$\Upsilon(1S)$

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

$\Upsilon(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
9460.40±0.10 OUR AVERAGE					
9460.37±0.01±2.85	15M	[1] AAIJ	24AC	LHCB	$\Upsilon(1S) \to \mu^+\mu^-$
9460.40±0.09±0.04		[2] 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		[3] SHAMOV	23	RVUE	$e^+e^- \to$ hadrons
9460.51±0.09±0.05		[4,5] ARTAMONOV	00	MD1	$e^+e^- \to$ hadrons
9460.60±0.09±0.05		[6,7] BARU	92B	MD1	$e^+e^- \to$ hadrons
9460.59±0.12		BARU	86	MD1	$e^+e^- \to$ hadrons
9460.6 ±0.4		[7,8] ARTAMONOV	84	MD1	$e^+e^- \to$ hadrons
9459.97±0.11±0.07		[9] MACKAY	84	CUSB	$e^+e^- \to$ hadrons

[1] Observed in prompt pp production.
[2] Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.
[3] Obtained by reanalysing CUSB data (MACKAY 84), but not authored by the CUSB collaboration.
[4] Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).
[5] Superseded by SHAMOV 23.
[6] Supersedes BARU 86.
[7] Superseded by ARTAMONOV 00.
[8] Value includes data of ARTAMONOV 82.
[9] 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	$(5.4 \pm 0.4) \times 10^{-4}$	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}	$J/\psi(1S)\chi_{c1}$	$(3.9 \pm 1.2) \times 10^{-6}$	
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}	$T_{c\overline{c}1}(3900)^{\pm}$ anything, $T_{c\overline{c}1} \to J/\psi(1S)\pi^{\pm}$	$< 1.3 \times 10^{-5}$	CL=90%
Γ_{17}	$T_{c\overline{c}1}(4200)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	$< 6.0 \times 10^{-5}$	CL=90%
Γ_{18}	$T_{c\overline{c}1}(4430)^{\pm}$ anything, $T_{c\overline{c}1} \to J/\psi(1S)\pi^{\pm}$	$< 4.9 \times 10^{-5}$	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	$(1.90 \pm 0.35) \times 10^{-4}$	
Γ_{25}	$\chi_{c1}(1P)X_{tetra}$	$< 3.78 \times 10^{-5}$	CL=90%
Γ_{26}	χ_{c2} anything	$(2.8 \pm 0.8) \times 10^{-4}$	
Γ_{27}	$\psi(2S)$ anything	$(1.23 \pm 0.20) \times 10^{-4}$	
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}	$T_{c\overline{c}}(4050)^{\pm}$ anything, $X \to \psi(2S)\pi^{\pm}$	$< 8.8 \times 10^{-5}$	CL=90%
Γ_{39}	$T_{c\overline{c}1}(4430)^{\pm}$ anything, $T_{c\overline{c}1} \to \psi(2S)\pi^{\pm}$	$< 6.7 \times 10^{-5}$	CL=90%
Γ_{40}	$\chi_{c1}(3872)$ anything	$< 2.2 \times 10^{-4}$	CL=90%
Γ_{41}	$T_{c\overline{c}1}(4200)^+ T_{c\overline{c}1}(4200)^-$	$< 2.23 \times 10^{-5}$	CL=90%
Γ_{42}	$T_{c\overline{c}1}(3900)^{\pm} T_{c\overline{c}1}(4200)^{\mp}$	$< 8.1 \times 10^{-6}$	CL=90%
Γ_{43}	$T_{c\overline{c}1}(3900)^+ T_{c\overline{c}1}(3900)^-$	$< 1.8 \times 10^{-6}$	CL=90%
Γ_{44}	$T_{c\overline{c}}(4050)^+ T_{c\overline{c}}(4050)^-$	$< 1.58 \times 10^{-5}$	CL=90%
Γ_{45}	$T_{c\overline{c}}(4250)^+ T_{c\overline{c}}(4250)^-$	$< 2.66 \times 10^{-5}$	CL=90%
Γ_{46}	$T_{c\overline{c}}(4050)^{\pm} T_{c\overline{c}}(4250)^{\mp}$	$< 4.42 \times 10^{-5}$	CL=90%
Γ_{47}	$T_{c\overline{c}1}(4430)^+ T_{c\overline{c}1}(4430)^-$	$< 2.03 \times 10^{-5}$	CL=90%
Γ_{48}	$T_{c\overline{c}}(4055)^{\pm} T_{c\overline{c}}(4055)^{\mp}$	$< 2.33 \times 10^{-5}$	CL=90%
Γ_{49}	$T_{c\overline{c}}(4055)^{\pm} T_{c\overline{c}1}(4430)^{\mp}$	$< 4.55 \times 10^{-5}$	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}	$\pi^+\pi^-\pi^0$	$(2.1 \pm 0.8) \times 10^{-6}$	
Γ_{56}	ϕK^+K^-	$(2.4 \pm 0.5) \times 10^{-6}$	
Γ_{57}	$\omega\pi^+\pi^-$	$(4.5 \pm 1.0) \times 10^{-6}$	
Γ_{58}	$K^*(892)^0 K^-\pi^+ +$ c.c.	$(4.4 \pm 0.8) \times 10^{-6}$	
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.	$(3.0 \pm 0.8) \times 10^{-6}$	
Γ_{63}	$K_1(1270)^{\pm} K^{\mp}$	$< 2.41 \times 10^{-6}$	CL=90%
Γ_{64}	$K_1(1400)^{\pm} K^{\mp}$	$(1.0 \pm 0.4) \times 10^{-6}$	
Γ_{65}	$b_1(1235)^{\pm}\pi^{\mp}$	$< 1.25 \times 10^{-6}$	CL=90%
Γ_{66}	$\pi^+\pi^-\pi^0\pi^0$	$(1.28 \pm 0.30) \times 10^{-5}$	
Γ_{67}	$K_S^0 K^+\pi^- +$ c.c.	$(1.6 \pm 0.4) \times 10^{-6}$	
Γ_{68}	$K^*(892)^0 \overline{K}{}^0 +$ c.c.	$(2.9 \pm 0.9) \times 10^{-6}$	
Γ_{69}	$K^*(892)^- K^+ +$ c.c.	$< 1.11 \times 10^{-6}$	CL=90%
Γ_{70}	$f_1(1285)$ anything	$(4.6 \pm 3.1) \times 10^{-3}$	
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}	${}^2H$ anything	$(2.85 \pm 0.25) \times 10^{-5}$	
Γ_{74}	Sum of 100 exclusive modes	(1.200 ± 0.017) %	

Radiative decays

Γ_{75}	$\gamma\pi^+\pi^-$		$(6.3 \pm 1.8) \times 10^{-5}$	
Γ_{76}	$\gamma\pi^0\pi^0$		$(1.7 \pm 0.7) \times 10^{-5}$	
Γ_{77}	$\quad\gamma\pi\pi$ (S-wave)		$(4.6 \pm 0.7) \times 10^{-5}$	
Γ_{78}	$\gamma\pi^0\eta$		$< 2.4 \times 10^{-6}$	CL=90%
Γ_{79}	γK^+K^-	[a]	$(1.14 \pm 0.13) \times 10^{-5}$	
Γ_{80}	$\gamma p\overline{p}$	[b]	$< 6 \times 10^{-6}$	CL=90%
Γ_{81}	$\gamma 2h^+2h^-$		$(7.0 \pm 1.5) \times 10^{-4}$	
Γ_{82}	$\gamma 3h^+3h^-$		$(5.4 \pm 2.0) \times 10^{-4}$	
Γ_{83}	$\gamma 4h^+4h^-$		$(7.4 \pm 3.5) \times 10^{-4}$	
Γ_{84}	$\gamma\pi^+\pi^-K^+K^-$		$(2.9 \pm 0.9) \times 10^{-4}$	
Γ_{85}	$\gamma 2\pi^+2\pi^-$		$(2.5 \pm 0.9) \times 10^{-4}$	
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}	$\quad\gamma f_0(1500) \to \gamma K^+K^-$		$(1.0 \pm 0.4) \times 10^{-5}$	
Γ_{99}	$\gamma f_0(1710)$		$< 2.6 \times 10^{-4}$	CL=90%
Γ_{100}	$\quad\gamma f_0(1710) \to \gamma K^+K^-$		$(1.01 \pm 0.32) \times 10^{-5}$	
Γ_{101}	$\gamma f_0(1710) \to \gamma\pi^+\pi^-$		$(5.3 \pm 2.0) \times 10^{-6}$	
Γ_{102}	$\quad\gamma f_0(1710) \to \gamma\pi^0\pi^0$		$< 1.4 \times 10^{-6}$	CL=90%
Γ_{103}	$\quad\gamma f_0(1710) \to \gamma\eta\eta$		$< 1.8 \times 10^{-6}$	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}	$\quad\gamma\chi_{c1}(3872),\ \chi_{c1} \to \pi^+\pi^-\pi^0 J/\psi$		$< 2.8 \times 10^{-6}$	CL=90%

Γ_{117}	$\gamma \chi_{c0}(3915) \rightarrow \omega J/\psi$			< 3.0	$\times 10^{-6}$	CL=90%
Γ_{118}	$\gamma \chi_{c1}(4140) \rightarrow \phi J/\psi$			< 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}	$\gamma X \rightarrow \gamma + \geq 4$ prongs		[e]	< 1.78	$\times 10^{-4}$	CL=95%
Γ_{122}	γA^0		[f]			
Γ_{123}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$		[g]	< 9	$\times 10^{-6}$	CL=90%
Γ_{124}	$\gamma A^0 \rightarrow \gamma \tau^+ \tau^-$		[a]	< 1.30	$\times 10^{-4}$	CL=90%
Γ_{125}	$\gamma A^0 \rightarrow \gamma g g$		[h]	< 1	%	CL=90%
Γ_{126}	$\gamma A^0 \rightarrow \gamma s \overline{s}$		[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] $2m_\tau < \mathrm{M}(\tau^+ \tau^-) < 9.2$ 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 $< \mathrm{M}(\mu^+ \mu^-) <$ 3565 MeV

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

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

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

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

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

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

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ — 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	$e^+e^- \rightarrow \Upsilon(1S) \rightarrow \tau^+\tau^-$
$2.61\pm0.12^{+0.09}_{-0.13}$	25k	CINABRO	94B	CLE2	$e^+e^- \rightarrow \tau^+\tau^-$
2.7 ±0.4 ±0.2		[2] ALBRECHT	85C	ARG	$\Upsilon(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±0.4		GILES	83	CLEO	$e^+e^- \rightarrow \tau^+\tau^-$

[1] BESSON 07 reports $[\Gamma(\Upsilon(1S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[2] Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ — 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	$\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.29±0.08±0.11		ALEXANDER	98	CLE2	$\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.42±0.14±0.14	307	ALBRECHT	87	ARG	$\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.8 ±0.3 ±0.2	826	BESSON	84	CLEO	$\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
5.1 ±3.0		BERGER	80C	PLUT	$e^+e^- \rightarrow e^+e^-$

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ 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	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.49±0.02±0.07	345k	ADAMS	05	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
2.49±0.08±0.13		ALEXANDER	98	CLE2	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.12±0.20±0.10		[1] BARU	92	MD1	$e^+e^- \rightarrow \mu^+\mu^-$
2.31±0.12±0.10		[1] KOBEL	92	CBAL	$e^+e^- \rightarrow \mu^+\mu^-$
2.52±0.07±0.07		CHEN	89B	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
2.61±0.09±0.11		KAARSBERG	89	CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
2.30±0.25±0.13	86	ALBRECHT	87	ARG	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.9 ±0.3 ±0.2	864	BESSON	84	CLEO	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.7 ±0.3 ±0.3		ANDREWS	83	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
3.2 ±1.3 ±0.3		ALBRECHT	82	DASP	$e^+e^- \rightarrow \mu^+\mu^-$
3.8 ±1.5 ±0.2		NICZYPORUK	82	LENA	$e^+e^- \rightarrow \mu^+\mu^-$
$1.4\ ^{+3.4}_{-1.4}$		BOCK	80	CNTR	$e^+e^- \rightarrow \mu^+\mu^-$
2.2 ±2.0		BERGER	79	PLUT	$e^+e^- \rightarrow \mu^+\mu^-$

[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	$\Upsilon(3S) \rightarrow \pi^+\pi^-\Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSON	07	CLEO	$e^+e^- \rightarrow \Upsilon(1S)$

[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	$\Upsilon(1S) \rightarrow$ hadrons

[1] Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ from BESSON 06A and PDG 08 values of $B(\mu^+\mu^-) = (2.48 \pm 0.05)\%$ 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	$\Upsilon(1S) \rightarrow \gamma +$ hadrons

[1] Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ 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	$\Upsilon(1S) \rightarrow (\gamma +)$ hadrons

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

$\Gamma(J/\psi(1S)\text{ anything})/\Gamma_{total}$ — 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	$e^+e^- \to J/\psi X$

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

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

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

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

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

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

$\Gamma\big(T_{c\overline{c}1}(4430)^{\pm}$ anything, $T_{c\overline{c}1} \to J/\psi(1S)\pi^{\pm}\big)/\Gamma_{total}$ — Γ_{18}/Γ

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

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

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

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

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

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

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

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

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

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

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

$\Gamma\big(\chi_{c1}$ anything$\big)/\Gamma_{total}$ — 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	$\Upsilon(1S) \to \gamma J/\psi(1S)$

$\Gamma\big(\chi_{c1}$ anything$\big)/\Gamma\big(J/\psi(1S)$ anything$\big)$ — 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	$e^+ e^- \to J/\psi X$

$\Gamma(\chi_{c1}(1P) X_{tetra})/\Gamma_{total}$ — 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	$e^+ e^- \rightarrow J/\psi \pi^+ \pi^- X$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\Gamma(T_{c\overline{c}1}(4430)^\pm$ anything, $T_{c\overline{c}1} \to \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$ — Γ_{39}/Γ

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

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.2 \times 10^{-4}$	90	[1] SHEN	16	BELL	$\Upsilon(1S) \to J/\psi\pi^+\pi^- X$

[1] SHEN 16 reports $[\Gamma(\Upsilon(1S) \to \chi_{c1}(3872)\,\text{anything})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S))] < 9.5 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.

$\Gamma(T_{c\overline{c}1}(4200)^+ T_{c\overline{c}1}(4200)^-)/\Gamma_{\text{total}}$ — 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 $B(T_{c\overline{c}1}(4200)^\pm \to J/\psi\pi^\pm) = 1$.

$\Gamma(T_{c\overline{c}1}(3900)^\pm T_{c\overline{c}1}(4200)^\mp)/\Gamma_{\text{total}}$ — 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 $B(T_{c\overline{c}1}(4200)^\pm \to J/\psi\pi^\pm) = 1 = B(T_{c\overline{c}1}(3900)^\pm \to J/\psi\pi^\pm)$.

$\Gamma(T_{c\overline{c}1}(3900)^+ T_{c\overline{c}1}(3900)^-)/\Gamma_{\text{total}}$ — 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 $B(T_{c\overline{c}1}(3900)^\pm \to J/\psi\pi^\pm) = 1$

$\Gamma(T_{c\overline{c}}(4050)^+ T_{c\overline{c}}(4050)^-)/\Gamma_{\text{total}}$ — 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 $B(T_{c\overline{c}}(4050)^\pm \to \chi_{c1}(1P)\pi^\pm) = 1$

$\Gamma\big(T_{c\overline{c}}(4250)^{+}\,T_{c\overline{c}}(4250)^{-}\big)/\Gamma_{total}$ — 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($T_{c\overline{c}}(4250)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}$) = 1

$\Gamma\big(T_{c\overline{c}}(4050)^{\pm}\,T_{c\overline{c}}(4250)^{\mp}\big)/\Gamma_{total}$ — 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($T_{c\overline{c}}(4050)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}$) = 1 = B($T_{c\overline{c}}(4250)^{\pm} \to \chi_{c1}(1P)\pi^{\pm}$)

$\Gamma\big(T_{c\overline{c}1}(4430)^{+}\,T_{c\overline{c}1}(4430)^{-}\big)/\Gamma_{total}$ — 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($T_{c\overline{c}1}(4430)^{\pm} \to \psi(2S)\pi^{\pm}$) = 1

$\Gamma\big(T_{c\overline{c}}(4055)^{\pm}\,T_{c\overline{c}}(4055)^{\mp}\big)/\Gamma_{total}$ — 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($T_{c\overline{c}}(4055)^{\pm} \to \psi(2S)\pi^{\pm}$) = 1

$\Gamma\big(T_{c\overline{c}}(4055)^{\pm}\,T_{c\overline{c}1}(4430)^{\mp}\big)/\Gamma_{total}$ — 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($T_{c\overline{c}}(4055)^{\pm} \to \psi(2S)\pi^{\pm}$) = 1 = B($T_{c\overline{c}1}(4430)^{\pm} \to \psi(2S)\pi^{\pm}$)

$\Gamma(\rho\pi)/\Gamma_{total}$ — 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.

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

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

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

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

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

$\Gamma(D^*(2010)^{\pm}\text{ anything})/\Gamma_{total}$ — 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 $x_p > 0.2$.

$\Gamma(f_1(1285)X_{tetra})/\Gamma_{total}$ — 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}.

$\Gamma(\overline{^2H}$ anything$)/\Gamma_{total}$ — 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	$e^+ e^- \to \overline{^2H}\, X$
$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07	CLEO	$e^+ e^- \to \overline{^2H}\, X$

Γ(Sum of 100 exclusive modes)$/\Gamma_{total}$ — 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.

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

$\Gamma(\gamma \pi \pi$ (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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ 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	$\Upsilon(1S) \rightarrow \gamma\eta' \rightarrow \gamma\pi^+\pi^-\eta, \gamma\rho$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<16	90	RICHICHI	01B	CLE2	$\Upsilon(1S) \rightarrow \gamma\eta' \rightarrow \gamma\eta\pi^+\pi^-$

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ 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	$\Upsilon(1S) \to \gamma\eta$

$\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$ 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.

$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.9 ±0.6 OUR AVERAGE						
2.13±0.28±0.72			[1] LEES	18A	BABR	$\Upsilon(1S) \to \gamma K^+K^-$
4.0 ±1.4 ±0.1		17	[2] BESSON	11	CLEO	$\Upsilon(1S) \to K^0_S K^0_S$
3.7 $^{+0.9}_{-0.7}$ ±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 ± 1.3 ± 0.6) × 10^{-5} from a measurement of [$\Gamma(\Upsilon(1S) \to \gamma f'_2(1525))/\Gamma_{\text{total}}$] × [B($f'_2(1525) \to K\overline{K}$)] assuming B($f'_2(1525) \to K\overline{K}$) = (88.8 ± 3.1) × 10^{-2}, which we rescale to our best value B($f'_2(1525) \to K\overline{K}$) = (88.8 ± 2.2) × 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.

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
10.1 ±0.6 OUR AVERAGE					
10.15±0.59 $^{+0.54}_{-0.43}$		[1] LEES	18A	BABR	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
10.5 ±1.6 $^{+1.9}_{-1.8}$		[2] BESSON	07A	CLE3	$\Upsilon(1S) \to \gamma\pi^0\pi^0$
10.2 ±0.8 ±0.7		ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
8.1 ±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($f_2(1270) \rightarrow \pi^0\pi^0$) = 1/3 B($f_2(1270) \rightarrow \pi\pi$) and B($f_2(1270) \rightarrow \pi\pi$) = $(84.2^{+2.9}_{-0.9})$%.
[2] Using B($f_2(1270) \rightarrow \pi^0\pi^0$) = B($f_2(1270) \rightarrow \pi\pi$)/3 and B($f_2(1270) \rightarrow \pi\pi$) = $(84.7^{+2.5}_{-1.2})$%.
[3] Using B($f_2(1270) \rightarrow \pi\pi$) = 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	$\Upsilon(1S) \rightarrow \gamma K^{\pm}\pi^{\mp}K^0_S$

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

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

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

[1] Using B($f_0(1500) \rightarrow \pi^0\pi^0$) = B($f_0(1500) \rightarrow \pi\pi$)/3 and B($f_0(1500) \rightarrow \pi\pi$) = (0.349 ± 0.023)%.
[2] Calculated by us using B($f_0(1500) \rightarrow \eta\eta$) = (5.1 ± 0.9)%.

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

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

[1] LEES 18A quotes B($\Upsilon(1S) \rightarrow \gamma f_0(1500) \rightarrow \gamma K\overline{K}$) = $(2.08 \pm 0.27 \pm 0.65) \times 10^{-5}$ 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	$\Upsilon(1S) \rightarrow \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	90	[1] FULTON	90B	CLEO	$\Upsilon(1S) \rightarrow \gamma K^+K^-$
<19	90	[1] FULTON	90B	CLEO	$\Upsilon(1S) \rightarrow \gamma K^0_S K^0_S$
< 8	90	[2] ALBRECHT	89	ARG	$\Upsilon(1S) \rightarrow \gamma\pi^+\pi^-$
<24	90	[3] SCHMITT	88	CBAL	$\Upsilon(1S) \rightarrow \gamma X$

[1] Assuming B($f_0(1710) \rightarrow K\overline{K}$) = 0.38.
[2] Assuming B($f_0(1710) \rightarrow \pi\pi$) = 0.04.
[3] Assuming B($f_0(1710) \rightarrow \eta\eta$) = 0.18.

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

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

[1] LEES 18A quotes B($\Upsilon(1S) \rightarrow \gamma f_0(1710) \rightarrow \gamma K\overline{K}$) = $(2.02 \pm 0.51 \pm 0.35) \times 10^{-5}$ 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	$\Upsilon(1S) \to \gamma p\overline{p}$

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

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

$\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ — 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.

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

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

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

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.6 \times 10^{-5}$	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.

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$4.7^{+2.4+0.4}_{-1.8-0.5}$		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.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.6 \times 10^{-6}$	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.

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

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

[1] SHEN 10A reports $[\Gamma(\Upsilon(1S) \to \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \to \pi^+\pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.

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

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

$\Gamma(\gamma X \overline{X}(m_X < 3.1\ \text{GeV}))/\Gamma_{total}$ — 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	$e^+e^- \to \gamma + X\overline{X}$

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

$\Gamma(\gamma X \overline{X}(m_X < 4.5\ \text{GeV}))/\Gamma_{total}$ — 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	$e^+e^- \to \gamma + X\overline{X}$

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

$\Gamma(\gamma X \to \gamma + \geq 4\ \text{prongs})/\Gamma_{total}$ — 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	$e^+e^- \to \gamma X$

$\Gamma(\gamma A^0)/\Gamma_{total}$ — 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	$e^+e^- \to \gamma + X$
$<3 \times 10^{-5}$	90	[2] BALEST	95	CLEO	$e^+e^- \to \gamma + X$
$<5.6 \times 10^{-5}$	90	[2] ANTREASYAN	90C	CBAL	$e^+e^- \to \gamma + X$

[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.

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

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

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

[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 × 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 × 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) = $2m_\tau$, ≈ 1.5 × 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 × 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 × 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	$\Upsilon(2S) \to \pi^+\pi^- e^\pm\mu^\mp$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.7 × 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	$e^+e^- \to \mu^{\pm}\tau^{\mp}$

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

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

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

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

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

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

$\Gamma(\gamma e^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$ 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

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ 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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