

$\Upsilon(1S)$

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

$\Upsilon(1S)$ 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	$e^+ e^- \rightarrow$ hadrons
9459.97 ± 0.11 ± 0.07	MACKAY	84 REDE	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.60 ± 0.09 ± 0.05	^{2,3} BARU	92B REDE	$e^+ e^- \rightarrow$ hadrons
9460.59 ± 0.12	BARU	86 REDE	$e^+ e^- \rightarrow$ hadrons
9460.6 ± 0.4	^{3,4} ARTAMONOV 84	REDE	$e^+ e^- \rightarrow$ 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³ Superseded by ARTAMONOV 00.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)	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 ± 0.05) %	

Hadronic decays

Γ_4 $\eta'(958)$ anything	(2.8 ± 0.4) %	
Γ_5 $J/\psi(1S)$ anything	(6.5 ± 0.7) × 10 ⁻⁴	
Γ_6 χ_{c0} anything	< 5 × 10 ⁻³	90%
Γ_7 χ_{c1} anything	(2.3 ± 0.7) × 10 ⁻⁴	
Γ_8 χ_{c2} anything	(3.4 ± 1.0) × 10 ⁻⁴	
Γ_9 $\psi(2S)$ anything	(2.7 ± 0.9) × 10 ⁻⁴	
Γ_{10} $\rho\pi$	< 2 × 10 ⁻⁴	90%
Γ_{11} $\pi^+ \pi^-$	< 5 × 10 ⁻⁴	90%
Γ_{12} $K^+ K^-$	< 5 × 10 ⁻⁴	90%
Γ_{13} $p\bar{p}$	< 5 × 10 ⁻⁴	90%
Γ_{14} $\pi^0 \pi^+ \pi^-$	< 1.84 × 10 ⁻⁵	90%
Γ_{15} $D^*(2010)^\pm$ anything		

Radiative decays

Γ_{16}	$\gamma\pi^+\pi^-$	$(6.3 \pm 1.8) \times 10^{-5}$	
Γ_{17}	$\gamma\pi^0\pi^0$	$(1.7 \pm 0.7) \times 10^{-5}$	
Γ_{18}	K^+K^- with $2 < m_{K^+K^-} < 3$ GeV	$(1.14 \pm 0.13) \times 10^{-5}$	
Γ_{19}	$\gamma p\bar{p}$ with $2 < m_{p\bar{p}} < 3$ GeV	$< 6 \times 10^{-6}$	90%
Γ_{20}	$\gamma 2h^+2h^-$	$(7.0 \pm 1.5) \times 10^{-4}$	
Γ_{21}	$\gamma 3h^+3h^-$	$(5.4 \pm 2.0) \times 10^{-4}$	
Γ_{22}	$\gamma 4h^+4h^-$	$(7.4 \pm 3.5) \times 10^{-4}$	
Γ_{23}	$\gamma\pi^+\pi^-K^+K^-$	$(2.9 \pm 0.9) \times 10^{-4}$	
Γ_{24}	$\gamma 2\pi^+2\pi^-$	$(2.5 \pm 0.9) \times 10^{-4}$	
Γ_{25}	$\gamma 3\pi^+3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$	
Γ_{26}	$\gamma 2\pi^+2\pi^-K^+K^-$	$(2.4 \pm 1.2) \times 10^{-4}$	
Γ_{27}	$\gamma\pi^+\pi^-p\bar{p}$	$(1.5 \pm 0.6) \times 10^{-4}$	
Γ_{28}	$\gamma 2\pi^+2\pi^-p\bar{p}$	$(4 \pm 6) \times 10^{-5}$	
Γ_{29}	$\gamma 2K^+2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$	
Γ_{30}	$\gamma\eta'(958)$	$< 1.6 \times 10^{-5}$	90%
Γ_{31}	$\gamma\eta$	$< 2.1 \times 10^{-5}$	90%
Γ_{32}	$\gamma f_0(980)$	$< 3 \times 10^{-5}$	90%
Γ_{33}	$\gamma f_2'(1525)$	$(3.7^{+1.2}_{-1.1}) \times 10^{-5}$	
Γ_{34}	$\gamma f_2(1270)$	$(1.00 \pm 0.10) \times 10^{-4}$	
Γ_{35}	$\gamma\eta(1405)$	$< 8.2 \times 10^{-5}$	90%
Γ_{36}	$\gamma f_0(1710)$	$< 1.8 \times 10^{-4}$	90%
Γ_{37}	$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$	90%
Γ_{38}	$\gamma f_0(2200) \rightarrow \gamma K^+K^-$	$< 2 \times 10^{-4}$	90%
Γ_{39}	$\gamma f_J(2220) \rightarrow \gamma K^+K^-$	$< 8 \times 10^{-7}$	90%
Γ_{40}	$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	$< 6 \times 10^{-7}$	90%
Γ_{41}	$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	$< 1.1 \times 10^{-6}$	90%
Γ_{42}	$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	$< 3 \times 10^{-3}$	90%
Γ_{43}	γX (X = pseudoscalar with $m < 7.2$ GeV)	$< 3 \times 10^{-5}$	90%
Γ_{44}	$\gamma X\bar{X}$ ($X\bar{X}$ = vectors with $m < 3.1$ GeV)	$< 1 \times 10^{-3}$	90%

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

$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_3/\Gamma$		
<u>VALUE (eV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
31.2±1.6±1.7	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

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

<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.240±0.016 OUR AVERAGE			
1.252±0.004±0.019	⁵ ROSNER	06 CLEO	9.5 e ⁺ e ⁻ → hadrons
1.187±0.023±0.031	⁵ BARU	92B MD1	e ⁺ e ⁻ → hadrons
1.23 ±0.02 ±0.05	⁵ JAKUBOWSKI	88 CBAL	e ⁺ e ⁻ → hadrons
1.37 ±0.06 ±0.09	⁶ GILES	84B CLEO	e ⁺ e ⁻ → hadrons
1.23 ±0.08 ±0.04	⁶ ALBRECHT	82 DASP	e ⁺ e ⁻ → hadrons
1.13 ±0.07 ±0.11	⁶ NICZYPORUK	82 LENA	e ⁺ e ⁻ → hadrons
1.09 ±0.25	⁶ BOCK	80 CNTR	e ⁺ e ⁻ → hadrons
1.35 ±0.14	⁷ BERGER	79 PLUT	e ⁺ e ⁻ → 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(μμ) = 0.026.

$\Upsilon(1S)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_2

<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>
1.340±0.018 OUR EVALUATION	

$\Upsilon(1S)$ BRANCHING RATIOS

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0267^{+0.0014}_{-0.0016} OUR AVERAGE				
0.0261±0.0012 ^{+0.0009} _{-0.0013}	25k	CINABRO	94B CLE2	e ⁺ e ⁻ → τ ⁺ τ ⁻
0.027 ±0.004 ±0.002		⁸ ALBRECHT	85C ARG	Υ(2S) →
0.034 ±0.004 ±0.004		GILES	83 CLEO	e ⁺ e ⁻ → τ ⁺ τ ⁻ π ⁺ π ⁻ τ ⁺ τ ⁻

⁸ Using B(Υ(1S) → ee) = B(Υ(1S) → μμ) = 0.0256; not used for width evaluations.

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0248±0.0005 OUR AVERAGE				
0.0249±0.0002±0.0007	345k	ADAMS	05 CLEO	e ⁺ e ⁻ → μ ⁺ μ ⁻
0.0249±0.0008±0.0013		ALEXANDER	98 CLE2	Υ(2S) → π ⁺ π ⁻ μ ⁺ μ ⁻
0.0212±0.0020±0.0010		⁹ BARU	92 MD1	e ⁺ e ⁻ → μ ⁺ μ ⁻
0.0231±0.0012±0.0010		⁹ KOBEL	92 CBAL	e ⁺ e ⁻ → μ ⁺ μ ⁻
0.0252±0.0007±0.0007		CHEN	89B CLEO	e ⁺ e ⁻ → μ ⁺ μ ⁻
0.0261±0.0009±0.0011		KAARSBERG	89 CSB2	e ⁺ e ⁻ → μ ⁺ μ ⁻
0.0230±0.0025±0.0013	86	ALBRECHT	87 ARG	Υ(2S) → π ⁺ π ⁻ μ ⁺ μ ⁻

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	$e^+ e^- \rightarrow \mu^+ \mu^-$

⁹ Taking into account interference between the resonance and continuum.

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$			Γ_2/Γ		
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.0238 ± 0.0011 OUR AVERAGE					
0.0229 ± 0.0008 ± 0.0011		ALEXANDER	98	CLE2	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$
0.0242 ± 0.0014 ± 0.0014	307	ALBRECHT	87	ARG	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$
0.028 ± 0.003 ± 0.002	826	BESSON	84	CLEO	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$
0.051 ± 0.030		BERGER	80c	PLUT	$e^+ e^- \rightarrow e^+ e^-$

$\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$			Γ_4/Γ		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
0.028 ± 0.004 ± 0.002	ARTUSO	03	CLE2	$\Upsilon(1S) \rightarrow \eta' \text{ anything}$	

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$			Γ_5/Γ		
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.65 ± 0.07 OUR AVERAGE					
0.64 ± 0.04 ± 0.06		730 ± 40	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$
1.1 ± 0.4 ± 0.2		10	FULTON	89	CLEO $e^+ e^- \rightarrow \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.68	90		ALBRECHT	92J	ARG $e^+ e^- \rightarrow e^+ e^- X, e^+ e^- \rightarrow \mu^+ \mu^- X$
<1.7	90		MASCHMANN	90	CBAL $e^+ e^- \rightarrow \text{hadrons}$
<20	90		NICZYPORUK	83	LENA

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

$\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$			Γ_6/Γ_5		
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<7.4	90	BRIERE	04	CLEO	$e^+ e^- \rightarrow J/\psi X$

$\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$			Γ_7/Γ_5		
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.35 ± 0.08 ± 0.06	52 ± 12	BRIERE	04	CLEO	$e^+ e^- \rightarrow J/\psi X$

$\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_8/Γ_5

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

$\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_9/Γ_5

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

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

<u>VALUE (units 10⁻⁴)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<5	90	BARU	92 MD1	$\Upsilon(1S) \rightarrow \pi^+ \pi^-$

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

<u>VALUE (units 10⁻⁴)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<5	90	BARU	92 MD1	$\Upsilon(1S) \rightarrow K^+ K^-$

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{13}/Γ

<u>VALUE (units 10⁻⁴)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<5	90	¹¹ BARU	96 MD1	$\Upsilon(1S) \rightarrow p\bar{p}$

¹¹Supersedes BARU 92 in this node.

$\Gamma(\pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

<u>VALUE (units 10⁻⁵)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<1.84	90	ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(\gamma X)/\Gamma_{\text{total}}$ Γ_{43}/Γ

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

<u>VALUE (units 10⁻⁵)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<3	90	¹² BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X$

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

$\Gamma(\gamma X \bar{X})/\Gamma_{\text{total}}$ Γ_{44}/Γ

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

<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<1	90	¹³ BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X \bar{X}$

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

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

<u>VALUE (units 10⁻⁵)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
6.3±1.2±1.3	¹⁴ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

¹⁴For $m_{\pi\pi} > 1$ GeV.

$\Gamma(\gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

<u>VALUE (units 10⁻⁵)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.7±0.6±0.3	¹⁵ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

¹⁵For $m_{\pi\pi} > 1$ GeV.

$\Gamma(K^+K^- \text{ with } 2 < m_{K^+K^-} < 3 \text{ GeV})/\Gamma_{\text{total}}$					Γ_{18}/Γ
<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.14±0.08±0.10	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$	
$\Gamma(\gamma p\bar{p} \text{ with } 2 < m_{p\bar{p}} < 3 \text{ GeV})/\Gamma_{\text{total}}$					Γ_{19}/Γ
<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.6	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma p\bar{p}$	
$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$					Γ_{24}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.5±0.7±0.5	26 ± 7	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$					Γ_{23}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.9±0.7±0.6	29 ± 8	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma \pi^+ \pi^- p\bar{p})/\Gamma_{\text{total}}$					Γ_{27}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.5±0.5±0.3	22 ± 6	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$					Γ_{29}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.2±0.2	2 ± 2	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$					Γ_{25}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.5±0.9±0.8	17 ± 5	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$					Γ_{26}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.4±0.9±0.8	18 ± 7	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 2\pi^+ 2\pi^- p\bar{p})/\Gamma_{\text{total}}$					Γ_{28}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.4±0.4±0.4	7 ± 6	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$					Γ_{20}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
7.0±1.1±1.0	80 ± 12	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	
$\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$					Γ_{21}/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
5.4±1.5±1.3	39 ± 11	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$	

$\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

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

$\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{10}/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	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$

$\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{15}/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 $x_p > 0.2$.				

$\Gamma(\gamma\eta(1405))/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.2	90	¹⁷ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$
¹⁷ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.				

$\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{30}/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	$\Upsilon(1S) \rightarrow \gamma X$

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 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	$\Upsilon(1S) \rightarrow \gamma X$

$\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	¹⁸ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
¹⁸ Assuming $B(f_0(980) \rightarrow \pi\pi) = 1$.				

$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$3.7^{+0.9}_{-0.7} \pm 0.8$		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

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

<14	90	¹⁹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19.4	90	¹⁹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

¹⁹ Assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.71$.

$\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.8	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

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

< 6.3	90	²⁰ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19	90	²⁰ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$
< 2.6	90	²⁰ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 8	90	²¹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<24	90	²² SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$

²⁰ Assuming $B(f_0(1710) \rightarrow K\bar{K}) = 0.38$.

²¹ Assuming $B(f_0(1710) \rightarrow \pi\pi) = 0.04$.

²² Assuming $B(f_0(1710) \rightarrow \eta\eta) = 0.18$.

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
10.0 ± 1.0 OUR AVERAGE				
10.2 ± 0.8 ± 0.7		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
8.1 ± 2.3 ^{+2.9} / _{-2.7}		²³ ANASTASSOV	99 CLE2	$e^+ e^- \rightarrow \text{hadrons}$

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

<21	90	²³ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<13	90	²³ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<81	90	SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$

²³ Using $B(f_2(1270) \rightarrow \pi\pi) = 0.84$.

$\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.3	90	²⁴ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

²⁴ Assuming $B(f_4(2050) \rightarrow \pi\pi) = 0.17$.

$\Gamma(\gamma f_J(2220) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 8	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

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

< 160	90	MASEK	02 CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 150	90	FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 290	90	ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<2000	90	BARU	89 MD1	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

$\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{40} / Γ

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

$\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p}) / \Gamma_{\text{total}}$ Γ_{41} / Γ

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

$\Gamma(\gamma \eta(2225) \rightarrow \gamma \phi \phi) / \Gamma_{\text{total}}$ Γ_{42} / Γ

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

$\Gamma(\gamma f_0(2200) \rightarrow \gamma K^+ K^-) / \Gamma_{\text{total}}$ Γ_{38} / Γ

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

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