$\Upsilon(1S)$

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

$\Upsilon(1S)$ 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[3] Superseded by ARTAMONOV 00.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
53.0±1.5 OUR NEW EVALUATION	See the Note on Width Determinations of the Υ states [52.5 ± 1.8 keV OUR 2002 EVALUATION]

$\Upsilon(1S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\tau^+\tau^-$	$(2.67^{+0.14}_{-0.16})$ %	
Γ_2	e^+e^-	(2.38±0.11) %	
Γ_3	$\mu^+\mu^-$	(2.48±0.06) %	
	Hadronic decays		
Γ_4	$J/\psi(1S)$ anything	$(1.1 \pm 0.4) \times 10^{-3}$	
Γ_5	$\rho\pi$	$< 2 \times 10^{-4}$	90%
Γ_6	$\pi^+\pi^-$	$< 5 \times 10^{-4}$	90%
Γ_7	K^+K^-	$< 5 \times 10^{-4}$	90%
Γ_8	$p\overline{p}$	$< 5 \times 10^{-4}$	90%
Γ_9	$\pi^0\pi^+\pi^-$	$< 1.84 \times 10^{-5}$	90%
Γ_{10}	$D^*(2010)^{\pm}$ anything		

Radiative decays

Γ_{11}	$\gamma\pi^+\pi^-$	$(6.3\ \pm 1.8\ ) \times 10^{-5}$		
Γ_{12}	$\gamma\pi^0\pi^0$	$(1.7\ \pm 0.7\ ) \times 10^{-5}$		
Γ_{13}	$\gamma 2h^+ 2h^-$	$(7.0\ \pm 1.5\ ) \times 10^{-4}$		
Γ_{14}	$\gamma 3h^+ 3h^-$	$(5.4\ \pm 2.0\ ) \times 10^{-4}$		
Γ_{15}	$\gamma 4h^+ 4h^-$	$(7.4\ \pm 3.5\ ) \times 10^{-4}$		
Γ_{16}	$\gamma\pi^+\pi^- K^+ K^-$	$(2.9\ \pm 0.9\ ) \times 10^{-4}$		
Γ_{17}	$\gamma 2\pi^+ 2\pi^-$	$(2.5\ \pm 0.9\ ) \times 10^{-4}$		
Γ_{18}	$\gamma 3\pi^+ 3\pi^-$	$(2.5\ \pm 1.2\ ) \times 10^{-4}$		
Γ_{19}	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	$(2.4\ \pm 1.2\ ) \times 10^{-4}$		
Γ_{20}	$\gamma\pi^+\pi^- p\overline{p}$	$(1.5\ \pm 0.6\ ) \times 10^{-4}$		
Γ_{21}	$\gamma 2\pi^+ 2\pi^- p\overline{p}$	$(4\ \pm 6\ ) \times 10^{-5}$		
Γ_{22}	$\gamma 2K^+ 2K^-$	$(2.0\ \pm 2.0\ ) \times 10^{-5}$		
Γ_{23}	$\gamma\eta'(958)$	< 1.6	$\times 10^{-5}$	90%
Γ_{24}	$\gamma\eta$	< 2.1	$\times 10^{-5}$	90%
Γ_{25}	$\gamma f'_2(1525)$	< 1.4	$\times 10^{-4}$	90%
Γ_{26}	$\gamma f_2(1270)$	$(8\ \pm 4\ ) \times 10^{-5}$		
Γ_{27}	$\gamma\eta(1440)$	< 8.2	$\times 10^{-5}$	90%
Γ_{28}	$\gamma f_0(1710) \to \gamma K\overline{K}$	< 2.6	$\times 10^{-4}$	90%
Γ_{29}	$\gamma f_0(2200) \to \gamma K^+ K^-$	< 2	$\times 10^{-4}$	90%
Γ_{30}	$\gamma f_J(2220) \to \gamma K^+ K^-$	< 1.5	$\times 10^{-5}$	90%
Γ_{31}	$\gamma f_J(2220) \to \gamma\pi^+\pi^-$	< 1.2	$\times 10^{-5}$	90%
Γ_{32}	$\gamma f_J(2220) \to \gamma p\overline{p}$	< 1.6	$\times 10^{-5}$	90%
Γ_{33}	$\gamma\eta(2225) \to \gamma\phi\phi$	< 3	$\times 10^{-3}$	90%
Γ_{34}	γX X = pseudoscalar with $m <$ 7.2 GeV)	< 3	$\times 10^{-5}$	90%
Γ_{35}	$\gamma X\overline{X}$ $X\overline{X}$ = vectors with $m <$ 3.1 GeV)	< 1	$\times 10^{-3}$	90%

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

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

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

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

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
1.216±0.027 OUR AVERAGE				
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
1.314±0.029 OUR NEW EVALUATION	[1.32 ± 0.03 keV OUR 1994 EVALUATION]

$\Upsilon(1S)$ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.0267^{+0.0014}_{-0.0016}$ OUR AVERAGE					
$0.0261 \pm 0.0012^{+0.0009}_{-0.0013}$	25k	CINABRO	94B	CLE2	$e^+e^- \to \tau^+\tau^-$
$0.027 \pm 0.004 \pm 0.002$		[8] ALBRECHT	85C	ARG	$\Upsilon(2S) \to \pi^+\pi^-\tau^+\tau^-$
$0.034 \pm 0.004 \pm 0.004$		GILES	83	CLEO	$e^+e^- \to \tau^+\tau^-$

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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0248±0.0006 OUR AVERAGE					
$0.0249 \pm 0.0008 \pm 0.0013$		ALEXANDER	98	CLE2	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
$0.0212 \pm 0.0020 \pm 0.0010$		[9] BARU	92	MD1	$e^+e^- \to \mu^+\mu^-$
$0.0231 \pm 0.0012 \pm 0.0010$		[9] KOBEL	92	CBAL	$e^+e^- \to \mu^+\mu^-$
$0.0252 \pm 0.0007 \pm 0.0007$		CHEN	89B	CLEO	$e^+e^- \to \mu^+\mu^-$
$0.0261 \pm 0.0009 \pm 0.0011$		KAARSBERG	89	CSB2	$e^+e^- \to \mu^+\mu^-$
$0.0230 \pm 0.0025 \pm 0.0013$	86	ALBRECHT	87	ARG	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
$0.029 \pm 0.003 \pm 0.002$	864	BESSON	84	CLEO	$\Upsilon(2S) \to \pi^+\pi^-\mu^+\mu^-$
$0.027 \pm 0.003 \pm 0.003$		ANDREWS	83	CLEO	$e^+e^- \to \mu^+\mu^-$
$0.032 \pm 0.013 \pm 0.003$		ALBRECHT	82	DASP	$e^+e^- \to \mu^+\mu^-$
$0.038 \pm 0.015 \pm 0.002$		NICZYPORUK	82	LENA	$e^+e^- \to \mu^+\mu^-$
$0.014^{+0.034}_{-0.014}$		BOCK	80	CNTR	$e^+e^- \to \mu^+\mu^-$
0.022 ± 0.020		BERGER	79	PLUT	$e^+e^- \to \mu^+\mu^-$

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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0238±0.0011 OUR AVERAGE					
0.0229±0.0008±0.0011		ALEXANDER	98	CLE2	$\Upsilon(2S) \to \pi^+\pi^- e^+e^-$
0.0242±0.0014±0.0014	307	ALBRECHT	87	ARG	$\Upsilon(2S) \to \pi^+\pi^- e^+e^-$
0.028 ±0.003 ±0.002	826	BESSON	84	CLEO	$\Upsilon(2S) \to \pi^+\pi^- e^+e^-$
0.051 ±0.030		BERGER	80C	PLUT	$e^+e^- \to e^+e^-$

$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
< 0.68	90	ALBRECHT	92J	ARG	$e^+e^- \to e^+e^- X$, $e^+e^- \to \mu^+\mu^- X$
1.1 ±0.4±0.2		[10] FULTON	89	CLEO	$e^+e^- \to \mu^+\mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.7	90	MASCHMANN	90	CBAL	$e^+e^- \to$ hadrons
<20	90	NICZYPORUK	83	LENA	

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

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_6/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_7/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_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<5	90	[11] BARU	96	MD1	$\Upsilon(1S) \to p\overline{p}$

[11] Supersedes BARU 92 in this node.

$\Gamma(\pi^0\pi^+\pi^-)/\Gamma_{total}$ — Γ_9/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.84	90	ANASTASSOV	99	CLE2	$e^+e^- \to$ hadrons

$\Gamma(\gamma X)/\Gamma_{total}$ — Γ_{34}/Γ

(X = pseudoscalar with $m <$ 7.2 GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<3	90	[12] BALEST	95	CLEO	$e^+e^- \to \gamma + X$

[12] For a noninteracting pseudoscalar X with mass < 7.2 GeV.

$\Gamma(\gamma X\overline{X})/\Gamma_{total}$ — Γ_{35}/Γ

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<1	90	[13] BALEST	95	CLEO	$e^+e^- \rightarrow \gamma + X\overline{X}$

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

$\Gamma(\gamma\pi^+\pi^-)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
6.3±1.2±1.3	[14] ANASTASSOV	99	CLE2	$e^+e^- \rightarrow$ hadrons

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

$\Gamma(\gamma\pi^0\pi^0)/\Gamma_{total}$ — Γ_{12}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
1.7±0.6±0.3	[15] ANASTASSOV	99	CLE2	$e^+e^- \rightarrow$ hadrons

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

$\Gamma(\gamma 2\pi^+2\pi^-)/\Gamma_{total}$ — Γ_{17}/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

$\Gamma(\gamma\pi^+\pi^-K^+K^-)/\Gamma_{total}$ — Γ_{16}/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

$\Gamma(\gamma\pi^+\pi^-p\overline{p})/\Gamma_{total}$ — Γ_{20}/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

$\Gamma(\gamma 2K^+2K^-)/\Gamma_{total}$ — Γ_{22}/Γ

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

$\Gamma(\gamma 3\pi^+3\pi^-)/\Gamma_{total}$ — Γ_{18}/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_{19}/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

$\Gamma(\gamma 2\pi^+2\pi^-p\overline{p})/\Gamma_{total}$ — Γ_{21}/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

$\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{total}$ Γ_{13}/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_{14}/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_{15}/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

$\Gamma(\rho\pi)/\Gamma_{total}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 2	90	FULTON	90B		$\Upsilon(1S) \rightarrow \rho^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<10	90	BLINOV	90	MD1	$\Upsilon(1S) \rightarrow \rho^0\pi^0$
<21	90	NICZYPORUK	83	LENA	$\Upsilon(1S) \rightarrow \rho^0\pi^0$

$\Gamma(D^*(2010)^\pm \text{anything})/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<19	90	[16] ALBRECHT	92J	ARG	$e^+e^- \rightarrow D^0\pi^\pm X$

[16] For $x_p > 0.2$.

$\Gamma(\gamma\eta(1440))/\Gamma_{total}$ Γ_{27}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<8.2	90	[17] FULTON	90B	CLEO	$\Upsilon(1S) \rightarrow \gamma K^+\pi^\mp K^0_S$

[17] Includes unknown branching ratio of $\eta(1440) \rightarrow K^\pm\pi^\mp K^0_S$.

$\Gamma(\gamma\eta'(958))/\Gamma_{total}$ Γ_{23}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.6	90	RICHICHI	01B	CLE2	$\Upsilon(1S) \rightarrow \gamma\eta' \rightarrow \gamma\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<130	90	SCHMITT	88	CBAL	$\Upsilon(1S) \rightarrow \gamma X$

$\Gamma(\gamma\eta)/\Gamma_{total}$ Γ_{24}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
< 2.1 (CL = 90%) [$<3.5 \times 10^{-4}$ (CL = 90%) OUR 2002 BEST LIMIT]					
< 2.1	90	MASEK	02	CLEO	$\Upsilon(1S) \rightarrow \gamma\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<28.2	90	MASEK	02	CLEO	$\eta \rightarrow \gamma\gamma$
< 6.7	90	MASEK	02	CLEO	$\eta \rightarrow \pi^0\pi^0\pi^0$
< 2.6	90	MASEK	02	CLEO	$\eta \rightarrow \pi^+\pi^-\pi^0$
<35	90	SCHMITT	88	CBAL	$\Upsilon(1S) \rightarrow \gamma X$

$\Gamma(\gamma f'_2(1525))/\Gamma_{total}$ — Γ_{25}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<14	90	[18] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<19.4	90	[18] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+ K^-$

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

$\Gamma(\gamma f_0(1710) \to \gamma K\overline{K})/\Gamma_{total}$ — Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 2.6	90	[19] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	90	[19] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+ K^-$
<19	90	[19] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^0_S K^0_S$
< 8	90	[20] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$
<24	90	[21] SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

[19] Assuming B($f_0(1710) \to K\overline{K}$) = 0.38.
[20] Assuming B($f_0(1710) \to \pi\pi$) = 0.04.
[21] Assuming B($f_0(1710) \to \eta\eta$) = 0.18.

$\Gamma(\gamma f_2(1270))/\Gamma_{total}$ — Γ_{26}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
$8.1 \pm 2.3^{+2.9}_{-2.7}$		[22] ANASTASSOV	99	CLE2	$e^+ e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<21	90	[22] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$
<13	90	[22] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$
<81	90	SCHMITT	88	CBAL	$\Upsilon(1S) \to \gamma X$

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

$\Gamma(\gamma f_J(2220) \to \gamma K^+ K^-)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.6	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma K^+ K^-$
< 1.5	90	[23] FULTON	90B	CLEO	$\Upsilon(1S) \to \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 2.9	90	[23] ALBRECHT	89	ARG	$\Upsilon(1S) \to \gamma K^+ K^-$
<20	90	[23] BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+ K^-$

[23] Including unknown branching ratio of $f_J(2220) \to K^+ K^-$.

$\Gamma(\gamma f_J(2220) \to \gamma \pi^+ \pi^-)/\Gamma_{total}$ — Γ_{31}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.2	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma \pi^+ \pi^-$

$\Gamma(\gamma f_J(2220) \to \gamma p\overline{p})/\Gamma_{total}$ — Γ_{32}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.6	90	MASEK	02	CLEO	$\Upsilon(1S) \to \gamma p\overline{p}$

$\Gamma(\gamma\eta(2225) \to \gamma\phi\phi)/\Gamma_{total}$ — Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.003	90	[24] BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+ K^- K^+ K^-$

[24] Assuming that the $\eta(2225)$ decays only into $\phi\phi$.

$\Gamma(\gamma f_0(2200) \to \gamma K^+ K^-)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0002	90	[25] BARU	89	MD1	$\Upsilon(1S) \to \gamma K^+ K^-$

[25] Assuming that the $f_0(2200)$ decays only into $K^+ K^-$.

$\Upsilon(1S)$ REFERENCES

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ANASTASSOV	99	PRL 82 286	A. Anastassov et al.	(CLEO Collab.)
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BALEST	95	PR D51 2053	R. Balest et al.	(CLEO Collab.)
CINABRO	94B	PL B340 129	D. Cinabro et al.	(CLEO Collab.)
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BARU	92	ZPHY C54 229	S.E. Baru et al.	(NOVO)
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KOBEL	92	ZPHY C53 193	M. Kobel et al.	(Crystal Ball Collab.)
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MASCHMANN	90	ZPHY C46 555	W.S. Maschmann et al.	(Crystal Ball Collab.)
ALBRECHT	89	ZPHY C42 349	H. Albrecht et al.	(ARGUS Collab.)
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