J/\psi(1S)X(4160)$	< 5.4	$\times 10^{-6}$	CL=90%
Γ_{15}	$X(4350)$ anything, $X \to J/\psi(1S)\phi$	< 8.1	$\times 10^{-6}$	CL=90%
Γ_{16}	$Z_c(3900)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	< 1.3	$\times 10^{-5}$	CL=90%
Γ_{17}	$Z_c(4200)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	< 6.0	$\times 10^{-5}$	CL=90%
Γ_{18}	$Z_c(4430)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	< 4.9	$\times 10^{-5}$	CL=90%
Γ_{19}	$X_{cs}^{\pm}$ anything, $X \to J/\psi K^{\pm}$	< 5.7	$\times 10^{-6}$	CL=90%
Γ_{20}	$\psi(4230)$ anything, $\psi \to J/\psi(1S)\pi^+\pi^-$	< 3.8	$\times 10^{-5}$	CL=90%
Γ_{21}	$\psi(4230)$ anything, $\psi \to J/\psi(1S)K^+K^-$	< 7.5	$\times 10^{-6}$	CL=90%
Γ_{22}	$\chi_{c1}(4140)$ anything, $\chi_{c1} \to J/\psi(1S)\phi$	< 5.2	$\times 10^{-6}$	CL=90%
Γ_{23}	χ_{c0} anything	< 4	$\times 10^{-3}$	CL=90%
Γ_{24}	χ_{c1} anything	(1.90 ±0.35)	$\times 10^{-4}$	
Γ_{25}	$\chi_{c1}(1P)X_{tetra}$	< 3.78	$\times 10^{-5}$	CL=90%
Γ_{26}	χ_{c2} anything	(2.8 ±0.8)	$\times 10^{-4}$	
Γ_{27}	$\psi(2S)$ anything	(1.23 ±0.20)	$\times 10^{-4}$	
Γ_{28}	$\psi(2S)\eta_c$	< 3.6	$\times 10^{-6}$	CL=90%
Γ_{29}	$\psi(2S)\chi_{c0}$	< 6.5	$\times 10^{-6}$	CL=90%
Γ_{30}	$\psi(2S)\chi_{c1}$	< 4.5	$\times 10^{-6}$	CL=90%
Γ_{31}	$\psi(2S)\chi_{c2}$	< 2.1	$\times 10^{-6}$	CL=90%
Γ_{32}	$\psi(2S)\eta_c(2S)$	< 3.2	$\times 10^{-6}$	CL=90%
Γ_{33}	$\psi(2S)X(3940)$	< 2.9	$\times 10^{-6}$	CL=90%
Γ_{34}	$\psi(2S)X(4160)$	< 2.9	$\times 10^{-6}$	CL=90%
Γ_{35}	$\psi(4230)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	< 7.9	$\times 10^{-5}$	CL=90%
Γ_{36}	$\psi(4360)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	< 5.2	$\times 10^{-5}$	CL=90%
Γ_{37}	$\psi(4660)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	< 2.2	$\times 10^{-5}$	CL=90%
Γ_{38}	$X(4050)^{\pm}$ anything, $X \to \psi(2S)\pi^{\pm}$	< 8.8	$\times 10^{-5}$	CL=90%
Γ_{39}	$Z_c(4430)^{\pm}$ anything, $Z_c \to \psi(2S)\pi^{\pm}$	< 6.7	$\times 10^{-5}$	CL=90%
Γ_{40}	$\chi_{c1}(3872)$anything	< 2.5	$\times 10^{-4}$	CL=90%
Γ_{41}	$Z_c(4200)^+ Z_c(4200)^-$	< 2.23	$\times 10^{-5}$	CL=90%
Γ_{42}	$Z_c(3900)^{\pm} Z_c(4200)^{\mp}$	< 8.1	$\times 10^{-6}$	CL=90%
Γ_{43}	$Z_c(3900)^+ Z_c(3900)^-$	< 1.8	$\times 10^{-6}$	CL=90%

Γ_{44}	$X(4050)^+ X(4050)^-$		< 1.58	$\times 10^{-5}$	CL=90%
Γ_{45}	$X(4250)^+ X(4250)^-$		< 2.66	$\times 10^{-5}$	CL=90%
Γ_{46}	$X(4050)^\pm X(4250)^\mp$		< 4.42	$\times 10^{-5}$	CL=90%
Γ_{47}	$Z_c(4430)^+ Z_c(4430)^-$		< 2.03	$\times 10^{-5}$	CL=90%
Γ_{48}	$X(4055)^\pm X(4055)^\mp$		< 2.33	$\times 10^{-5}$	CL=90%
Γ_{49}	$X(4055)^\pm Z_c(4430)^\mp$		< 4.55	$\times 10^{-5}$	CL=90%
Γ_{50}	$\rho\pi$		< 3.68	$\times 10^{-6}$	CL=90%
Γ_{51}	$\omega\pi^0$		< 3.90	$\times 10^{-6}$	CL=90%
Γ_{52}	$\pi^+\pi^-$		< 5	$\times 10^{-4}$	CL=90%
Γ_{53}	K^+K^-		< 5	$\times 10^{-4}$	CL=90%
Γ_{54}	$p\overline{p}$		< 5	$\times 10^{-4}$	CL=90%
Γ_{55}	$\pi^+\pi^-\pi^0$		(2.1 ±0.8)	$\times 10^{-6}$	
Γ_{56}	ϕK^+K^-		(2.4 ±0.5)	$\times 10^{-6}$	
Γ_{57}	$\omega\pi^+\pi^-$		(4.5 ±1.0)	$\times 10^{-6}$	
Γ_{58}	$K^*(892)^0 K^-\pi^+$ + c.c.		(4.4 ±0.8)	$\times 10^{-6}$	
Γ_{59}	$\phi f'_2(1525)$		< 1.63	$\times 10^{-6}$	CL=90%
Γ_{60}	$\omega f_2(1270)$		< 1.79	$\times 10^{-6}$	CL=90%
Γ_{61}	$\rho(770) a_2(1320)$		< 2.24	$\times 10^{-6}$	CL=90%
Γ_{62}	$K^*(892)^0 \overline{K}^*_2(1430)^0$ + c.c.		(3.0 ±0.8)	$\times 10^{-6}$	
Γ_{63}	$K_1(1270)^\pm K^\mp$		< 2.41	$\times 10^{-6}$	CL=90%
Γ_{64}	$K_1(1400)^\pm K^\mp$		(1.0 ±0.4)	$\times 10^{-6}$	
Γ_{65}	$b_1(1235)^\pm \pi^\mp$		< 1.25	$\times 10^{-6}$	CL=90%
Γ_{66}	$\pi^+\pi^-\pi^0\pi^0$		(1.28 ±0.30)	$\times 10^{-5}$	
Γ_{67}	$K^0_S K^+\pi^-$ + c.c.		(1.6 ±0.4)	$\times 10^{-6}$	
Γ_{68}	$K^*(892)^0 \overline{K}^0$ + c.c.		(2.9 ±0.9)	$\times 10^{-6}$	
Γ_{69}	$K^*(892)^- K^+$ + c.c.		< 1.11	$\times 10^{-6}$	CL=90%
Γ_{70}	$f_1(1285)$ anything		(4.6 ±3.1)	$\times 10^{-3}$	
Γ_{71}	$D^*(2010)^\pm$ anything		(2.52 ±0.20)	%	
Γ_{72}	$f_1(1285) X_{tetra}$		< 6.24	$\times 10^{-5}$	CL=90%
Γ_{73}	$^2\overline{H}$ anything		(2.85 ±0.25)	$\times 10^{-5}$	
Γ_{74}	Sum of 100 exclusive modes		(1.200±0.017)	%	

Radiative decays

Γ_{75}	$\gamma\pi^+\pi^-$		(6.3 ±1.8)	$\times 10^{-5}$	
Γ_{76}	$\gamma\pi^0\pi^0$		(1.7 ±0.7)	$\times 10^{-5}$	
Γ_{77}	$\gamma\pi\pi$ (S-wave)		(4.6 ±0.7)	$\times 10^{-5}$	
Γ_{78}	$\gamma\pi^0\eta$		< 2.4	$\times 10^{-6}$	CL=90%
Γ_{79}	γK^+K^-	[*a*]	(1.14 ±0.13)	$\times 10^{-5}$	
Γ_{80}	$\gamma p\overline{p}$	[*b*]	< 6	$\times 10^{-6}$	CL=90%
Γ_{81}	$\gamma 2h^+ 2h^-$		(7.0 ±1.5)	$\times 10^{-4}$	
Γ_{82}	$\gamma 3h^+ 3h^-$		(5.4 ±2.0)	$\times 10^{-4}$	
Γ_{83}	$\gamma 4h^+ 4h^-$		(7.4 ±3.5)	$\times 10^{-4}$	
Γ_{84}	$\gamma\pi^+\pi^- K^+K^-$		(2.9 ±0.9)	$\times 10^{-4}$	
Γ_{85}	$\gamma 2\pi^+ 2\pi^-$		(2.5 ±0.9)	$\times 10^{-4}$	

Γ_{86}	$\gamma 3\pi^+ 3\pi^-$		$(2.5 \pm 1.2) \times 10^{-4}$		
Γ_{87}	$\gamma 2\pi^+ 2\pi^- K^+ K^-$		$(2.4 \pm 1.2) \times 10^{-4}$		
Γ_{88}	$\gamma \pi^+ \pi^- p \overline{p}$		$(1.5 \pm 0.6) \times 10^{-4}$		
Γ_{89}	$\gamma 2\pi^+ 2\pi^- p \overline{p}$		$(4 \pm 6) \times 10^{-5}$		
Γ_{90}	$\gamma 2K^+ 2K^-$		$(2.0 \pm 2.0) \times 10^{-5}$		
Γ_{91}	$\gamma \eta'(958)$		$< 1.9 \times 10^{-6}$	CL=90%	
Γ_{92}	$\gamma \eta$		$< 1.0 \times 10^{-6}$	CL=90%	
Γ_{93}	$\gamma f_0(980)$		$< 3 \times 10^{-5}$	CL=90%	
Γ_{94}	$\gamma f'_2(1525)$		$(2.9 \pm 0.6) \times 10^{-5}$		
Γ_{95}	$\gamma f_2(1270)$		$(1.01 \pm 0.06) \times 10^{-4}$		
Γ_{96}	$\gamma \eta(1405)$		$< 8.2 \times 10^{-5}$	CL=90%	
Γ_{97}	$\gamma f_0(1500)$		$< 1.5 \times 10^{-5}$	CL=90%	
Γ_{98}	$\gamma f_0(1500) \to \gamma K^+ K^-$		$(1.0 \pm 0.4) \times 10^{-5}$		
Γ_{99}	$\gamma f_0(1710)$		$< 2.6 \times 10^{-4}$	CL=90%	
Γ_{100}	$\gamma f_0(1710) \to \gamma K^+ K^-$		$(1.01 \pm 0.32) \times 10^{-5}$		
Γ_{101}	$\gamma f_0(1710) \to \gamma \pi^+ \pi^-$		$(5.3 \pm 2.0) \times 10^{-6}$		
Γ_{102}	$\gamma f_0(1710) \to \gamma \pi^0 \pi^0$		$< 1.4 \times 10^{-6}$	CL=90%	
Γ_{103}	$\gamma f_0(1710) \to \gamma \eta \eta$		$< 1.8 \times 10^{-6}$	CL=90%	
Γ_{104}	$\gamma f_4(2050)$		$< 5.3 \times 10^{-5}$	CL=90%	
Γ_{105}	$\gamma f_0(2200) \to \gamma K^+ K^-$		$< 2 \times 10^{-4}$	CL=90%	
Γ_{106}	$\gamma f_J(2220) \to \gamma K^+ K^-$		$< 8 \times 10^{-7}$	CL=90%	
Γ_{107}	$\gamma f_J(2220) \to \gamma \pi^+ \pi^-$		$< 6 \times 10^{-7}$	CL=90%	
Γ_{108}	$\gamma f_J(2220) \to \gamma p \overline{p}$		$< 1.1 \times 10^{-6}$	CL=90%	
Γ_{109}	$\gamma \eta(2225) \to \gamma \phi \phi$		$< 3 \times 10^{-3}$	CL=90%	
Γ_{110}	$\gamma \eta_c(1S)$		$< 2.9 \times 10^{-5}$	CL=90%	
Γ_{111}	$\gamma \eta_c(2S)$		$< 4 \times 10^{-4}$	CL=90%	
Γ_{112}	$\gamma \chi_{c0}$		$< 6.6 \times 10^{-5}$	CL=90%	
Γ_{113}	$\gamma \chi_{c1}$		$(4.7 {}^{+2.4}_{-1.9}) \times 10^{-5}$		
Γ_{114}	$\gamma \chi_{c2}$		$< 7.6 \times 10^{-6}$	CL=90%	
Γ_{115}	$\gamma \chi_{c1}(3872)$		$< 4 \times 10^{-5}$	CL=90%	
Γ_{116}	$\gamma \chi_{c1}(3872)$, $\chi_{c1} \to \pi^+ \pi^- \pi^0 J/\psi$		$< 2.8 \times 10^{-6}$	CL=90%	
Γ_{117}	$\gamma \chi_{c0}(3915) \to \omega J/\psi$		$< 3.0 \times 10^{-6}$	CL=90%	
Γ_{118}	$\gamma \chi_{c1}(4140) \to \phi J/\psi$		$< 2.2 \times 10^{-6}$	CL=90%	
Γ_{119}	$\gamma X \overline{X} (m_X < 3.1$ GeV)	[c]	$< 1 \times 10^{-3}$	CL=90%	
Γ_{120}	$\gamma X \overline{X} (m_X < 4.5$ GeV)	[d]	$< 2.4 \times 10^{-4}$	CL=90%	
Γ_{121}	$\gamma X \to \gamma + \geq 4$ prongs	[e]	$< 1.78 \times 10^{-4}$	CL=95%	
Γ_{122}	γA^0	[f]			
Γ_{123}	$\gamma A^0 \to \gamma \mu^+ \mu^-$	[g]	$< 9 \times 10^{-6}$	CL=90%	
Γ_{124}	$\gamma A^0 \to \gamma \tau^+ \tau^-$	[a]	$< 1.30 \times 10^{-4}$	CL=90%	
Γ_{125}	$\gamma A^0 \to \gamma g g$	[h]	< 1 %	CL=90%	
Γ_{126}	$\gamma A^0 \to \gamma s \overline{s}$	[h]	$< 1 \times 10^{-3}$	CL=90%	

Lepton Family number (LF) violating modes

Γ_{127}	$e^\pm \mu^\mp$	LF	< 3.9	$\times 10^{-7}$	CL=90%
Γ_{128}	$\mu^\pm \tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%
Γ_{129}	$e^\pm \tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%
Γ_{130}	$\gamma e^\pm \mu^\mp$	LF	< 4.2	$\times 10^{-7}$	CL=90%
Γ_{131}	$\gamma \mu^\pm \tau^\mp$	LF	< 6.1	$\times 10^{-6}$	CL=90%
Γ_{132}	$\gamma e^\pm \tau^\mp$	LF	< 6.5	$\times 10^{-6}$	CL=90%

Other decays

Γ_{133}	invisible		< 3.0	$\times 10^{-4}$	CL=90%
Γ_{134}	hadrons		(96 ± 4) %		

[a] $2m_\tau < \text{M}(\tau^+\tau^-) < 9.2$ GeV

[b] 2 GeV $< m_{K^+K^-} < 3$ GeV

[c] $X\overline{X}$ = vectors with $m < 3.1$ GeV

[d] X and $\overline{X}$ = zero spin with $m < 4.5$ GeV

[e] 1.5 GeV $< m_X < 5.0$ GeV

[f] A^0 = scalar with $m < 8.0$ GeV

[g] 201 MeV $< \text{M}(\mu^+\mu^-) < 3565$ MeV

[h] 0.5 GeV $< m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

$\Upsilon(1S)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_3\Gamma_2/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
31.2±1.6±1.7	KOBEL	92	CBAL	$e^+e^- \to \mu^+\mu^-$

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{134}\Gamma_2/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
1.240±0.016 OUR AVERAGE				
1.252±0.004±0.019	[1] ROSNER	06	CLEO	9.5 $e^+e^- \to$ hadrons
1.187±0.023±0.031	[1] BARU	92B	MD1	$e^+e^- \to$ hadrons
1.23 ±0.02 ±0.05	[1] JAKUBOWSKI	88	CBAL	$e^+e^- \to$ hadrons
1.37 ±0.06 ±0.09	[2] GILES	84B	CLEO	$e^+e^- \to$ hadrons
1.23 ±0.08 ±0.04	[2] ALBRECHT	82	DASP	$e^+e^- \to$ hadrons
1.13 ±0.07 ±0.11	[2] NICZYPORUK	82	LENA	$e^+e^- \to$ hadrons
1.09 ±0.25	[2] BOCK	80	CNTR	$e^+e^- \to$ hadrons
1.35 ±0.14	[3] BERGER	79	PLUT	$e^+e^- \to$ hadrons

[1] Radiative corrections evaluated following KURAEV 85.
[2] Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.
[3] Radiative corrections reevaluated by ALEXANDER 89 using $\text{B}(\mu\mu) = 0.026$.

$\Upsilon(1S)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ — Γ_2

VALUE (keV)	DOCUMENT ID
1.340±0.018 OUR EVALUATION	

$\Upsilon(1S)$ BRANCHING RATIOS

$\Gamma(\tau^+\tau^-)/\Gamma_{total}$ — Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.60±0.10 OUR AVERAGE					
2.53±0.13±0.04	60k	[1] BESSON	07	CLEO	$e^+e^- \to \Upsilon(1S) \to \tau^+\tau^-$
$2.61\pm0.12^{+0.09}_{-0.13}$	25k	CINABRO	94B	CLE2	$e^+e^- \to \tau^+\tau^-$
2.7 ±0.4 ±0.2		[2] ALBRECHT	85C	ARG	$\Upsilon(2S) \to \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±0.4		GILES	83	CLEO	$e^+e^- \to \tau^+\tau^-$

[1] BESSON 07 reports $[\Gamma(\Upsilon(1S) \to \tau^+\tau^-)/\Gamma_{total}]$ / $[B(\Upsilon(1S) \to \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\Upsilon(1S) \to \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] Using $B(\Upsilon(1S) \to ee) = B(\Upsilon(1S) \to \mu\mu) = 0.0256$; not used for width evaluations.

$\Gamma(e^+e^-)/\Gamma_{total}$ — Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.39±0.08 OUR AVERAGE					
2.40±0.01±0.12	191k	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-e^+e^-$
2.29±0.08±0.11		ALEXANDER	98	CLE2	$\Upsilon(2S) \to \pi^+\pi^-e^+e^-$
2.42±0.14±0.14	307	ALBRECHT	87	ARG	$\Upsilon(2S) \to \pi^+\pi^-e^+e^-$
2.8 ±0.3 ±0.2	826	BESSON	84	CLEO	$\Upsilon(2S) \to \pi^+\pi^-e^+e^-$
5.1 ±3.0		BERGER	80C	PLUT	$e^+e^- \to e^+e^-$

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ — Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.48±0.04 OUR AVERAGE					
2.46±0.01±0.11	246k	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
2.49±0.02±0.07	345k	ADAMS	05	CLEO	$e^+e^- \to \mu^+\mu^-$
2.49±0.08±0.13		ALEXANDER	98	CLE2	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
2.12±0.20±0.10		[1] BARU	92	MD1	$e^+e^- \to \mu^+\mu^-$
2.31±0.12±0.10		[1] KOBEL	92	CBAL	$e^+e^- \to \mu^+\mu^-$
2.52±0.07±0.07		CHEN	89B	CLEO	$e^+e^- \to \mu^+\mu^-$
2.61±0.09±0.11		KAARSBERG	89	CSB2	$e^+e^- \to \mu^+\mu^-$
2.30±0.25±0.13	86	ALBRECHT	87	ARG	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
2.9 ±0.3 ±0.2	864	BESSON	84	CLEO	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$

2.7 ±0.3 ±0.3	ANDREWS	83	CLEO	$e^+e^- \to \mu^+\mu^-$
3.2 ±1.3 ±0.3	ALBRECHT	82	DASP	$e^+e^- \to \mu^+\mu^-$
3.8 ±1.5 ±0.2	NICZYPORUK	82	LENA	$e^+e^- \to \mu^+\mu^-$
$1.4 ^{+3.4}_{-1.4}$	BOCK	80	CNTR	$e^+e^- \to \mu^+\mu^-$
2.2 ±2.0	BERGER	79	PLUT	$e^+e^- \to \mu^+\mu^-$

[1] Taking into account interference between the resonance and continuum.

$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ — Γ_1/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.008±0.023 OUR AVERAGE					
1.005±0.013±0.022	0.7M	[1] DEL-AMO-SA...	10C	BABR	$\Upsilon(3S) \to \pi^+\pi^- \Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSON	07	CLEO	$e^+e^- \to \Upsilon(1S)$

[1] Allows any number of extra photons with total energy < 500 MeV.

$\Gamma(ggg)/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
81.7±0.7	20M	[1] BESSON	06A	CLEO	$\Upsilon(1S) \to$ hadrons

[1] Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg)$ = (2.70 ± 0.01 ± 0.13 ± 0.24)% from BESSON 06A and PDG 08 values of B($\mu^+\mu^-$) = (2.48 ± 0.05)% and $R_{hadrons}$ = 3.51. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{total}$ measurement of BESSON 06A.

$\Gamma(\gamma gg)/\Gamma_{total}$ — Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.20±0.60	400k	[1] BESSON	06A	CLEO	$\Upsilon(1S) \to \gamma +$ hadrons

[1] Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg)$ = (2.70±0.01±0.13±0.24)% and $\Gamma(ggg)/\Gamma_{total}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{total}$ measurement of BESSON 06A.

$\Gamma(\gamma gg)/\Gamma(ggg)$ — Γ_5/Γ_4

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.70±0.01±0.27	20M	BESSON	06A	CLEO	$\Upsilon(1S) \to (\gamma +)$ hadrons

$\Gamma(\eta'(958)$ anything$)/\Gamma_{total}$ — Γ_6/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.0294±0.0024 OUR AVERAGE				
0.030 ±0.002 ±0.002	AQUINES	06A	CLE3	$\Upsilon(1S) \to \eta'$ anything
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2	$\Upsilon(1S) \to \eta'$ anything

$\Gamma(J/\psi(1S)$ anything$)/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
5.4 ±0.4 OUR FIT Error includes scale factor of 1.4.						
5.4 ±0.4 OUR AVERAGE Error includes scale factor of 1.5.						
5.25±0.13±0.25		3k	SHEN	16	BELL	$e^+e^- \to J/\psi X$
6.4 ±0.4 ±0.6		730	BRIERE	04	CLEO	$e^+e^- \to J/\psi X$
11 ±4 ±2			[1] FULTON	89	CLEO	$e^+e^- \to \mu^+\mu^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	ALBRECHT	92J	ARG	$e^+e^- \to e^+e^-X$, $\mu^+\mu^-X$
<17	90	MASCHMANN	90	CBAL	$e^+e^- \to$ hadrons
<200	90	NICZYPORUK	83	LENA	

[1] Using B($(J/\psi) \to \mu^+\mu^-$) = (6.9 ± 0.9)%.

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{total}$ — Γ_8/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.2 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{total}$ — Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.4 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
3.90±1.21±0.23	20	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{total}$ — Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.4 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{total}$ — Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.2 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.4 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.4 × 10^−6	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(X(4350)$ anything, $X \to J/\psi(1S)\phi)/\Gamma_{total}$ — Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<8.1 × 10^−6	90	SHEN	16	BELL	$\Upsilon(1S) \to J/\psi K^+K^-X$

$\Gamma(Z_c(3900)^\pm$ anything, $Z_c \to J/\psi(1S)\pi^\pm)/\Gamma_{total}$ — Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.3 × 10^−5	90	SHEN	16	BELL	$\Upsilon(1S) \to J/\psi\pi^\pm X$

$\Gamma(Z_c(4200)^\pm$ anything, $Z_c \to J/\psi(1S)\pi^\pm)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.0 × 10^−5	90	SHEN	16	BELL	$\Upsilon(1S) \to J/\psi\pi^\pm X$

$\Gamma(Z_c(4430)^{\pm}$ anything, $Z_c \rightarrow J/\psi(1S)\pi^{\pm})/\Gamma_{total}$ — Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.9 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi\pi^{\pm}X$

$\Gamma(X_{cs}^{\pm}$ anything, $X \rightarrow J/\psi K^{\pm})/\Gamma_{total}$ — Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.7 × 10^{-6}	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^{-}X$

$\Gamma(\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)\pi^{+}\pi^{-})/\Gamma_{total}$ — Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.8 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi\pi^{+}\pi^{-}X$

$\Gamma(\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)K^{+}K^{-})/\Gamma_{total}$ — Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.5 × 10^{-6}	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^{+}K^{-}X$

$\Gamma(\chi_{c1}(4140)$ anything, $\chi_{c1} \rightarrow J/\psi(1S)\phi)/\Gamma_{total}$ — Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.2 × 10^{-6}	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^{+}K^{-}X$

$\Gamma(\chi_{c0}$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ — Γ_{23}/Γ_7

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.4	90	BRIERE	04	CLEO	$e^{+}e^{-} \rightarrow J/\psi X$

$\Gamma(\chi_{c1}$ anything$)/\Gamma_{total}$ — Γ_{24}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.90±0.35 OUR FIT					
1.90±0.43±0.14	215	JIA	17	BELL	$\Upsilon(1S) \rightarrow \gamma J/\psi(1S)$

$\Gamma(\chi_{c1}$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ — Γ_{24}/Γ_7

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.35±0.07 OUR FIT					
0.35±0.08±0.06	52 ± 12	BRIERE	04	CLEO	$e^{+}e^{-} \rightarrow J/\psi X$

$\Gamma(\chi_{c1}(1P)X_{tetra})/\Gamma_{total}$ — Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<37.8 × 10^{-6}	90	[1] JIA	17A	BELL	$e^{+}e^{-} \rightarrow$ hadrons

[1] For a tetraquark state X_{tetra}, with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.4×10^{-6} to 37.8×10^{-6}.

$\Gamma(\chi_{c2}$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ — Γ_{26}/Γ_7

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.52±0.12±0.09	47 ± 11	BRIERE	04	CLEO	$e^{+}e^{-} \rightarrow J/\psi X$

$\Gamma(\psi(2S)$ anything$)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.23±0.17±0.11	215	SHEN	16	BELL	$e^{+}e^{-} \rightarrow \psi(2S)X$

$\Gamma(\psi(2S)$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ **Γ_{27}/Γ_7**

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.41±0.11±0.08	42 ± 11	BRIERE	04	CLEO	$e^+e^- \to J/\psi\pi^+\pi^- X$

$\Gamma(\psi(2S)\eta_c)/\Gamma_{total}$ **Γ_{28}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.6 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{total}$ **Γ_{29}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.5 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{total}$ **Γ_{30}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.5 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{total}$ **Γ_{31}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.1 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{total}$ **Γ_{32}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.2 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)X(3940))/\Gamma_{total}$ **Γ_{33}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.9 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)X(4160))/\Gamma_{total}$ **Γ_{34}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.9 × 10^{-6}	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(4230)$ anything, $\psi \to \psi(2S)\pi^+\pi^-)/\Gamma_{total}$ **Γ_{35}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.9 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \to \psi(2S)\pi^+\pi^- X$

$\Gamma(\psi(4360)$ anything, $\psi \to \psi(2S)\pi^+\pi^-)/\Gamma_{total}$ **Γ_{36}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.2 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \to \psi(2S)\pi^+\pi^- X$

$\Gamma(\psi(4660)$ anything, $\psi \to \psi(2S)\pi^+\pi^-)/\Gamma_{total}$ **Γ_{37}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.2 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \to \psi(2S)\pi^+\pi^- X$

$\Gamma(X(4050)^\pm$ anything, $X \to \psi(2S)\pi^\pm)/\Gamma_{total}$ **Γ_{38}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<8.8 × 10^{-5}	90	SHEN	16	BELL	$\Upsilon(1S) \to \psi(2S)\pi^\pm X$

$\Gamma(Z_c(4430)^{\pm}$ anything, $Z_c \to \psi(2S)\pi^{\pm})/\Gamma_{total}$ — Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.7 \times 10^{-5}$	90	SHEN	16	BELL	$\Upsilon(1S) \to \psi(2S)\pi^{\pm} X$

$\Gamma(\chi_{c1}(3872)$ anything$)/\Gamma_{total}$ — Γ_{40}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.5 \times 10^{-4}$	90	[1] SHEN	16	BELL	$\Upsilon(1S) \to J/\psi\pi^+\pi^- X$

[1] SHEN 16 reports $[\Gamma(\Upsilon(1S) \to \chi_{c1}(3872)\text{anything})/\Gamma_{total}] \times [B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S))] < 9.5 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S)) = 3.8 \times 10^{-2}$.

$\Gamma(Z_c(4200)^+ Z_c(4200)^-)/\Gamma_{total}$ — Γ_{41}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<22.3 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to J/\psi\pi^{\pm} X$

[1] Assuming $B(Z_c(4200)^{\pm} \to J/\psi\pi^{\pm}) = 1$.

$\Gamma(Z_c(3900)^{\pm} Z_c(4200)^{\mp})/\Gamma_{total}$ — Γ_{42}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<8.1 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to J/\psi\pi^{\pm} X$

[1] Assuming $B(Z_c(4200)^{\pm} \to J/\psi\pi^{\pm}) = 1 = B(Z_c(3900)^{\pm} \to J/\psi\pi^{\pm})$.

$\Gamma(Z_c(3900)^+ Z_c(3900)^-)/\Gamma_{total}$ — Γ_{43}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.8 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to J/\psi\pi^{\pm} X$

[1] Assuming $B(Z_c(3900)^{\pm} \to J/\psi\pi^{\pm}) = 1$

$\Gamma(X(4050)^+ X(4050)^-)/\Gamma_{total}$ — Γ_{44}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<15.8 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to \chi_{c1}(1P)\pi^{\pm} X$

[1] Assuming $B(X(4050)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}) = 1$

$\Gamma(X(4250)^+ X(4250)^-)/\Gamma_{total}$ — Γ_{45}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<26.6 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to \chi_{c1}(1P)\pi^{\pm} X$

[1] Assuming $B(X(4250)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}) = 1$

$\Gamma(X(4050)^{\pm} X(4250)^{\mp})/\Gamma_{total}$ — Γ_{46}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<44.2 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to \chi_{c1}(1P)\pi^{\pm} X$

[1] Assuming $B(X(4050)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}) = 1 = B(X(4250)^{\pm} \to \chi_{c1}(1P)\pi^{\pm})$

$\Gamma(Z_c(4430)^+ Z_c(4430)^-)/\Gamma_{total}$ — Γ_{47}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<20.3 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(2S) \to \psi(2S)\pi^{\pm} X$

[1] Assuming $B(Z_c(4430)^{\pm} \to \psi(2S)\pi^{\pm}) = 1$

$\Gamma(X(4055)^{\pm} X(4055)^{\mp})/\Gamma_{total}$ — Γ_{48}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<23.3 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to \psi(2S)\pi^{\pm} X$

[1] Assuming B($X(4055)^{\pm} \to \psi(2S)\pi^{\pm}$) = 1

$\Gamma(X(4055)^{\pm} Z_c(4430)^{\mp})/\Gamma_{total}$ — Γ_{49}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<45.5 \times 10^{-6}$	90	[1] JIA	18	BELL	$\Upsilon(1S) \to \psi(2S)\pi^{\pm} X$

[1] Assuming B($X(4055)^{\pm} \to \psi(2S)\pi^{\pm}$) = 1 = B($Z_c(4430)^{\pm} \to \psi(2S)\pi^{\pm}$)

$\Gamma(\rho\pi)/\Gamma_{total}$ — Γ_{50}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<3.68	90	SHEN	13	BELL	$\Upsilon(1S) \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1 \times 10^3$	90	BLINOV	90	MD1	$\Upsilon(1S) \to \rho^0\pi^0$
$<2 \times 10^2$	90	FULTON	90B		$\Upsilon(1S) \to \rho^0\pi^0$
$<2.1 \times 10^3$	90	NICZYPORUK	83	LENA	$\Upsilon(1S) \to \rho^0\pi^0$

$\Gamma(\omega\pi^0)/\Gamma_{total}$ — Γ_{51}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<3.90	90	SHEN	13	BELL	$\Upsilon(1S) \to \pi^+\pi^-\pi^0\pi^0$

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<5	90	BARU	92	MD1	$\Upsilon(1S) \to \pi^+\pi^-$

$\Gamma(K^+K^-)/\Gamma_{total}$ — Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<5	90	BARU	92	MD1	$\Upsilon(1S) \to K^+K^-$

$\Gamma(p\overline{p})/\Gamma_{total}$ — Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<5	90	[1] BARU	96	MD1	$\Upsilon(1S) \to p\overline{p}$

[1] Supersedes BARU 92 in this node.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{55}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.14±0.72±0.34		26 ± 9	SHEN	13	BELL	$\Upsilon(1S) \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<18.4	90		ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons

$\Gamma(\phi K^+K^-)/\Gamma_{total}$ — Γ_{56}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
2.36±0.37±0.29	56	SHEN	12A	BELL	$\Upsilon(1S) \to 2(K^+K^-)$

$\Gamma(\omega\pi^+\pi^-)/\Gamma_{total}$ — Γ_{57}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
4.46±0.67±0.72	64	SHEN	12A	BELL	$\Upsilon(1S) \to 2(\pi^+\pi^-)\pi^0$

$\Gamma(K^*(892)^0 K^-\pi^+ + c.c.)/\Gamma_{total}$ — Γ_{58}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
4.42±0.50±0.58	173	SHEN	12A	BELL	$\Upsilon(1S) \to K^+K^-\pi^+\pi^-$

$\Gamma(\phi f'_2(1525))/\Gamma_{total}$ — Γ_{59}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.63	90	SHEN	12A	BELL	$\Upsilon(1S) \to 2(K^+K^-)$

$\Gamma(\omega f_2(1270))/\Gamma_{total}$ — Γ_{60}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.79	90	SHEN	12A	BELL	$\Upsilon(1S) \to 2(\pi^+\pi^-)\pi^0$

$\Gamma(\rho(770) a_2(1320))/\Gamma_{total}$ — Γ_{61}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<2.24	90	SHEN	12A	BELL	$\Upsilon(1S) \to 2(\pi^+\pi^-)\pi^0$

$\Gamma(K^*(892)^0 \overline{K}^*_2(1430)^0 + c.c.)/\Gamma_{total}$ — Γ_{62}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
3.02±0.68±0.34	42	SHEN	12A	BELL	$\Upsilon(1S) \to K^+K^-\pi^+\pi^-$

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{total}$ — Γ_{63}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<2.41	90	SHEN	12A	BELL	$\Upsilon(1S) \to K^+K^-\pi^+\pi^-$

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{total}$ — Γ_{64}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
1.02±0.35±0.22	24	SHEN	12A	BELL	$\Upsilon(1S) \to K^+K^-\pi^+\pi^-$

$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{total}$ — Γ_{65}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.25	90	SHEN	12A	BELL	$\Upsilon(1S) \to 2(\pi^+\pi^-)\pi^0$

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$ — Γ_{66}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
12.8±2.0±2.3	143 ± 22	SHEN	13	BELL	$\Upsilon(1S) \to \pi^+\pi^-\pi^0\pi^0$

$\Gamma(K^0_S K^+\pi^- + c.c.)/\Gamma_{total}$ — Γ_{67}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.59±0.33±0.18		37 ± 8	SHEN	13	BELL	$\Upsilon(1S) \to K^0_S K^-\pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.4	90		[1] DOBBS	12A		$\Upsilon(1S) \to K^0_S K^-\pi^+$

[1] Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

$\Gamma(K^*(892)^0 \overline{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ — Γ_{68}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
2.92±0.85±0.37	16 ± 5	SHEN	13	BELL	$\Upsilon(1S) \to K^0_S K^- \pi^+$

$\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$ — Γ_{69}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.11	90	SHEN	13	BELL	$\Upsilon(1S) \to K^0_S K^- \pi^+$

$\Gamma(f_1(1285)\text{ anything})/\Gamma_{\text{total}}$ — Γ_{70}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
4.6±2.8±1.3	3.1k	JIA	17A	BELL	$e^+ e^- \to$ hadrons

$\Gamma(D^*(2010)^{\pm}\text{ anything})/\Gamma_{\text{total}}$ — Γ_{71}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
25.2±1.3±1.5		≈ 2k	[1] AUBERT	10C	BABR	$\Upsilon(2S) \to \pi^+ \pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<19	90		[2] ALBRECHT	92J	ARG	$e^+ e^- \to D^0 \pi^{\pm} X$

[1] For $x_p > 0.1$.
[2] For $x_p > 0.2$.

$\Gamma(f_1(1285) X_{tetra})/\Gamma_{\text{total}}$ — Γ_{72}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<62.4 × 10^−6	90	[1] JIA	17A	BELL	$e^+ e^- \to$ hadrons

[1] For a tetraquark state X_{tetra}, with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.6×10^{-6} to 62.4×10^{-6}.

$\Gamma(\overline{^2H}\text{ anything})/\Gamma_{\text{total}}$ — Γ_{73}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.85±0.25 OUR AVERAGE					
$2.81 \pm 0.49^{+0.20}_{-0.24}$		LEES	14G	BABR	$e^+ e^- \to \overline{^2H}\, X$
2.86±0.19±0.21	455	ASNER	07	CLEO	$e^+ e^- \to \overline{^2H}\, X$

$\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ — Γ_{74}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		COMMENT
1.200±0.017	[1,2] DOBBS	12A	$\Upsilon(1S) \to$ hadrons

[1] DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.
[2] Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

$\Gamma(ggg, \gamma gg \to \overline{d}\text{ anything})/\Gamma(ggg, \gamma gg \to \text{anything})$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
3.36±0.23±0.25	455	ASNER	07	CLEO	$e^+ e^- \to \overline{d} X$

$\Gamma(\gamma\pi^+\pi^-)/\Gamma_{total}$ — Γ_{75}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.3±1.2±1.3	[1] ANASTASSOV 99	CLE2	$e^+e^- \to$ hadrons

[1] For $m_{\pi\pi} > 1$ GeV.

$\Gamma(\gamma\pi^0\pi^0)/\Gamma_{total}$ — Γ_{76}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.3	[1] ANASTASSOV 99	CLE2	$e^+e^- \to$ hadrons

[1] For $m_{\pi\pi} > 1$ GeV.

$\Gamma(\gamma\pi\pi(\text{S-wave}))/\Gamma_{total}$ — Γ_{77}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.63±0.56±0.48	LEES 18A	BABR	$\Upsilon(1S) \to \gamma\pi^+\pi^-$

$\Gamma(\gamma\pi^0\eta)/\Gamma_{total}$ — Γ_{78}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	[1] BESSON 07A	CLEO	$e^+e^- \to \Upsilon(1S)$

[1] BESSON 07A obtained this limit for $0.7 < m_{\pi^0\eta} < 3$ GeV.

$\Gamma(\gamma K^+K^-)/\Gamma_{total}$ — Γ_{79}/Γ

$(2 < m_{K^+K^-} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.14±0.08±0.10	90	ATHAR 06	CLE3	$\Upsilon(1S) \to \gamma K^+K^-$

$\Gamma(\gamma p\overline{p})/\Gamma_{total}$ — Γ_{80}/Γ

$(2 < m_{p\overline{p}} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	ATHAR 06	CLE3	$\Upsilon(1S) \to \gamma p\overline{p}$

$\Gamma(\gamma 2h^+2h^-)/\Gamma_{total}$ — Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0±1.1±1.0	80 ± 12	FULTON 90B	CLEO	$e^+e^- \to$ hadrons

$\Gamma(\gamma 3h^+3h^-)/\Gamma_{total}$ — Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±1.5±1.3	39 ± 11	FULTON 90B	CLEO	$e^+e^- \to$ hadrons

$\Gamma(\gamma 4h^+4h^-)/\Gamma_{total}$ — Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.4±2.5±2.5	36 ± 12	FULTON 90B	CLEO	$e^+e^- \to$ hadrons

$\Gamma(\gamma\pi^+\pi^-K^+K^-)/\Gamma_{total}$ — Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.7±0.6	29 ± 8	FULTON 90B	CLEO	$e^+e^- \to$ hadrons

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{total}$ — Γ_{85}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.5±0.7±0.5	26 ± 7	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{total}$ — Γ_{86}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.5±0.9±0.8	17 ± 5	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{total}$ — Γ_{87}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.4±0.9±0.8	18 ± 7	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma \pi^+ \pi^- p \overline{p})/\Gamma_{total}$ — Γ_{88}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.5±0.5±0.3	22 ± 6	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma 2\pi^+ 2\pi^- p \overline{p})/\Gamma_{total}$ — Γ_{89}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
0.4±0.4±0.4	7 ± 6	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{total}$ — Γ_{90}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
0.2±0.2	2 ± 2	FULTON	90B	CLEO	$e^+ e^- \to$ hadrons

$\Gamma(\gamma \eta'(958))/\Gamma_{total}$ — Γ_{91}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.9	90	ATHAR	07A	CLEO	$\Upsilon(1S) \to \gamma \eta' \to \gamma \pi^+ \pi^- \eta, \gamma \rho$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<16	90	RICHICHI	01B	CLE2	$\Upsilon(1S) \to \gamma \eta' \to \gamma \eta \pi^+ \pi^-$

$\Gamma(\gamma \eta)/\Gamma_{total}$ — Γ_{92}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.0	90	ATHAR	07A	CLEO	$\Upsilon(1S) \to \gamma \eta \to \gamma \gamma \gamma$, $\gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<21	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma \eta$

$\Gamma(\gamma f_0(980))/\Gamma_{total}$ — Γ_{93}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<3	90	[1] ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$

[1] Assuming B($f_0(980) \to \pi \pi$) = 1.

$\Gamma(\gamma f_2'(1525))/\Gamma_{total}$ — Γ_{94}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.9 ±0.6 OUR AVERAGE						
$2.13 \pm 0.28 \pm 0.72$			[1] LEES	18A	BABR	$\Upsilon(1S) \to \gamma K^+ K^-$
$4.1 \pm 1.4 \pm 0.1$		17	[2] BESSON	11	CLEO	$\Upsilon(1S) \to K^0_S K^0_S$
$3.7 {}^{+0.9}_{-0.7} \pm 0.8$			ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<14	90		[3] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+ K^-$
<19.4	90		[3] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+ K^-$

[1] Using B($f_2'(1525) \to K\overline{K}$) = 0.887 ± 0.022 and B($K^0\overline{K}^0$) = 1/2 B($K\overline{K}$).

[2] BESSON 11 reports $(4.0 \pm 1.3 \pm 0.6) \times 10^{-5}$ from a measurement of [$\Gamma(\Upsilon(1S) \to \gamma f_2'(1525))/\Gamma_{total}$] × [B($f_2'(1525) \to K\overline{K}$)] assuming B($f_2'(1525) \to K\overline{K}$) = $(88.8 \pm 3.1) \times 10^{-2}$, which we rescale to our best value B($f_2'(1525) \to K\overline{K}$) = $(87.6 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The result also assumes B($K^0_S \to \pi^+\pi^-$) = (69.20 ± 0.05)% and B($f_2'(1525) \to K\overline{K}$) = 4 B($f_2'(1525) \to K^0_S K^0_S$).

[3] Assuming B($f_2'(1525) \to K\overline{K}$) = 0.71.

$\Gamma(\gamma f_2(1270))/\Gamma_{total}$ — Γ_{95}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
10.1 ±0.6 OUR AVERAGE					
$10.15 \pm 0.59 {}^{+0.54}_{-0.43}$		[1] LEES	18A	BABR	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
$10.5 \pm 1.6 {}^{+1.9}_{-1.8}$		[2] BESSON	07A	CLE3	$\Upsilon(1S) \to \gamma\pi^0\pi^0$
$10.2 \pm 0.8 \pm 0.7$		ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
$8.1 \pm 2.3 {}^{+2.9}_{-2.7}$		[3] ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<21	90	[3] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<13	90	[3] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<81	90	SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

[1] Using B($f_2(1270) \to \pi^0\pi^0$) = 1/3 B($f_2(1270) \to \pi\pi$) and B($f_2(1270) \to \pi\pi$) = $(84.2^{+2.9}_{-0.9})$%.

[2] Using B($f_2(1270) \to \pi^0\pi^0$) = B($f_2(1270) \to \pi\pi$)/3 and B($f_2(1270) \to \pi\pi$) = $(84.7^{+2.5}_{-1.2})$%.

[3] Using B($f_2(1270) \to \pi\pi$) = 0.84.

$\Gamma(\gamma\eta(1405))/\Gamma_{total}$ — Γ_{96}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<8.2	90	[1] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^\pm\pi^\mp K^0_S$

[1] Includes unknown branching ratio of $\eta(1405) \to K^\pm\pi^\mp K^0_S$.

$\Gamma(\gamma f_0(1500))/\Gamma_{total}$ — Γ_{97}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.5	90	[1] BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.1	90	[2] BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma\eta\eta$

[1] Using B($f_0(1500) \to \pi^0\pi^0$) = B($f_0(1500) \to \pi\pi$)/3 and B($f_0(1500) \to \pi\pi$) = (0.349 ± 0.023)%.

[2] Calculated by us using B($f_0(1500) \to \eta\eta$) = (5.1 ± 0.9)%.

$\Gamma(\gamma f_0(1500) \to \gamma K^+K^-)/\Gamma_{total}$ — Γ_{98}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
1.04±0.14±0.33	[1] LEES	18A	BABR	$e^+e^- \to \Upsilon(1S) \to \gamma K^+K^-$

[1] LEES 18A quotes B($\Upsilon(1S) \to \gamma f_0(1500) \to \gamma K\overline{K}$) = (2.08 ± 0.27 ± 0.65) × 10^{-5} assuming B($K^0\overline{K}^0$) = 1/2 B($K\overline{K}$).

$\Gamma(\gamma f_0(1710))/\Gamma_{total}$ — Γ_{99}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 2.6	90	[1] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	90	[1] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+K^-$
<19	90	[1] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^0_S K^0_S$
< 8	90	[2] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<24	90	[3] SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

[1] Assuming B($f_0(1710) \to K\overline{K}$) = 0.38.

[2] Assuming B($f_0(1710) \to \pi\pi$) = 0.04.

[3] Assuming B($f_0(1710) \to \eta\eta$) = 0.18.

$\Gamma(\gamma f_0(1710) \to \gamma K^+K^-)/\Gamma_{total}$ — Γ_{100}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
1.01±0.26±0.18		[1] LEES	18A	BABR	$e^+e^- \to \Upsilon(1S) \to \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.7	90	ATHAR	06	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma K^+K^-$

[1] LEES 18A quotes B($\Upsilon(1S) \to \gamma f_0(1710) \to \gamma K\overline{K}$) = (2.02 ± 0.51 ± 0.35) × 10^{-5} assuming B($K^0\overline{K}^0$) = 1/2 B($K\overline{K}$).

$\Gamma(\gamma f_0(1710) \to \gamma\pi^+\pi^-)/\Gamma_{total}$ — Γ_{101}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
0.53±0.17±0.11	[1] LEES	18A	BABR	$\Upsilon(1S) \to \gamma\pi^+\pi^-$

[1] LEES 18A quotes B($\Upsilon(1S) \to \gamma f_0(1710) \to \gamma\pi\pi$) = (0.79 ± 0.26 ± 0.17) × 10^{-5} assuming B($\pi^0\pi^0$) = 1/3 B($\pi\pi$).

$\Gamma(\gamma f_0(1710) \to \gamma\pi^0\pi^0)/\Gamma_{total}$ — Γ_{102}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.4	90	BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma\pi^0\pi^0$

$\Gamma(\gamma f_0(1710) \to \gamma\eta\eta)/\Gamma_{total}$ — Γ_{103}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.8	90	BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma\eta\eta$

$\Gamma(\gamma f_4(2050))/\Gamma_{total}$ — Γ_{104}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<5.3	90	[1] ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$

[1] Assuming B($f_4(2050) \to \pi\pi$) = 0.17.

$\Gamma(\gamma f_0(2200) \to \gamma K^+K^-)/\Gamma_{total}$ — Γ_{105}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0002	90	BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+K^-$

$\Gamma(\gamma f_J(2220) \to \gamma K^+K^-)/\Gamma_{total}$ — Γ_{106}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID		TECN	COMMENT
< 8	90	ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 160	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma K^+K^-$
< 150	90	FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+K^-$
< 290	90	ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+K^-$
<2000	90	BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+K^-$

$\Gamma(\gamma f_J(2220) \to \gamma\pi^+\pi^-)/\Gamma_{total}$ — Γ_{107}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID		TECN	COMMENT
< 6	90	ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<120	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma\pi^+\pi^-$

$\Gamma(\gamma f_J(2220) \to \gamma p\overline{p})/\Gamma_{total}$ — Γ_{108}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID		TECN	COMMENT
< 11	90	ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma p\overline{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<160	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma p\overline{p}$

$\Gamma(\gamma\eta(2225) \to \gamma\phi\phi)/\Gamma_{total}$ — Γ_{109}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.003	90	BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+K^-K^+K^-$

$\Gamma(\gamma\eta_c(1S))/\Gamma_{total}$ — Γ_{110}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.9 \times 10^{-5}$	90	[1] KATRENKO	20	BELL	$e^+e^- \to \gamma$ + hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5.7 \times 10^{-5}$	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

[1] Using $\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$ decays.

$\Gamma(\gamma\eta_c(2S))/\Gamma_{total}$ — Γ_{111}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4 × 10^{-4}	90	[1] KATRENKO	20	BELL	$e^+e^- \to \gamma$ + hadrons

[1] Using $\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$ decays.

$\Gamma(\gamma\chi_{c0})/\Gamma_{total}$ — Γ_{112}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.6 × 10^{-5}	90	[1] KATRENKO	20	BELL	$\Upsilon(1S) \to \gamma$ + hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.5 \times 10^{-4}$	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

[1] Using $\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$ decays.

$\Gamma(\gamma\chi_{c1})/\Gamma_{total}$ — Γ_{113}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$4.7^{+2.4}_{-1.8}{}^{+0.4}_{-0.5}$		5	[1] KATRENKO	20	BELL	$\Upsilon(1S) \to \gamma$ + hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<2.3	90		SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

[1] Using $\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$ decays.

$\Gamma(\gamma\chi_{c2})/\Gamma_{total}$ — Γ_{114}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.6 × 10^{-6}	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.3 \times 10^{-5}$	90	[1] KATRENKO	20	BELL	$\Upsilon(1S) \to \gamma$ + hadrons

[1] Using $\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$ decays.

$\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{total}$ — Γ_{115}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4 × 10^{-5}	90	[1] SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

[1] SHEN 10A reports $[\Gamma(\Upsilon(1S) \to \gamma\chi_{c1}(3872))/\Gamma_{total}] \times [B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S)) = 3.8 \times 10^{-2}$.

$\Gamma(\gamma\chi_{c1}(3872),\ \chi_{c1} \to \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{total}$ — Γ_{116}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.8 × 10^{-6}	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma\chi_{c0}(3915) \to \omega J/\psi)/\Gamma_{total}$ — Γ_{117}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<3.0	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma\chi_{c1}(4140) \to \phi J/\psi)/\Gamma_{total}$ — Γ_{118}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<2.2	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma X\overline{X}(m_X < 3.1\text{ GeV}))/\Gamma_{\text{total}}$ — Γ_{119}/Γ

($X\overline{X}$ = vectors with $m <$ 3.1 GeV)

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<1	90	[1] BALEST	95	CLEO	$e^+e^- \rightarrow \gamma + X\overline{X}$

[1] For a noninteracting vector X with mass $<$ 3.1 GeV.

$\Gamma(\gamma X\overline{X}(m_X < 4.5\text{ GeV}))/\Gamma_{\text{total}}$ — Γ_{120}/Γ

X and $\overline{X}$ = zero spin with $m <$ 4.5 GeV

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<24	90	[1] DEL-AMO-SA...	11J	BABR	$e^+e^- \rightarrow \gamma + X\overline{X}$

[1] For a noninteracting scalar X with mass $m <$ 4.5 GeV.

$\Gamma(\gamma X \rightarrow \gamma + \geq 4\text{ prongs})/\Gamma_{\text{total}}$ — Γ_{121}/Γ

(1.5 GeV $< m_X <$ 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.78	95	ROSNER	07A	CLEO	$e^+e^- \rightarrow \gamma X$

$\Gamma(\gamma A^0)/\Gamma_{\text{total}}$ — Γ_{122}/Γ

(A^0 = scalar with $m <$ 8.0 GeV)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.5 \times 10^{-6}$	90	[1] DEL-AMO-SA...	11J	BABR	$e^+e^- \rightarrow \gamma + X$
$<3 \times 10^{-5}$	90	[2] BALEST	95	CLEO	$e^+e^- \rightarrow \gamma + X$
$<5.6 \times 10^{-5}$	90	[2] ANTREASYAN	90C	CBAL	$e^+e^- \rightarrow \gamma + X$

[1] For a non-interacting scalar or pseudoscalar, A^0, with mass $m_{A^0} <$ 8.0 GeV. 90% CL upper limits range from 1.9×10^{-6} to 4.5×10^{-6}.

[2] For any non-interacting long-lived particle with mass $<$ 7.2 GeV.

$\Gamma(\gamma A^0 \rightarrow \gamma\mu^+\mu^-)/\Gamma_{\text{total}}$ — Γ_{123}/Γ

(201 $<$ M($\mu^+\mu^-$) $<$ 3565 MeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 9	90	[1] LOVE	08	CLEO	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma\mu^+\mu^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<16	90	[2] JIA	22	BELL	$\Upsilon(2S) \rightarrow \gamma\mu^+\mu^-\pi^+\pi^-$
< 9.7	90	[3] LEES	13C	BABR	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma\mu^+\mu^-$

[1] For a narrow scalar or pseudoscalar, A^0, with 201 $<$ M($\mu^+\mu^-$) $<$ 3565 MeV, excluding J/ψ. Measured 90% CL limits as a function of M($\mu^+\mu^-$) range from 1–9 $\times 10^{-6}$.

[2] For a narrow scalar or pseudoscalar, A^0, with 0.22 $<$ M(A^0) $<$ 9.2 GeV, resulting in 90% CL upper limits ranging from 3.1×10^{-7} at M(A^0) = 0.22 GeV to 1.6×10^{-5} at M(A^0) = 9.2 GeV.

[3] For a narrow scalar or pseudoscalar, A^0, with mass in the range 0.212–9.2 GeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} are in the range 0.28–9.7 $\times 10^{-6}$.

$\Gamma(\gamma A^0 \to \gamma\tau^+\tau^-)/\Gamma_{total}$ — Γ_{124}/Γ

($2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<130	90	[1] LEES	13R	BABR	$\Upsilon(2S) \to \gamma\tau^+\tau^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<150	90	[2] JIA	22	BELL	$\Upsilon(2S) \to \gamma\tau^+\tau^-\pi^+\pi^-$
< 50	90	[3] LOVE	08	CLEO	$e^+e^- \to \gamma A^0 \to \gamma\tau^+\tau^-$

[1] For a narrow scalar or pseudoscalar, A^0, with $2m_\tau < M(A^0) < 9.2$ GeV, resulting in 90% CL upper limits of 0.9×10^{-5} at $M(A^0) = 2m_\tau$, $\approx 1.5 \times 10^{-5}$ at $M(A^0) = 7.5$ GeV, and 13×10^{-5} at $M(A^0) = 9.2$ GeV.

[2] For a narrow scalar or pseudoscalar, A^0, with $2m_\tau < M(A^0) < 9.2$ GeV, resulting in 90% CL upper limits ranging from 3.8×10^{-6} at $M(A^0) = 2m_\tau$ to 1.5×10^{-4} at $M(A^0) = 9.2$ GeV.

[3] For a narrow scalar or pseudoscalar, A^0, with $2m_\tau < M(A^0) < 7.5$ GeV, resulting in 90% CL limits ranging from 1×10^{-5} at $M(A^0)=2m_\tau$ to 5×10^{-5} at $M(A^0)$=7.5 GeV.

$\Gamma(\gamma A^0 \to \gamma g g)/\Gamma_{total}$ — Γ_{125}/Γ

(0.5 GeV $< m <$ 9.0 GeV)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1 \times 10^{-2}$	90	[1] LEES	13L	BABR	$\Upsilon(1S) \to \gamma X$

[1] For a narrow, CP-odd pseudoscalar, A^0, searched for in 26 hadronic decay modes with invariant mass 0.5 GeV $< m_{A^0} <$ 9.0 GeV. Measured 90% CL limits as a function of m_{A^0} range from 10^{-6} to 10^{-2}.

$\Gamma(\gamma A^0 \to \gamma s\bar{s})/\Gamma_{total}$ — Γ_{126}/Γ

(0.5 GeV $< m <$ 9.0 GeV)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1 \times 10^{-3}$	90	[1] LEES	13L	BABR	$\Upsilon(1S) \to \gamma X$

[1] For a narrow, CP-odd pseudoscalar, A^0, searched for in 14 hadronic decay modes with invariant mass 1.5 GeV $< m_{A^0} <$ 9.0 GeV. Measured 90% CL limits as a function of m_{A^0} range from 10^{-5} to 10^{-3}.

LEPTON FAMILY NUMBER (*LF*) VIOLATING MODES

$\Gamma(e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{127}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID		TECN	COMMENT
<3.9	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^- e^\pm\mu^\mp$

$\Gamma(\mu^\pm\tau^\mp)/\Gamma_{total}$ — Γ_{128}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.7 \times 10^{-6}$	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-\mu^\pm\tau^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.0 \times 10^{-6}$	95	LOVE	08A	CLEO	$e^+e^- \to \mu^\pm\tau^\mp$

$\Gamma(e^\pm\tau^\mp)/\Gamma_{total}$ — Γ_{129}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<2.7	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^- e^\pm\tau^\mp$

$\Gamma(\gamma e^{\pm}\mu^{\mp})/\Gamma_{total}$ — Γ_{130}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID		TECN	COMMENT
<4.2	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-\gamma e^{\pm}\mu^{\mp}$

$\Gamma(\gamma \mu^{\pm}\tau^{\mp})/\Gamma_{total}$ — Γ_{131}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<6.1	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-\gamma \mu^{\pm}\tau^{\mp}$

$\Gamma(\gamma e^{\pm}\tau^{\mp})/\Gamma_{total}$ — Γ_{132}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<6.5	90	PATRA	22	BELL	$\Upsilon(2S) \to \pi^+\pi^-\gamma e^{\pm}\tau^{\mp}$

OTHER DECAYS

$\Gamma(\text{invisible})/\Gamma_{total}$ — Γ_{133}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 3.0	90	AUBERT	09AX	BABR	$\Upsilon(3S) \to \pi^+\pi^-\Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<39	90	RUBIN	07	CLEO	$\Upsilon(2S) \to \pi^+\pi^-\Upsilon(1S)$
<25	90	TAJIMA	07	BELL	$\Upsilon(3S) \to \pi^+\pi^-\Upsilon(1S)$

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