$\psi(2S)$

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

$\psi(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
3685.96±0.09 OUR AVERAGE					
3685.95±0.10	413	[1] ARTAMONOV	00	OLYA	$e^+e^- \to$ hadrons
3686.02±0.09±0.27		ARMSTRONG	93B	E760	$\overline{p}p \to e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3684 ±2		GRIBUSHIN	96	FMPS	515 π^- Be $\to 2\mu X$
3683 ±5	77	ANTONIAZZI	94	E705	300 $\pi^\pm$, pLi $\to J/\psi\pi^+\pi^-$X
3686.00±0.10	413	[2] ZHOLENTZ	80	OLYA	e^+e^-

[1] Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).
[2] Superseded by ARTAMONOV 00.

$m_{\psi(2S)} - m_{J/\psi(1S)}$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
589.07±0.13 OUR AVERAGE				
589.7 ±1.2	LEMOIGNE	82	GOLI	190 π^- Be $\to 2\mu$
589.07±0.13	[3] ZHOLENTZ	80	OLYA	e^+e^-
588.7 ±0.8	LUTH	75	MRK1	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
588 ±1	[4] BAI	98E	BES	e^+e^-

[3] Redundant with data in mass above.
[4] Systematic errors not evaluated.

$\psi(2S)$ WIDTH

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
277±31 OUR AVERAGE Error includes scale factor of 1.1.				
306±36±16	ARMSTRONG	93B	E760	$\overline{p}p \to e^+e^-$
243±43	[5] PDG	92	RVUE	

[5] Uses $\Gamma(ee)$ from ALEXANDER 89 and $B(ee) = (88 \pm 13) \times 10^{-4}$ from FELDMAN 77.

$\psi(2S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	hadrons	(98.10±0.30) %	
Γ_2	virtual $\gamma \to$ hadrons	(2.9 ±0.4) %	
Γ_3	e^+e^-	(7.9 ±0.5) $\times 10^{-3}$	
Γ_4	$\mu^+\mu^-$	(1.2 ±0.4) %	

Decays into $J/\psi(1S)$ and anything

Γ_5	$J/\psi(1S)$ anything	(61 ±4) %	S=1.1
Γ_6	$J/\psi(1S)$ neutrals	(24.8 ±1.8) %	
Γ_7	$J/\psi(1S)\pi^+\pi^-$	(34.8 ±2.8) %	S=1.1
Γ_8	$J/\psi(1S)\pi^0\pi^0$	(20.3 ±1.8) %	
Γ_9	$J/\psi(1S)\eta$	(2.2 ±0.4) %	S=2.1
Γ_{10}	$J/\psi(1S)\pi^0$	(9.7 ±2.1) $\times 10^{-4}$	

Hadronic decays

Γ_{11}	$3(\pi^+\pi^-)\pi^0$	(3.5 ±1.6) $\times 10^{-3}$	
Γ_{12}	$2(\pi^+\pi^-)\pi^0$	(3.0 ±0.8) $\times 10^{-3}$	
Γ_{13}	$\omega f_2(1270)$	$<$ 1.7 $\times 10^{-4}$	CL=90%
Γ_{14}	$\rho a_2(1320)$	$<$ 2.3 $\times 10^{-4}$	CL=90%
Γ_{15}	$\pi^+\pi^- K^+ K^-$	(1.6 ±0.4) $\times 10^{-3}$	
Γ_{16}	$K^*(892)\overline{K}{}^*_2(1430)^0$	$<$ 1.2 $\times 10^{-4}$	CL=90%
Γ_{17}	$K_1(1270)^{\pm} K^{\mp}$	(1.00±0.28) $\times 10^{-3}$	
Γ_{18}	$\pi^+\pi^- p\overline{p}$	(8.0 ±2.0) $\times 10^{-4}$	
Γ_{19}	$K^+\overline{K}{}^*(892)^0\pi^-$ + c.c.	(6.7 ±2.5) $\times 10^{-4}$	
Γ_{20}	$b_1^{\pm}\pi^{\mp}$	(5.2 ±1.3) $\times 10^{-4}$	
Γ_{21}	$2(\pi^+\pi^-)$	(4.5 ±1.0) $\times 10^{-4}$	
Γ_{22}	$\rho^0\pi^+\pi^-$	(4.2 ±1.5) $\times 10^{-4}$	
Γ_{23}	$\overline{p}p$	(2.01±0.35) $\times 10^{-4}$	
Γ_{24}	$3(\pi^+\pi^-)$	(1.5 ±1.0) $\times 10^{-4}$	
Γ_{25}	$\overline{p}p\pi^0$	(1.4 ±0.5) $\times 10^{-4}$	
Γ_{26}	$\Delta^{++}\overline{\Delta}{}^{--}$	(1.28±0.35) $\times 10^{-4}$	
Γ_{27}	$\Sigma^0\overline{\Sigma}{}^0$	(1.2 ±0.6) $\times 10^{-4}$	
Γ_{28}	$\Sigma^{*+}\overline{\Sigma}{}^{*-}$	(1.1 ±0.4) $\times 10^{-4}$	
Γ_{29}	K^+K^-	(1.0 ±0.7) $\times 10^{-4}$	
Γ_{30}	$\pi^+\pi^-\pi^0$	(8 ±5) $\times 10^{-5}$	
Γ_{31}	$\rho\pi$	$<$ 8.3 $\times 10^{-5}$	CL=90%
Γ_{32}	$\pi^+\pi^-$	(8 ±5) $\times 10^{-5}$	
Γ_{33}	$\Lambda\overline{\Lambda}$	(1.81±0.34) $\times 10^{-4}$	
Γ_{34}	$K_1(1400)^{\pm}K^{\mp}$	$<$ 3.1 $\times 10^{-4}$	CL=90%
Γ_{35}	$\Xi^-\overline{\Xi}{}^+$	(9.4 ±3.1) $\times 10^{-5}$	
Γ_{36}	$\Xi^{*0}\overline{\Xi}{}^{*0}$	$<$ 8.1 $\times 10^{-5}$	CL=90%
Γ_{37}	$\Omega^-\overline{\Omega}{}^+$	$<$ 7.3 $\times 10^{-5}$	CL=90%
Γ_{38}	$K^+K^-\pi^0$	$<$ 2.96 $\times 10^{-5}$	CL=90%
Γ_{39}	$K^+\overline{K}{}^*(892)^-$ + c.c.	$<$ 5.4 $\times 10^{-5}$	CL=90%
Γ_{40}	$\phi f'_2(1525)$	$<$ 4.5 $\times 10^{-5}$	CL=90%

Radiative decays

Γ_{41}	$\gamma \chi_{c0}(1P)$	(9.3 ±0.9) %		
Γ_{42}	$\gamma \chi_{c1}(1P)$	(8.7 ±0.8) %		
Γ_{43}	$\gamma \chi_{c2}(1P)$	(7.9 ±0.8) %		
Γ_{44}	$\gamma \eta_c(1S)$	(2.8 ±0.6) $\times 10^{-3}$		
Γ_{45}	$\gamma \eta_c(2S)$			
Γ_{46}	$\gamma \pi^0$			
Γ_{47}	$\gamma \eta'(958)$	(1.5 ±0.4) $\times 10^{-4}$		
Γ_{48}	$\gamma \eta$	$<$ 9 $\times 10^{-5}$	CL=90%	
Γ_{49}	$\gamma \gamma$	$<$ 1.6 $\times 10^{-4}$	CL=90%	
Γ_{50}	$\gamma \eta(1440) \to \gamma K \overline{K} \pi$	$<$ 1.2 $\times 10^{-4}$	CL=90%	

Mode needed for fitting purposes

Γ_{51}	1. − other fit modes	(16 ±5) %	S=1.1

CONSTRAINED FIT INFORMATION

An overall fit to 11 branching ratios uses 19 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 19.8$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle \delta x_i \delta x_j \right\rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_7	26						
x_8	20	80					
x_9	4	15	19				
x_{41}	0	0	0	0			
x_{42}	0	−1	1	−1	0		
x_{43}	0	0	1	0	0	−1	
x_{51}	−31	−92	−88	−24	−18	−16	−16
	x_4	x_7	x_8	x_9	x_{41}	x_{42}	x_{43}

$\psi(2S)$ PARTIAL WIDTHS

Γ(hadrons) Γ_1

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
224±56	LUTH	75	MRK1	$e^+ e^-$

$\Gamma(e^+e^-)$ Γ_3

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
2.12±0.18 OUR AVERAGE				
2.07±0.32	[6] BAI	98E	BES	e^+e^-
2.14±0.21	ALEXANDER	89	RVUE	See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.0 ±0.3	BRANDELIK	79C	DASP	e^+e^-
2.1 ±0.3	[7] LUTH	75	MRK1	e^+e^-

[6] Value includes radiative corrections computed by ALEXANDER 89.
[7] From a simultaneous fit to e^+e^-, $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

$\Gamma(\gamma\gamma)$ Γ_{49}

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<43	90	BRANDELIK	79C	DASP	e^+e^-

$\psi(2S)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel$_I$ in the e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(I)$ or the branching ratio $\Gamma(I)$/total.

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_3/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.2±0.4	ABRAMS	75	MRK1	e^+e^-

$\psi(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.981 ±0.003	[8] LUTH	75	MRK1	e^+e^-

$\Gamma(\text{virtual}\gamma \to \text{hadrons})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.029±0.004	[9] LUTH	75	MRK1	e^+e^-

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
79± 5 OUR AVERAGE				
74± 2±7	[10] AMBROGIANI	00A	E835	$p\overline{p} \to \psi(2S)X$
83± 5±7	[11] ARMSTRONG	97	E760	$\overline{p}p \to \psi(2S)X$
88±13	[12] FELDMAN	77	RVUE	e^+e^-

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
77±17	[13] HILGER	75	SPEC	e^+e^-

$\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.89 ± 0.16	BOYARSKI 75C	MRK1	e^+e^-

[8] Includes cascade decay into $J/\psi(1S)$.
[9] Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.
[10] Using $B(J/\psi \to e^+e^-) = 0.0602 \pm 0.0019$ and $B(\psi(2S) \to J/\psi(1S)\text{anything}) = 0.57 \pm 0.04$.
[11] Using $B(J/\psi \to e^+e^-) = 0.0599 \pm 0.0025$ and $B(\psi(2S) \to J/\psi(1S)\text{anything}) = 0.57 \pm 0.04$.
[12] From an overall fit assuming equal partial widths for e^+e^- and $\mu^+\mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.
[13] Restated by us using $B(\psi(2S) \to J/\psi(1S)\text{anything}) = 0.55$.

DECAYS INTO $J/\psi(1S)$ AND ANYTHING

$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma = (\Gamma_7+\Gamma_8+\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
0.61±0.04 OUR FIT Error includes scale factor of 1.1.			
0.55±0.07 OUR AVERAGE			
0.51 ± 0.12	BRANDELIK 79C	DASP	$e^+e^- \to \mu^+\mu^- X$
0.57 ± 0.08	ABRAMS 75B	MRK1	$e^+e^- \to \mu^+\mu^- X$

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma = (0.9761\Gamma_8+0.715\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})/\Gamma$

VALUE	DOCUMENT ID
0.248±0.018 OUR FIT	

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\text{anything})$ $\Gamma_6/\Gamma_5 = (0.9761\Gamma_8+0.715\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})/(\Gamma_7+\Gamma_8+\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})$

VALUE	DOCUMENT ID	TECN	COMMENT
0.409±0.013 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.44\ \pm0.03$	[14] ABRAMS 75B	MRK1	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ $\Gamma_6/\Gamma_7 = (0.9761\Gamma_8+0.715\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})/\Gamma_7$

VALUE	DOCUMENT ID	TECN	COMMENT
0.71±0.04 OUR FIT Error includes scale factor of 1.1.			
0.73±0.09	[14] TANENBAUM 76	MRK1	e^+e^-

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.348±0.028 OUR FIT Error includes scale factor of 1.1.				
0.32 ±0.04		ABRAMS 75B	MRK1	$e^+e^- \to J/\psi\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.283\pm0.021\pm0.020$	363	[15] ARMSTRONG 97	E760	$\overline{p}p \to \psi(2S)X$

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma_{total}$ — Γ_8/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.203±0.018 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.184±0.019±0.013	157	[15] ARMSTRONG	97	E760	$\overline{p}p \rightarrow \psi(2S)X$

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$ — $\Gamma_8/\Gamma_5 = \Gamma_8/(\Gamma_7+\Gamma_8+\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})$

VALUE	DOCUMENT ID		TECN	COMMENT
0.335±0.013 OUR FIT				
0.328±0.013±0.008	AMBROGIANI	00A	E835	$p\overline{p} \rightarrow \psi(2S)X$

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ — Γ_8/Γ_7

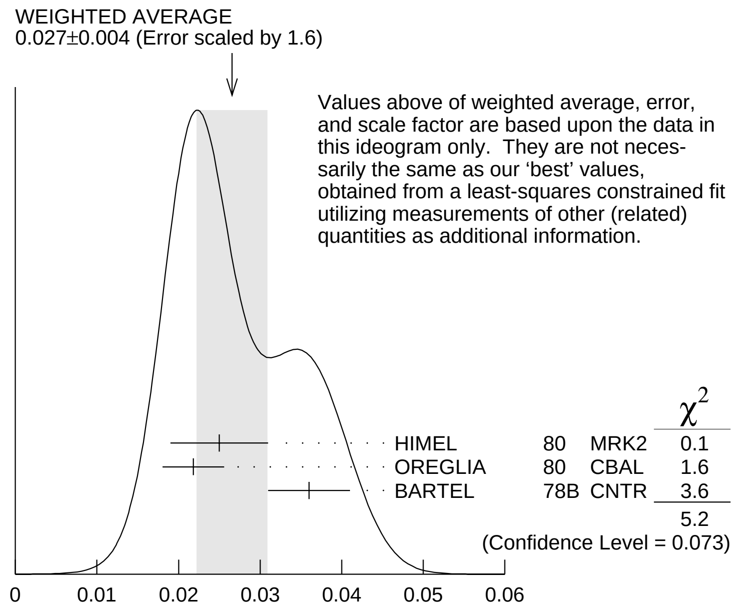
VALUE	DOCUMENT ID		TECN	COMMENT
0.584±0.034 OUR FIT				
0.609±0.079	[16] GU	99	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.53 ±0.06	[17] TANENBAUM	76	MRK1	e^+e^-
0.64 ±0.15	[18] HILGER	75	SPEC	e^+e^-

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(\mu^+\mu^-)$ — Γ_7/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
30 ±10 OUR FIT				
30.2± 7.1±6.8	[19] GRIBUSHIN	96	FMPS	515 π^- Be $\rightarrow 2\mu X$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.022 ±0.004 OUR FIT Error includes scale factor of 2.1.					
0.027 ±0.004 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.					
0.025 ±0.006	166	HIMEL	80	MRK2	e^+e^-
0.0218±0.0014±0.0035	386	OREGLIA	80	CBAL	$e^+e^- \rightarrow J/\psi 2\gamma$
0.036 ±0.005	164	BARTEL	78B	CNTR	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.032 ±0.010 ±0.002	36	[20] ARMSTRONG	97	E760	$\overline{p}p \rightarrow \psi(2S)X$
0.035 ±0.009	17	[20] BRANDELIK	79B	DASP	$e^+e^- \rightarrow J/\psi 2\gamma$
0.043 ±0.008	44	[20] TANENBAUM	76	MRK1	e^+e^-



$\Gamma\big(J/\psi(1S)\eta\big)/\Gamma_{\text{total}}$

$\Gamma\big(J/\psi(1S)\eta\big)/\Gamma\big(J/\psi(1S)\text{anything}\big)$

$\Gamma_9/\Gamma_5 = \Gamma_9/(\Gamma_7+\Gamma_8+\Gamma_9+0.273\Gamma_{42}+0.135\Gamma_{43})$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.036 ±0.007 OUR FIT Error includes scale factor of 2.4.				
0.030 ±0.004 OUR AVERAGE				
0.0282±0.0024±0.0028	AMBROGIANI	00A	E835	$p\overline{p} \rightarrow \psi(2S)X$
0.062 ±0.016	[16] GU	99	RVUE	

$\Gamma\big(J/\psi(1S)\pi^0\big)/\Gamma_{\text{total}}$ — Γ_{10}/Γ

VALUE (units 10^{-4})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
9.7±2.1 OUR AVERAGE					
15 ±6	7	HIMEL	80	MRK2	e^+e^-
9 ±2 ±1	23	OREGLIA	80	CBAL	$\psi(2S) \rightarrow J/\psi 2\gamma$

[14] The ABRAMS 75B measurement of Γ_6/Γ_5 and the TANENBAUM 76 result for Γ_6/Γ_7 are not independent. The TANENBAUM 76 result is used in the fit because it includes more accurate corrections for angular distributions.

[15] Using B($J/\psi \rightarrow e^+e^-$) = 0.0599 ± 0.0025 and B($\psi(2S) \rightarrow J/\psi(1S)$anything)= 0.57 ± 0.04.

[16] Using data from ARMSTRONG 97.

[17] Not independent of the TANENBAUM 76 result for Γ_6/Γ_7.

[18] Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

[19] Using B($J/\psi(1S) \rightarrow \mu^+\mu^-$) = 0.0597 ± 0.0025.

[20] Low statistics data removed from average.

HADRONIC DECAYS

$\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
35±16	6	FRANKLIN	83	MRK2	$e^+e^- \rightarrow$ hadrons

$\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{total}$ — Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
30±8	42	FRANKLIN	83	MRK2	e^+e^-

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{total}$ — Γ_{15}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
16±4	[21] TANENBAUM	78	MRK1	e^+e^-

$\Gamma(K_1(1270)^{\pm}K^{\mp})/\Gamma_{total}$ — Γ_{17}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
10.0±1.8±2.1	[22] BAI	99C	BES	e^+e^-

$\Gamma(\pi^+\pi^-p\overline{p})/\Gamma_{total}$ — Γ_{18}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
8 ±2	[21] TANENBAUM	78	MRK1	e^+e^-

$\Gamma(K^+\overline{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma_{total}$ — Γ_{19}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
6.7±2.5	TANENBAUM	78	MRK1	e^+e^-

$\Gamma(b_1^{\pm}\pi^{\mp})/\Gamma_{total}$ — Γ_{20}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
5.2±0.8±1.0	[23] BAI	99C	BES	e^+e^-

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
4.5±1.0	TANENBAUM	78	MRK1	e^+e^-

$\Gamma(\omega f_2(1270))/\Gamma_{total}$ — Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.7	90	BAI	98J	BES	e^+e^-

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{total}$ — Γ_{22}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
4.2±1.5	TANENBAUM	78	MRK1	e^+e^-

$\Gamma(\rho a_2(1320))/\Gamma_{total}$ — Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.3	90	BAI	98J	BES	e^+e^-

$\Gamma(\overline{p}p)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.01±0.35 OUR AVERAGE					
2.16±0.15±0.36	201	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$
1.4 ±0.8	4	BRANDELIK	79C	DASP	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.3 ±0.7		FELDMAN	77	MRK1	e^+e^-

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{24}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
1.5±1.0	[21] TANENBAUM	78	MRK1	e^+e^-

$\Gamma(\overline{p}p\pi^0)/\Gamma_{total}$ — Γ_{25}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.4±0.5	9	FRANKLIN	83	MRK2	e^+e^-

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
1.0±0.7		BRANDELIK	79C	DASP	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.5	90	FELDMAN	77	MRK1	e^+e^-

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{32}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
0.8±0.5		BRANDELIK	79C	DASP	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.5	90	FELDMAN	77	MRK1	e^+e^-

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
0.85±0.46	4	FRANKLIN	83	MRK2	$e^+e^- \to$ hadrons

$\Gamma(\Lambda\overline{\Lambda})/\Gamma_{total}$ — Γ_{33}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.81±0.20±0.27		80	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4	90		FELDMAN	77	MRK1	e^+e^-

$\Gamma(\Delta^{++}\overline{\Delta}^{--})/\Gamma_{total}$ — Γ_{26}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
12.8±1.0±3.4	157	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$

$\Gamma(\Sigma^0\overline{\Sigma}^0)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
12±4±4	8	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$

$\Gamma(\Sigma^{*+}\overline{\Sigma}^{*-})/\Gamma_{total}$ **Γ_{28}/Γ**

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
11±3±3	14	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$

$\Gamma(K_1(1400)^{\pm}K^{\mp})/\Gamma_{total}$ **Γ_{34}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<3.1	90	[25] BAI	99C	BES	e^+e^-

$\Gamma(\Xi^-\overline{\Xi}^+)/\Gamma_{total}$ **Γ_{35}/Γ**

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
9.4±2.7±1.5		12	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<20	90		FELDMAN	77	MRK1	e^+e^-

$\Gamma(\Xi^{*0}\overline{\Xi}^{*0})/\Gamma_{total}$ **Γ_{36}/Γ**

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<8.1	90	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$

$\Gamma(\Omega^-\overline{\Omega}^+)/\Gamma_{total}$ **Γ_{37}/Γ**

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<7.3	90	[24] BAI	01	BES	$e^+e^- \to \psi(2S)$

$\Gamma(\rho\pi)/\Gamma_{total}$ **Γ_{31}/Γ**

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 0.83	90	1	FRANKLIN	83	MRK2	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<10	90		BARTEL	76	CNTR	e^+e^-
<10	90		[26] ABRAMS	75	MRK1	e^+e^-

$\Gamma(K^+K^-\pi^0)/\Gamma_{total}$ **Γ_{38}/Γ**

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<2.96	90	1	FRANKLIN	83	MRK2	$e^+e^- \to$ hadrons

$\Gamma(K^+\overline{K}^*(892)^- + c.c.)/\Gamma_{total}$ **Γ_{39}/Γ**

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<5.4	90	FRANKLIN	83	MRK2	$e^+e^- \to$ hadrons

$\Gamma(K^*(892)\overline{K}_2^*(1430)^0)/\Gamma_{total}$ **Γ_{16}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.2	90	BAI	98J	BES	e^+e^-

$\Gamma(\phi f'_2(1525))/\Gamma_{total}$ — Γ_{40}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.45	90	BAI	98J	BES	$e^+e^- \to 2(K^+K^-)$

[21] Assuming entirely strong decay.
[22] Assuming $B(K_1(1270) \to K\rho)=0.42 \pm 0.06$
[23] Assuming $B(b_1 \to \omega\pi)=1$.
[24] Estimated using $B(\psi(2S) \to J/\psi\pi^+\pi^-)= 0.310 \pm 0.028$.
[25] Assuming $B(K_1(1400) \to K^*\pi)=0.94 \pm 0.06$
[26] Final state $\rho^0\pi^0$.

RADIATIVE DECAYS

$\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{total}$ — Γ_{41}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
9.3±0.9 OUR FIT				
9.3±0.8 OUR AVERAGE				
9.9±0.5±0.8	[27] GAISER	86	CBAL	$e^+e^- \to \gamma X$
7.2±2.3	[27] BIDDICK	77	CNTR	$e^+e^- \to \gamma X$
7.5±2.6	[27] WHITAKER	76	MRK1	e^+e^-

$\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{total}$ — Γ_{42}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
8.7±0.8 OUR FIT				
8.7±0.8 OUR AVERAGE				
9.0±0.5±0.7	[28] GAISER	86	CBAL	$e^+e^- \to \gamma X$
7.1±1.9	[29] BIDDICK	77	CNTR	$e^+e^- \to \gamma X$

$\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{total}$ — Γ_{43}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
7.9±0.8 OUR FIT				
7.8±0.8 OUR AVERAGE				
8.0±0.5±0.7	[30] GAISER	86	CBAL	$e^+e^- \to \gamma X$
7.0±2.0	[29] BIDDICK	77	CNTR	$e^+e^- \to \gamma X$

$\Gamma(\gamma\eta_c(1S))/\Gamma_{total}$ — Γ_{44}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
0.28±0.06	GAISER	86	CBAL	$e^+e^- \to \gamma X$

$\Gamma(\gamma\eta_c(2S))/\Gamma_{total}$ — Γ_{45}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.2 to 1.3	95	EDWARDS	82C	CBAL	$e^+e^- \to \gamma X$

$\Gamma(\gamma\pi^0)/\Gamma_{total}$ — Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 54	95	[31] LIBERMAN	75	SPEC	e^+e^-
$<$100	90	WIIK	75	DASP	e^+e^-

$\Gamma(\gamma\eta'(958))/\Gamma_{total}$ — Γ_{47}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.54±0.31±0.20		~ 43	BAI	98F	BES	$\psi(2S) \to \pi^+\pi^- 2\gamma$, $\pi^+\pi^- 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<60	90		[32] BRAUNSCH...	77	DASP	e^+e^-
<11	90		[33] BARTEL	76	CNTR	e^+e^-

$\Gamma(\gamma\eta)/\Gamma_{total}$ — Γ_{48}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.9	90	BAI	98F	BES	$\psi(2S) \to \pi^+\pi^- 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2	90	YAMADA	77	DASP	$e^+e^- \to 3\gamma$

$\Gamma(\gamma\eta(1440) \to \gamma K\overline{K}\pi)/\Gamma_{total}$ — Γ_{50}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<0.12	90	[34] SCHARRE	80	MRK1	e^+e^-

[27] Angular distribution ($1+\cos^2\theta$) assumed.
[28] Angular distribution ($1-0.189\cos^2\theta$) assumed.
[29] Valid for isotropic distribution of the photon.
[30] Angular distribution ($1-0.052\cos^2\theta$) assumed.
[31] Restated by us using $B(\psi(2S) \to \mu^+\mu^-) = 0.0077$.
[32] Restated by us using total decay width 228 keV.
[33] The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{total}$.
[34] Includes unknown branching fraction $\eta(1440) \to K\overline{K}\pi$.

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