$\Upsilon(1S)$

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

$\Upsilon(1S)$ MASS

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
9460.30±0.26 OUR AVERAGE	Error includes scale factor of 3.3.				
9460.51±0.09±0.05	[1]	ARTAMONOV	00	MD1	$e^+e^- \to$ hadrons
9459.97±0.11±0.07		MACKAY	84	REDE	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9460.60±0.09±0.05	[2,3]	BARU	92B	REDE	$e^+e^- \to$ hadrons
9460.59±0.12		BARU	86	REDE	$e^+e^- \to$ hadrons
9460.6 ±0.4	[3,4]	ARTAMONOV	84	REDE	$e^+e^- \to$ hadrons

[1] Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).
[2] Superseding BARU 86.
[3] Superseded by ARTAMONOV 00.
[4] Value includes data of ARTAMONOV 82.

$\Upsilon(1S)$ 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^-	(2.38 ±0.11) %	
Γ_3	$\mu^+\mu^-$	(2.48 ±0.05) %	
	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}	$X(3900)^{\pm}$ anything, $X \to J/\psi(1S)\pi^{\pm}$	<	1.3		$\times 10^{-5}$	CL=90%
Γ_{17}	$X(4200)^{\pm}$ anything, $X \to J/\psi(1S)\pi^{\pm}$	<	6.0		$\times 10^{-5}$	CL=90%
Γ_{18}	$X(4430)^{\pm}$ anything, $X \to J/\psi(1S)\pi^{\pm}$	<	4.9		$\times 10^{-5}$	CL=90%
Γ_{19}	$X^{\pm}_{cs}$ anything, $X \to J/\psi K^{\pm}$	<	5.7		$\times 10^{-6}$	CL=90%
Γ_{20}	$X(3872)$ anything, $X \to J/\psi(1S)\pi^+\pi^-$	<	9.5		$\times 10^{-6}$	CL=90%
Γ_{21}	$X(4260)$ anything, $X \to J/\psi(1S)\pi^+\pi^-$	<	3.8		$\times 10^{-5}$	CL=90%
Γ_{22}	$X(4260)$ anything, $X \to J/\psi(1S)K^+K^-$	<	7.5		$\times 10^{-6}$	CL=90%
Γ_{23}	$X(4140)$ anything, $X \to J/\psi(1S)\phi$	<	5.2		$\times 10^{-6}$	CL=90%
Γ_{24}	χ_{c0} anything	<	4		$\times 10^{-3}$	CL=90%
Γ_{25}	χ_{c1} anything	(	1.90	± 0.35	) $\times 10^{-4}$	
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}	$X(4260)$ anything, $X \to \psi(2S)\pi^+\pi^-$	<	7.9		$\times 10^{-5}$	CL=90%
Γ_{36}	$X(4360)$ anything, $X \to \psi(2S)\pi^+\pi^-$	<	5.2		$\times 10^{-5}$	CL=90%
Γ_{37}	$X(4660)$ anything, $X \to \psi(2S)\pi^+\pi^-$	<	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}	$X(4430)^{\pm}$ anything, $X \to \psi(2S)\pi^{\pm}$	<	6.7		$\times 10^{-5}$	CL=90%
Γ_{40}	$\rho\pi$	<	3.68		$\times 10^{-6}$	CL=90%
Γ_{41}	$\omega\pi^0$	<	3.90		$\times 10^{-6}$	CL=90%
Γ_{42}	$\pi^+\pi^-$	<	5		$\times 10^{-4}$	CL=90%
Γ_{43}	K^+K^-	<	5		$\times 10^{-4}$	CL=90%
Γ_{44}	$p\overline{p}$	<	5		$\times 10^{-4}$	CL=90%
Γ_{45}	$\pi^+\pi^-\pi^0$	(	2.1	± 0.8	) $\times 10^{-6}$	
Γ_{46}	ϕK^+K^-	(	2.4	± 0.5	) $\times 10^{-6}$	
Γ_{47}	$\omega\pi^+\pi^-$	(	4.5	± 1.0	) $\times 10^{-6}$	

Γ_{48}	$K^*(892)^0 K^- \pi^+$ + c.c.		(4.4 ±0.8) $\times 10^{-6}$		
Γ_{49}	$\phi f_2'(1525)$		< 1.63	$\times 10^{-6}$	CL=90%
Γ_{50}	$\omega f_2(1270)$		< 1.79	$\times 10^{-6}$	CL=90%
Γ_{51}	$\rho(770) a_2(1320)$		< 2.24	$\times 10^{-6}$	CL=90%
Γ_{52}	$K^*(892)^0 \overline{K}{}_2^*(1430)^0$ + c.c.		(3.0 ±0.8) $\times 10^{-6}$		
Γ_{53}	$K_1(1270)^\pm K^\mp$		< 2.41	$\times 10^{-6}$	CL=90%
Γ_{54}	$K_1(1400)^\pm K^\mp$		(1.0 ±0.4) $\times 10^{-6}$		
Γ_{55}	$b_1(1235)^\pm \pi^\mp$		< 1.25	$\times 10^{-6}$	CL=90%
Γ_{56}	$\pi^+ \pi^- \pi^0 \pi^0$		(1.28 ±0.30) $\times 10^{-5}$		
Γ_{57}	$K_S^0 K^+ \pi^-$ + c.c.		(1.6 ±0.4) $\times 10^{-6}$		
Γ_{58}	$K^*(892)^0 \overline{K}{}^0$ + c.c.		(2.9 ±0.9) $\times 10^{-6}$		
Γ_{59}	$K^*(892)^- K^+$ + c.c.		< 1.11	$\times 10^{-6}$	CL=90%
Γ_{60}	$D^*(2010)^\pm$ anything		(2.52 ±0.20) %		
Γ_{61}	$\overline{^2H}$ anything		(2.85 ±0.25) $\times 10^{-5}$		
Γ_{62}	Sum of 100 exclusive modes		(1.200±0.017) %		

Radiative decays

Γ_{63}	$\gamma \pi^+ \pi^-$		(6.3 ±1.8) $\times 10^{-5}$		
Γ_{64}	$\gamma \pi^0 \pi^0$		(1.7 ±0.7) $\times 10^{-5}$		
Γ_{65}	$\gamma \pi^0 \eta$		< 2.4	$\times 10^{-6}$	CL=90%
Γ_{66}	$\gamma K^+ K^-$	[a]	(1.14 ±0.13) $\times 10^{-5}$		
Γ_{67}	$\gamma p \overline{p}$	[b]	< 6	$\times 10^{-6}$	CL=90%
Γ_{68}	$\gamma 2h^+ 2h^-$		(7.0 ±1.5) $\times 10^{-4}$		
Γ_{69}	$\gamma 3h^+ 3h^-$		(5.4 ±2.0) $\times 10^{-4}$		
Γ_{70}	$\gamma 4h^+ 4h^-$		(7.4 ±3.5) $\times 10^{-4}$		
Γ_{71}	$\gamma \pi^+ \pi^- K^+ K^-$		(2.9 ±0.9) $\times 10^{-4}$		
Γ_{72}	$\gamma 2\pi^+ 2\pi^-$		(2.5 ±0.9) $\times 10^{-4}$		
Γ_{73}	$\gamma 3\pi^+ 3\pi^-$		(2.5 ±1.2) $\times 10^{-4}$		
Γ_{74}	$\gamma 2\pi^+ 2\pi^- K^+ K^-$		(2.4 ±1.2) $\times 10^{-4}$		
Γ_{75}	$\gamma \pi^+ \pi^- p \overline{p}$		(1.5 ±0.6) $\times 10^{-4}$		
Γ_{76}	$\gamma 2\pi^+ 2\pi^- p \overline{p}$		(4 ±6) $\times 10^{-5}$		
Γ_{77}	$\gamma 2K^+ 2K^-$		(2.0 ±2.0) $\times 10^{-5}$		
Γ_{78}	$\gamma \eta'(958)$		< 1.9	$\times 10^{-6}$	CL=90%
Γ_{79}	$\gamma \eta$		< 1.0	$\times 10^{-6}$	CL=90%
Γ_{80}	$\gamma f_0(980)$		< 3	$\times 10^{-5}$	CL=90%
Γ_{81}	$\gamma f_2'(1525)$		(3.8 ±0.9) $\times 10^{-5}$		
Γ_{82}	$\gamma f_2(1270)$		(1.01 ±0.09) $\times 10^{-4}$		
Γ_{83}	$\gamma \eta(1405)$		< 8.2	$\times 10^{-5}$	CL=90%
Γ_{84}	$\gamma f_0(1500)$		< 1.5	$\times 10^{-5}$	CL=90%
Γ_{85}	$\gamma f_0(1710)$		< 2.6	$\times 10^{-4}$	CL=90%
Γ_{86}	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$		< 7	$\times 10^{-6}$	CL=90%
Γ_{87}	$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$		< 1.4	$\times 10^{-6}$	CL=90%
Γ_{88}	$\gamma f_0(1710) \rightarrow \gamma \eta \eta$		< 1.8	$\times 10^{-6}$	CL=90%
Γ_{89}	$\gamma f_4(2050)$		< 5.3	$\times 10^{-5}$	CL=90%

Γ_{90}	$\gamma f_0(2200) \to \gamma K^+ K^-$		$<$	2	$\times 10^{-4}$	CL=90%
Γ_{91}	$\gamma f_J(2220) \to \gamma K^+ K^-$		$<$	8	$\times 10^{-7}$	CL=90%
Γ_{92}	$\gamma f_J(2220) \to \gamma \pi^+ \pi^-$		$<$	6	$\times 10^{-7}$	CL=90%
Γ_{93}	$\gamma f_J(2220) \to \gamma p \overline{p}$		$<$	1.1	$\times 10^{-6}$	CL=90%
Γ_{94}	$\gamma \eta(2225) \to \gamma \phi \phi$		$<$	3	$\times 10^{-3}$	CL=90%
Γ_{95}	$\gamma \eta_c(1S)$		$<$	5.7	$\times 10^{-5}$	CL=90%
Γ_{96}	$\gamma \chi_{c0}$		$<$	6.5	$\times 10^{-4}$	CL=90%
Γ_{97}	$\gamma \chi_{c1}$		$<$	2.3	$\times 10^{-5}$	CL=90%
Γ_{98}	$\gamma \chi_{c2}$		$<$	7.6	$\times 10^{-6}$	CL=90%
Γ_{99}	$\gamma X(3872) \to \pi^+ \pi^- J/\psi$		$<$	1.6	$\times 10^{-6}$	CL=90%
Γ_{100}	$\gamma X(3872) \to \pi^+ \pi^- \pi^0 J/\psi$		$<$	2.8	$\times 10^{-6}$	CL=90%
Γ_{101}	$\gamma X(3915) \to \omega J/\psi$		$<$	3.0	$\times 10^{-6}$	CL=90%
Γ_{102}	$\gamma X(4140) \to \phi J/\psi$		$<$	2.2	$\times 10^{-6}$	CL=90%
Γ_{103}	γX	[c]	$<$	4.5	$\times 10^{-6}$	CL=90%
Γ_{104}	$\gamma X \overline{X} (m_X < 3.1$ GeV)	[d]	$<$	1	$\times 10^{-3}$	CL=90%
Γ_{105}	$\gamma X \overline{X} (m_X < 4.5$ GeV)	[e]	$<$	2.4	$\times 10^{-4}$	CL=90%
Γ_{106}	$\gamma X \to \gamma + \geq 4$ prongs	[f]	$<$	1.78	$\times 10^{-4}$	CL=95%
Γ_{107}	$\gamma a_1^0 \to \gamma \mu^+ \mu^-$	[g]	$<$	9	$\times 10^{-6}$	CL=90%
Γ_{108}	$\gamma a_1^0 \to \gamma \tau^+ \tau^-$	[a]	$<$	1.30	$\times 10^{-4}$	CL=90%
Γ_{109}	$\gamma a_1^0 \to \gamma g g$	[h]	$<$	1	%	CL=90%
Γ_{110}	$\gamma a_1^0 \to \gamma s \overline{s}$	[h]	$<$	1	$\times 10^{-3}$	CL=90%

Lepton Family number (*LF*) violating modes

Γ_{111}	$\mu^\pm \tau^\mp$	*LF*	$<$	6.0	$\times 10^{-6}$	CL=95%

Other decays

Γ_{112}	invisible		$<$	3.0	$\times 10^{-4}$	CL=90%

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

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

[c] X = scalar with $m < 8.0$ GeV

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

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

[f] 1.5 GeV $< m_X < 5.0$ 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.

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

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

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

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ — $\Gamma_0\Gamma_2/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
1.240±0.016 OUR AVERAGE				
1.252±0.004±0.019	[5] ROSNER	06	CLEO	9.5 $e^+e^- \to$ hadrons
1.187±0.023±0.031	[5] BARU	92B	MD1	$e^+e^- \to$ hadrons
1.23 ±0.02 ±0.05	[5] JAKUBOWSKI	88	CBAL	$e^+e^- \to$ hadrons
1.37 ±0.06 ±0.09	[6] GILES	84B	CLEO	$e^+e^- \to$ hadrons
1.23 ±0.08 ±0.04	[6] ALBRECHT	82	DASP	$e^+e^- \to$ hadrons
1.13 ±0.07 ±0.11	[6] NICZYPORUK	82	LENA	$e^+e^- \to$ hadrons
1.09 ±0.25	[6] BOCK	80	CNTR	$e^+e^- \to$ hadrons
1.35 ±0.14	[7] BERGER	79	PLUT	$e^+e^- \to$ hadrons

[5] Radiative corrections evaluated following KURAEV 85.
[6] Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.
[7] 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±0.05	60k	[8] 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		[9] ALBRECHT	85C	ARG	$\Upsilon(2S) \to \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±0.4		GILES	83	CLEO	$e^+e^- \to \tau^+\tau^-$

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

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.38±0.11 OUR AVERAGE					
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	$e^+e^- \to e^+e^-$

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ $\quad\Gamma_3/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0248±0.0005 OUR AVERAGE					
0.0249±0.0002±0.0007	345k	ADAMS	05	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0249±0.0008±0.0013		ALEXANDER	98	CLE2	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.0212±0.0020±0.0010		[10] BARU	92	MD1	$e^+e^- \rightarrow \mu^+\mu^-$
0.0231±0.0012±0.0010		[10] KOBEL	92	CBAL	$e^+e^- \rightarrow \mu^+\mu^-$
0.0252±0.0007±0.0007		CHEN	89B	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0261±0.0009±0.0011		KAARSBERG	89	CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
0.0230±0.0025±0.0013	86	ALBRECHT	87	ARG	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.029 ±0.003 ±0.002	864	BESSON	84	CLEO	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.027 ±0.003 ±0.003		ANDREWS	83	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.032 ±0.013 ±0.003		ALBRECHT	82	DASP	$e^+e^- \rightarrow \mu^+\mu^-$
0.038 ±0.015 ±0.002		NICZYPORUK	82	LENA	$e^+e^- \rightarrow \mu^+\mu^-$
0.014 $^{+0.034}_{-0.014}$		BOCK	80	CNTR	$e^+e^- \rightarrow \mu^+\mu^-$
0.022 ±0.020		BERGER	79	PLUT	$e^+e^- \rightarrow \mu^+\mu^-$

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

$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ $\quad\Gamma_1/\Gamma_3$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.008±0.023 OUR AVERAGE					
1.005±0.013±0.022	0.7M	[11] DEL-AMO-SA...	10C	BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSON	07	CLEO	$e^+e^- \rightarrow \Upsilon(1S)$

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

$\Gamma(ggg)/\Gamma_{total}$ $\quad\Gamma_4/\Gamma$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
81.7±0.7	20M	[12] BESSON	06A	CLEO	$\Upsilon(1S) \rightarrow$ hadrons

[12] 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.

$\Gamma(\gamma gg)/\Gamma_{total}$ $\quad\Gamma_5/\Gamma$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.20±0.60	400k	[13] BESSON	06A	CLEO	$\Upsilon(1S) \rightarrow \gamma +$ hadrons

[13] 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.

$\Gamma(\gamma gg)/\Gamma(ggg)$ $\quad\Gamma_5/\Gamma_4$

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			[14] 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	

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

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{total}$ 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
$<3.4 \times 10^{-6}$	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
$<1.4 \times 10^{-6}$	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
$<2.2 \times 10^{-6}$	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
$<5.4 \times 10^{-6}$	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
$<5.4 \times 10^{-6}$	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
$<8.1 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \to J/\psi K^+ K^- X$

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

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

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

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

$\Gamma(X(4430)^{\pm}$ anything, $X \to J/\psi(1S)\pi^{\pm})/\Gamma_{total}$ **Γ_{18}/Γ**

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

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

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

$\Gamma(X(3872)$ anything, $X \to J/\psi(1S)\pi^+\pi^-)/\Gamma_{total}$ **Γ_{20}/Γ**

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<9.5 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \to J/\psi \pi^+ \pi^- X$

$\Gamma(X(4260)$ anything, $X \to J/\psi(1S)\pi^+\pi^-)/\Gamma_{total}$ **Γ_{21}/Γ**

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

$\Gamma(X(4260)$ anything, $X \to J/\psi(1S)K^+K^-)/\Gamma_{total}$ **Γ_{22}/Γ**

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

$\Gamma(X(4140)$ anything, $X \to J/\psi(1S)\phi)/\Gamma_{total}$ **Γ_{23}/Γ**

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

$\Gamma(\chi_{c0}$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ **Γ_{24}/Γ_7**

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

$\Gamma(\chi_{c1}$ anything$)/\Gamma_{total}$ **Γ_{25}/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	$\Upsilon(1S) \to \gamma J/\psi(1S)$

$\Gamma(\chi_{c1}$ anything$)/\Gamma(J/\psi(1S)$ anything$)$ **Γ_{25}/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	$e^+ e^- \to J/\psi X$

$\Gamma(\chi_{c2}$ 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	$e^+e^- \to J/\psi X$

$\Gamma(\psi(2S)$ 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	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)$ 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	$e^+e^- \to \psi(2S)X$

$\Gamma(X(4260)$ anything, $X \to \psi(2S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{35}/Γ

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

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

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

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

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

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

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

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

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

$\Gamma(\rho\pi)/\Gamma_{total}$ — Γ_{40}/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_{41}/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_{42}/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_{43}/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_{44}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<5	90	[15] BARU	96	MD1	$\Upsilon(1S) \to p\overline{p}$

[15] Supersedes BARU 92 in this node.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{45}/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_{46}/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_{47}/Γ

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

$\Gamma(K^*(892)^0 K^-\pi^+ + c.c.)/\Gamma_{total}$ — Γ_{48}/Γ

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

$\Gamma(\phi f'_2(1525))/\Gamma_{total}$ — Γ_{49}/Γ

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

$\Gamma(\omega f_2(1270))/\Gamma_{total}$ — Γ_{50}/Γ

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

$\Gamma(\rho(770) a_2(1320))/\Gamma_{total}$ — Γ_{51}/Γ

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

$\Gamma(K^*(892)^0 \overline{K}^*_2(1430)^0 + c.c.)/\Gamma_{total}$ — Γ_{52}/Γ

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

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{total}$ — Γ_{53}/Γ

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

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{total}$ — Γ_{54}/Γ

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

$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{total}$ — Γ_{55}/Γ

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

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$ — Γ_{56}/Γ

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

$\Gamma(K^0_S K^+\pi^- + c.c.)/\Gamma_{total}$ — Γ_{57}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.59±0.33±0.18		37 ± 8	SHEN	13	BELL	$\Upsilon(1S) \rightarrow K^0_S K^-\pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.4	90		[16] DOBBS	12A		$\Upsilon(1S) \rightarrow K^0_S K^-\pi^+$

[16] 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_{58}/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_{59}/Γ

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

$\Gamma(D^*(2010)^{\pm}$ anything$)/\Gamma_{\text{total}}$ — Γ_{60}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
25.2±1.3±1.5		≈ 2k	[17] AUBERT	10C	BABR	$\Upsilon(2S) \to \pi^+\pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<19	90		[18] ALBRECHT	92J	ARG	$e^+e^- \to D^0 \pi^{\pm} X$

[17] For $x_p > 0.1$.
[18] For $x_p > 0.2$.

$\Gamma(\overline{^2H}$ anything$)/\Gamma_{\text{total}}$ — Γ_{61}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.85±0.25 OUR AVERAGE					
$2.81\pm0.49^{+0.20}_{-0.24}$		LEES	14G	BABR	$e^+e^- \to \overline{^2H}\, X$
2.86±0.19±0.21	455	ASNER	07	CLEO	$e^+e^- \to \overline{^2H}\, X$

Γ(Sum of 100 exclusive modes)$/\Gamma_{\text{total}}$ — Γ_{62}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		COMMENT
1.200±0.017	[19,20] DOBBS	12A	$\Upsilon(1S) \to$ hadrons

[19] DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.
[20] 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	$e^+e^- \to \overline{d} X$

$\Gamma(\gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$ — Γ_{63}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
6.3±1.2±1.3	[21] ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons

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

$\Gamma(\gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$ — Γ_{64}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
1.7±0.6±0.3	[22] ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons

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

$\Gamma(\gamma\pi^0\eta)/\Gamma_{total}$ — Γ_{65}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<2.4	90	[23] BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S)$

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

$\Gamma(\gamma K^+K^-)/\Gamma_{total}$ — Γ_{66}/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_{67}/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_{68}/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_{69}/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_{70}/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_{71}/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_{72}/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_{73}/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_{74}/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_{75}/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_{76}/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_{77}/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_{78}/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_{79}/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_{80}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<3	90	[24] ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$

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

$\Gamma(\gamma f'_2(1525))/\Gamma_{total}$ Γ_{81}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
3.8±0.9 OUR AVERAGE						
4.0±1.4±0.1		17 ± 5	[25] 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		[26] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+K^-$
<19.4	90		[26] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+K^-$

[25] BESSON 11 reports $(4.0 \pm 1.3 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\Upsilon(1S) \to \gamma f'_2(1525))/\Gamma_{total}] \times [B(f'_2(1525) \to K\overline{K})]$ assuming $B(f'_2(1525) \to K\overline{K}) = (88.8 \pm 3.1) \times 10^{-2}$, which we rescale to our best value $B(f'_2(1525) \to K\overline{K}) = (88.7 \pm 2.2) \times 10^{-2}$. 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 $B(K^0_S \to \pi^+\pi^-) = (69.20 \pm 0.05)\%$ and $B(f'_2(1525) \to K\overline{K}) = 4\ B(f'_2(1525) \to K^0_S K^0_S)$.

[26] Assuming $B(f'_2(1525) \to K\overline{K}) = 0.71$.

$\Gamma(\gamma f_2(1270))/\Gamma_{total}$ — Γ_{82}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
10.1±0.9 OUR AVERAGE					
$10.5\pm1.6^{+1.9}_{-1.8}$		[27] BESSON	07A	CLE3	$\Upsilon(1S) \to \gamma\pi^0\pi^0$
$10.2\pm0.8\pm0.7$		ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
$8.1\pm2.3^{+2.9}_{-2.7}$		[28] ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<21	90	[28] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<13	90	[28] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<81	90	SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

[27] Using $B(f_2(1270) \to \pi^0\pi^0) = B(f_2(1270) \to \pi\pi)/3$ and $B(f_2(1270) \to \pi\pi) = (0.845^{+0.025}_{-0.012})\%$.

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

$\Gamma(\gamma\eta(1405))/\Gamma_{total}$ — Γ_{83}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<8.2	90	[29] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^\pm\pi^\mp K^0_S$

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

$\Gamma(\gamma f_0(1500))/\Gamma_{total}$ — Γ_{84}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.5	90	[30] 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	[31] BESSON	07A	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma\eta\eta$

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

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

$\Gamma(\gamma f_0(1710))/\Gamma_{total}$ — Γ_{85}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 2.6	90	[32] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	90	[32] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+K^-$
<19	90	[32] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^0_S K^0_S$
< 8	90	[33] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma\pi^+\pi^-$
<24	90	[34] SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

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

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

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

$\Gamma(\gamma f_0(1710) \to \gamma K^+K^-)/\Gamma_{total}$ — Γ_{86}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<0.7	90	ATHAR	06	CLEO	$e^+e^- \to \Upsilon(1S) \to \gamma K^+K^-$

$\Gamma(\gamma f_0(1710) \to \gamma \pi^0 \pi^0)/\Gamma_{total}$ — Γ_{87}/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_{88}/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_{89}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<5.3	90	[35] ATHAR	06	CLE3	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$

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

$\Gamma(\gamma f_0(2200) \to \gamma K^+ K^-)/\Gamma_{total}$ — Γ_{90}/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_{91}/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_{92}/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_{93}/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_{94}/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_{95}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<5.7	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma\chi_{c0})/\Gamma_{total}$ — Γ_{96}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<6.5	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma\chi_{c1})/\Gamma_{total}$ — Γ_{97}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<2.3	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma\chi_{c2})/\Gamma_{total}$ — Γ_{98}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<7.6	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma X(3872) \to \pi^+\pi^- J/\psi)/\Gamma_{total}$ — Γ_{99}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<1.6	90	SHEN	10A	BELL	$\Upsilon(1S) \to \gamma X$

$\Gamma(\gamma X(3872) \to \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{total}$ — Γ_{100}/Γ

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

$\Gamma(\gamma X(3915) \to \omega J/\psi)/\Gamma_{total}$ — Γ_{101}/Γ

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

$\Gamma(\gamma X(4140) \to \phi J/\psi)/\Gamma_{total}$ — Γ_{102}/Γ

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

$\Gamma(\gamma X)/\Gamma_{total}$ — Γ_{103}/Γ

(X = scalar with $m <$ 8.0 GeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 4.5	90	[36] DEL-AMO-SA..11J		BABR	$e^+e^- \to \gamma + X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<30	90	[37] BALEST	95	CLEO	$e^+e^- \to \gamma + X$

[36] For a noninteracting scalar X with mass $m <$ 8.0 GeV.
[37] For a noninteracting pseudoscalar X with mass $<$ 7.2 GeV.

$\Gamma(\gamma X\overline{X}(m_X < 3.1\text{ GeV}))/\Gamma_{total}$ — Γ_{104}/Γ

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<1	90	[38] BALEST	95	CLEO	$e^+e^- \to \gamma + X\overline{X}$

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

$\Gamma(\gamma X\overline{X}(m_X < 4.5\text{ GeV}))/\Gamma_{total}$ — Γ_{105}/Γ

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<24	90	[39] DEL-AMO-SA..11J		BABR	$e^+e^- \to \gamma + X\overline{X}$

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

$\Gamma(\gamma X \to \gamma + \geq 4\text{ prongs})/\Gamma_{\text{total}}$ Γ_{106}/Γ

(1.5 GeV $< m_X <$ 5.0 GeV)

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

$\Gamma(\gamma a_1^0 \to \gamma\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{107}/Γ

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<9	90	[40] LOVE	08	CLEO	$e^+e^- \to \gamma a_1^0 \to \gamma\mu^+\mu^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<9.7	90	[41] LEES	13C	BABR	$e^+e^- \to \gamma a_1^0 \to \gamma\mu^+\mu^-$

[40] For a narrow scalar or pseudoscalar a_1^0 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 $\times 10^{-6}$.

[41] For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9200 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from 0.28–9.7 $\times$ 10^{-6}.

$\Gamma(\gamma a_1^0 \to \gamma\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_{108}/Γ

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<130	90	[42] LEES	13R	BABR	$\Upsilon(2S) \to \gamma\tau^+\tau^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 50	90	[43] LOVE	08	CLEO	$e^+e^- \to \gamma a_1^0 \to \gamma\tau^+\tau^-$

[42] For a narrow scalar a_1^0 with $2m_\tau <$ M(a_1^0) $<$ 9.2 GeV, which result in a 90% CL upper limits of 0.9×10^{-5} at M(a_1^0) $= 2m_\tau$, $\approx 1.5\times10^{-5}$ at M(a_1^0) = 7.5 GeV, and 13×10^{-5} at M(a_1^0) = 9.2 GeV.

[43] For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau <$ M(a_1^0) $<$ 7.5 GeV, which result in a 90% CL limits ranging from 1×10^{-5} at M(a_1^0)=$2m_\tau$ to 5×10^{-5} at M(a_1^0)=7.5 GeV.

$\Gamma(\gamma a_1^0 \to \gamma g g)/\Gamma_{\text{total}}$ Γ_{109}/Γ

(0.5 GeV $< m <$ 9.0 GeV)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1 × 10^{-2}	90	[44] LEES	13L	BABR	$\Upsilon(1S) \to \gamma X$

[44] For a narrow, CP-odd pseudoscalar a_1^0 searched for in 26 hadronic decay modes with invariant mass 0.5 GeV $< m_X <$ 9.0 GeV. Measured 90% CL limit as a function of m_X range from 10^{-6} to 10^{-2}.

$\Gamma(\gamma a_1^0 \to \gamma s\bar{s})/\Gamma_{\text{total}}$ Γ_{110}/Γ

(0.5 GeV $< m <$ 9.0 GeV)

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1 × 10^{-3}	90	[45] LEES	13L	BABR	$\Upsilon(1S) \to \gamma X$

[45] For a narrow, CP-odd pseudoscalar a_1^0 searched for in 14 hadronic decay modes with invariant mass 1.5 GeV $< m_X <$ 9.0 GeV. Measured 90% CL limit as a function of m_X range from 10^{-5} to 10^{-3}.

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

$\Gamma(\mu^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$ — Γ_{111}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<6.0	95	LOVE	08A	CLEO	$e^+e^- \to \mu^{\pm}\tau^{\mp}$

OTHER DECAYS

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ — Γ_{112}/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	$\Upsilon(3S) \to \pi^+\pi^-\Upsilon(1S)$

$\Upsilon(1S)$ REFERENCES

JIA	17	PR D95 012001	S. Jia et al.	(BELLE Collab.)
SHEN	16	PR D93 112013	C.P. Shen et al.	(BELLE Collab.)
LEES	14G	PR D89 111102	J.P. Lees et al.	(BABAR Collab.)
YANG	14	PR D90 112008	S.D. Yang et al.	(BELLE Collab.)
LEES	13C	PR D87 031102	J.P. Lees et al.	(BABAR Collab.)
LEES	13L	PR D88 031701	J.P. Lees et al.	(BABAR Collab.)
LEES	13R	PR D88 071102	J.P. Lees et al.	(BABAR Collab.)
SHEN	13	PR D88 011102	C.P. Shen et al.	(BELLE Collab.)
DOBBS	12A	PR D86 052003	S. Dobbs et al.	
SHEN	12A	PR D86 031102	C.P. Shen et al.	(BELLE Collab.)
BESSON	11	PR D83 037101	D. Besson et al.	(CLEO Collab.)
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez et al.	(BABAR Collab.)
AUBERT	10C	PR D81 011102	B. Aubert et al.	(BABAR Collab.)
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez et al.	(BABAR Collab.)
SHEN	10A	PR D82 051504	C.P. Shen et al.	(BELLE Collab.)
AUBERT	09AX	PRL 103 251801	B. Aubert et al.	(BABAR Collab.)
LOVE	08	PRL 101 151802	W. Love et al.	(CLEO Collab.)
LOVE	08A	PRL 101 201601	W. Love et al.	(CLEO Collab.)
PDG	08	PL B667 1	C. Amsler et al.	(PDG Collab.)
ASNER	07	PR D75 012009	D.M. Asner et al.	(CLEO Collab.)
ATHAR	07A	PR D76 072003	S.B. Athar et al.	(CLEO Collab.)
BESSON	07	PRL 98 052002	D. Besson et al.	(CLEO Collab.)
BESSON	07A	PR D75 072001	D. Besson et al.	(CLEO Collab.)
ROSNER	07A	PR D76 117102	J.L. Rosner et al.	(CLEO Collab.)
RUBIN	07	PR D75 031104	P. Rubin et al.	(CLEO Collab.)
TAJIMA	07	PRL 98 132001	O. Tajima et al.	(BELLE Collab.)
AQUINES	06A	PR D74 092006	O. Aquines et al.	(CLEO Collab.)
ATHAR	06	PR D73 032001	S.B. Athar et al.	(CLEO Collab.)
BESSON	06A	PR D74 012003	D. Besson et al.	(CLEO Collab.)
ROSNER	06	PRL 96 092003	J.L. Rosner et al.	(CLEO Collab.)
ADAMS	05	PRL 94 012001	G.S. Adams et al.	(CLEO Collab.)
BRIERE	04	PR D70 072001	R.A. Briere et al.	(CLEO Collab.)
ARTUSO	03	PR D67 052003	M. Artuso et al.	(CLEO Collab.)
MASEK	02	PR D65 072002	G. Masek et al.	(CLEO Collab.)
RICHICHI	01B	PRL 87 141801	S.J. Richichi et al.	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov et al.	
ANASTASSOV	99	PRL 82 286	A. Anastassov et al.	(CLEO Collab.)
ALEXANDER	98	PR D58 052004	J.P. Alexander et al.	(CLEO Collab.)
BARU	96	PRPL 267 71	S.E. Baru et al.	(NOVO)
BALEST	95	PR D51 2053	R. Balest et al.	(CLEO Collab.)
CINABRO	94B	PL B340 129	D. Cinabro et al.	(CLEO Collab.)
ALBRECHT	92J	ZPHY C55 25	H. Albrecht et al.	(ARGUS Collab.)
BARU	92	ZPHY C54 229	S.E. Baru et al.	(NOVO)
BARU	92B	ZPHY C56 547	S.E. Baru et al.	(NOVO)
KOBEL	92	ZPHY C53 193	M. Kobel et al.	(Crystal Ball Collab.)

BLINOV	90	PL B245 311	A.E. Blinov *et al.*	(NOVO)
FULTON	90B	PR D41 1401	R. Fulton *et al.*	(CLEO Collab.)
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann *et al.*	(Crystal Ball Collab.)
ALBRECHT	89	ZPHY C42 349	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	89	NP B320 45	J.P. Alexander *et al.*	(LBL, MICH, SLAC)
BARU	89	ZPHY C42 505	S.E. Baru *et al.*	(NOVO)
CHEN	89B	PR D39 3528	W.Y. Chen *et al.*	(CLEO Collab.)
FULTON	89	PL B224 445	R. Fulton *et al.*	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg *et al.*	(CUSB Collab.)
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding, World Scientific, Singapore				
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski *et al.*	(Crystal Ball Collab.) IGJPC
SCHMITT	88	ZPHY C40 199	P. Schmitt *et al.*	(Crystal Ball Collab.)
ALBRECHT	87	ZPHY C35 283	H. Albrecht *et al.*	(ARGUS Collab.)
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86	ZPHY C30 551	S.E. Baru *et al.*	(NOVO)
ALBRECHT	85C	PL 154B 452	H. Albrecht *et al.*	(ARGUS Collab.)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
		Translated from YAF 41 733.		
ARTAMONOV	84	PL 137B 272	A.S. Artamonov *et al.*	(NOVO)
BESSON	84	PR D30 1433	D. Besson *et al.*	(CLEO Collab.)
GILES	84B	PR D29 1285	R. Giles *et al.*	(CLEO Collab.)
MACKAY	84	PR D29 2483	W.W. MacKay *et al.*	(CUSB Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews *et al.*	(CLEO Collab.)
GILES	83	PRL 50 877	R. Giles *et al.*	(HARV, OSU, ROCH, RUTG+)
NICZYPORUK	83	ZPHY C17 197	B. Niczyporuk *et al.*	(LENA Collab.)
ALBRECHT	82	PL 116B 383	H. Albrecht *et al.*	(DESY, DORT, HEIDH+)
ARTAMONOV	82	PL 118B 225	A.S. Artamonov *et al.*	(NOVO)
NICZYPORUK	82	ZPHY C15 299	B. Niczyporuk *et al.*	(LENA Collab.)
BERGER	80C	PL 93B 497	C. Berger *et al.*	(PLUTO Collab.)
BOCK	80	ZPHY C6 125	P. Bock *et al.*	(HEIDP, MPIM, DESY, HAMB)
BERGER	79	ZPHY C1 343	C. Berger *et al.*	(PLUTO Collab.)