Erratum

Particle Data Group, J.J. Hernández et al., Review of particle properties, Phys. Lett. B 239 (1990) 1.

• In the expression for the r.m.s. multiple scattering angle, Eq. (6) on page III.14 of the Review and p. 109 of the Data Booklet, the coefficient of the log term should be 0.038 rather than 0.20:

$$\theta_0 = \frac{13.6\ \text{MeV}}{\beta cp}\, z\, \sqrt{x/X_0}\left[1 + 0.038 \ln(x/X_0)\right]. \qquad (6)$$

• The $\psi(2S) \to \pi^+\pi^-$ and $\psi(2S) \to \pi^0\pi^0$ branching ratios in both the Meson Summary Table and the Full Listings are incorrect. We have also improved our handling of the $\psi(2S)$ decays into final states which include a $J/\psi(1S)$ by performing a constrained fit to the available data. The following branching fractions correct the Summary Table, p. II.15 in the Review and p. 58 in the Data Booklet:

$\psi(2S)$ Decays into $J/\psi(1S)$ and anything

$J/\psi(1S)$ anything	(57 ± 4) %		—
$J/\psi(1S)$ neutrals	(23.2 ± 2.6) %		—
$J/\psi(1S)\pi^+\pi^-$	(32.4 ± 2.6) %		477
$J/\psi(1S)\pi^0\pi^0$	(18.4 ± 2.7) %		481
$J/\psi(1S)\eta$	(2.7 ± 0.4) %	S=1.7	196
$J/\psi(1S)\pi^0$	(9.7 ± 2.1) $\times 10^{-4}$		527

We append errata pages VII.153–VII.155 which completely replace the $\psi(2S)$.

• There have been some changes made to some K^* masses and widths:
The ASTON 87 and 88 measurements should not have been excluded in favor of the BIRD 89 measurement for the $K^*(1370)$ and $K^*(1680)$. Using all three experiments, the new **averages** are:

$K^*(1370)$ mass: 1412 ± 12 (Error includes scale factor of 1.1).†
$K^*(1370)$ width: 227 ± 22 (Error includes scale factor of 1.1).†
$K^*(1680)$ mass: 1714 ± 20 (Error includes scale factor of 1.1).†
$K^*(1680)$ width: 323 ± 110 (Error includes scale factor of 4.2).†

The BIRD 89 measurement for the $K^*(892)^-$ mass should be $890.4 \pm 0.2 \pm 0.5$ changing our average to:
$K^*(892)$ mass (charged): 891.59 ± 0.24 (Error includes scale factor of 1.1).†

The BIRD 89 measurement for the $K_3^*(1780)$ mass should be $1720 \pm 10 \pm 15$ changing our average to:
$K_3^*(1780)$ mass: 1770 ± 10 (Error includes scale factor of 1.7).†

†[For the $K^*(1370)$, see pp. II.9 and VII.100 in the Review and p. 36 in the Data Booklet.]
†[For the $K^*(1680)$, see pp. II.10 and VII.105 in the Review and p. 37 in the Data Booklet.]
†[For the $K^*(892)^-$, see pp. II.9 and VII.96 in the Review and p. 35 in the Data Booklet.]
†[For the $K_3^*(1780)$, see pp. II.10 and VII.107 in the Review and p. 38 in the Data Booklet.]

• On page I.6, A. Baldini should be listed at the University of Pisa.

• On page I.14, in the section on the Serpukhov Databases, we provide the following amplification: Copies of the PPDS databases are available on the CERN VAX cluster. CERN VAX users can access the databases with the following command:

PPDS ? (to get help and a list of existing databases, or just use:)
PPDS

Instructions on using the databases are given in the preprint CERN/TH/SIS-89-03.

• On page III.2 of the Review and p. 5 of the Data Booklet, the symbol for the earth's equatorial radius should be $R_\oplus$.

• On page III.24 of the Review and p. 133 of the Data Booklet, in Table 4, the coefficient giving the dose rate from photons (from π^0 decay) in an SSC interaction region should be 124 rather than 400. [An erratum to SSC-SR-1033 has been published as SSCL-285 (1990)].

• On page III.77, the reference to the CERN-HERA group in the table heading should read: A. Baldini, V. Flaminio, and O. Yushchenko (CERN-HERA and COMPAS groups) have done a least-squares fit ...

• On page X.1, the CERN-HERA publications (83-01, 83-02, and 84-01) have been updated in A. Baldini, V. Flaminio, W.G. Moorhead, and D.R.O. Morrison (CERN-HERA and COMPAS groups): *Total Cross Sections for Reactions of High Energy Particles*, Landolt-Börnstein, New Series, Volumes **12a** and **12b**. H. Schopper, ed. (1987).

• Also on page X.1, the fourth publication in the CERN-HERA series was inadvertently omitted. It is *Compilation of Cross Sections: 4. γ, ν, Λ, Σ, Ξ, and K_L^0 Induced Reactions*, CERN-HERA-87-01: CERN-HERA and COMPAS Groups: S.I. Alekhin, A. Baldini, P. Capiluppi, M. Cobal, V.V. Ezhela, V. Flaminio, G. Giacomelli, S.B. Lugovskii, G. Mandrioli, W.G. Moorhead, D.R.O. Morrison, N. Rivoire, A.M. Rossi, P. Serra, A.N. Tolstenkov, and O.P. Yushchenko.

$\psi(2S)$ or $\psi(3685)$

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

$\psi(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
3686.00±0.10	413	ZHOLENTZ	80	OLYA	e^+e^-

$\psi(2S) - J/\psi(1S)$ MASS DIFFERENCE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
589.07±0.13 OUR AVERAGE				
589.7 ±1.2	LEMOIGNE	82	GOLI	190 GeV π^- Be → 2μ
589.07±0.13	[1] ZHOLENTZ	80	OLYA	e^+e^-
588.7 ±0.8	LUTH	75	MRK1	

[1] Redundant with data in mass above.

$\psi(2S)$ WIDTH

VALUE (keV)	DOCUMENT ID
243±43 OUR EVALUATION	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 γ → hadrons	(2.9 ±0.4) %	
Γ_3	e^+e^-	(8.8 ±1.3) × 10^{-3}	
Γ_4	$\mu^+\mu^-$	(7.7 ±1.7) × 10^{-3}	
	Decays into $J/\psi(1S)$ and anything		
Γ_5	$J/\psi(1S)$ anything	(57 ±4) %	
Γ_6	$J/\psi(1S)$ neutrals	(23.2 ±2.6) %	
Γ_7	$J/\psi(1S)\pi^+\pi^-$	(32.4 ±2.6) %	
Γ_8	$J/\psi(1S)\pi^0\pi^0$	(18.4 ±2.7) %	
Γ_9	$J/\psi(1S)\eta$	(2.7 ±0.4) %	S=1.7
Γ_{10}	$J/\psi(1S)\pi^0$	(9.7 ±2.1) × 10^{-4}	
	Hadronic decays		
Γ_{11}	$3(\pi^+\pi^-)\pi^0$	(3.5 ±1.6) × 10^{-3}	
Γ_{12}	$2(\pi^+\pi^-)\pi^0$	(3.1 ±0.7) × 10^{-3}	
Γ_{13}	$\pi^+\pi^- K^+ K^-$	(1.6 ±0.4) × 10^{-3}	
Γ_{14}	$\pi^+\pi^- p\bar{p}$	(8.0 ±2.0) × 10^{-4}	
Γ_{15}	$K^+\bar{K}^*(892)^0\pi^-$ + c.c.	(6.7 ±2.5) × 10^{-4}	
Γ_{16}	$2(\pi^+\pi^-)$	(4.5 ±1.0) × 10^{-4}	
Γ_{17}	$\rho^0\pi^+\pi^-$	(4.2 ±1.5) × 10^{-4}	
Γ_{18}	$\bar{p}p$	(1.9 ±0.5) × 10^{-4}	
Γ_{19}	$3(\pi^+\pi^-)$	(1.5 ±1.0) × 10^{-4}	
Γ_{20}	$\bar{p}p\pi^0$	(1.4 ±0.5) × 10^{-4}	
Γ_{21}	K^+K^-	(1.0 ±0.7) × 10^{-4}	
Γ_{22}	$\pi^+\pi^-$	(8 ±5) × 10^{-5}	
Γ_{23}	$\pi^+\pi^-\pi^0$	(8 ±5) × 10^{-5}	
Γ_{24}	$\Lambda\bar{\Lambda}$	< 4 × 10^{-4}	CL=90%
Γ_{25}	$\Xi^-\bar{\Xi}^+$	< 2 × 10^{-4}	CL=90%
Γ_{26}	$\rho\pi$	< 8.3 × 10^{-5}	CL=90%
Γ_{27}	$K^+K^-\pi^0$	< 2.96 × 10^{-5}	CL=90%
Γ_{28}	$K^+\bar{K}^*(892)^-$ + c.c.	< 1.79 × 10^{-5}	CL=90%
	Radiative decays		
Γ_{29}	$\gamma\chi_{c0}(1P)$	(9.3 ±0.8) %	
Γ_{30}	$\gamma\chi_{c1}(1P)$	(8.7 ±0.8) %	
Γ_{31}	$\gamma\chi_{c2}(1P)$	(7.8 ±0.8) %	
Γ_{32}	$\gamma\eta_c(1S)$	(2.8 ±0.6) × 10^{-3}	
Γ_{33}	$\gamma\eta_c(2S)$		
Γ_{34}	$\gamma\pi^0$	< 5.4 × 10^{-3}	CL=95%
Γ_{35}	$\gamma\eta'(958)$	< 1.1 × 10^{-3}	CL=90%
Γ_{36}	$\gamma\eta$	< 2 × 10^{-4}	CL=90%
Γ_{37}	$\gamma\gamma$	< 1.8 × 10^{-4}	CL=90%
Γ_{38}	$\gamma\eta(1440)$ → $\gamma K\bar{K}\pi$	[a] < 1.2 × 10^{-4}	CL=90%
	Mode needed for fitting purposes		
Γ_{39}	other fit modes	(30 ±4) %	

[a] See $\eta(1440)$ mini-review.

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 13 measurements and one constraint to determine 6 parameters. The overall fit has a $\chi^2 = 6.9$ for 8 degrees of freedom.

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

x_8	35				
x_9	0	−11			
x_{30}	1	−7	0		
x_{31}	0	−3	0	0	
x_{39}	−80	−78	−4	−14	−16
	x_7	x_8	x_9	x_{30}	x_{31}

$\psi(2S)$ 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
2.14±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	[2] LUTH	75	MRK1	e^+e^-

[2] From a simultaneous fit to e^+e^-, $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$

$\Gamma(\gamma\gamma)$ Γ_{37}

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

$\psi(2S)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma$(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.

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

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

Γ(hadrons)/Γ_{total} Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.981±0.003	[3] LUTH	75	MRK1	e^+e^-

Γ(virtual γ → hadrons)/Γ_{total} Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.029±0.004	[4] LUTH	75	MRK1	e^+e^-

$\Gamma(e^+e^-)/\Gamma_{total}$ Γ_3/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
88±13	[5] FELDMAN	77	RVUE	e^+e^-

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
77±17	[6] HILGER	75	SPEC	e^+e^-

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.89±0.16	BOYARSKI	75C	MRK1	e^+e^-

[3] Includes cascade decay into $J/\psi(1S)$.

[4] Included in Γ(hadrons)/Γ_{total}.

[5] 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.

[6] Restated by us using $B(\psi(2S) \to J/\psi(1S)$ anything$) = 0.55$.

Meson Full Listings ERRATA

$\psi(2S) = \psi(3685)$

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

$\Gamma(J/\psi(1S)\text{ anything})/\Gamma_{total}$ Γ_5/Γ $(\Gamma_7+\Gamma_8+\Gamma_9+.273\Gamma_{30}+.135\Gamma_{31})/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
0.57±0.04 OUR FIT			
0.55±0.07 OUR AVERAGE			
0.51±0.12	BRANDELIK 79C	DASP	e^+e^-
0.57±0.08	ABRAMS 75B	MRK1	e^+e^-

$\Gamma(J/\psi(1S)\text{ neutrals})/\Gamma_{total}$ Γ_6/Γ $(.9761\Gamma_8+.708\Gamma_9+.273\Gamma_{30}+.135\Gamma_{31})/\Gamma$

VALUE	DOCUMENT ID
0.232±0.026 OUR FIT	

$\Gamma(J/\psi(1S)\text{ neutrals})/\Gamma(J/\psi(1S)\text{ anything})$ Γ_6/Γ_5 $(.9761\Gamma_8+.708\Gamma_9+.273\Gamma_{30}+.135\Gamma_{31})/(\Gamma_7+\Gamma_8+\Gamma_9+.273\Gamma_{30}+.135\Gamma_{31})$

VALUE	DOCUMENT ID	TECN	COMMENT
0.409±0.026 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.44 ±0.03	[7] ABRAMS 75B	MRK1	$e^+e^- \to J/\psi$

$\Gamma(J/\psi(1S)\text{ neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_6/Γ_7 $(.9761\Gamma_8+.708\Gamma_9+.273\Gamma_{30}+.135\Gamma_{31})/\Gamma_7$

VALUE	DOCUMENT ID	TECN	COMMENT
0.72±0.08 OUR FIT			
0.73±0.09	[7] TANENBAUM 76	MRK1	e^+e^-

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.324±0.026 OUR FIT			
0.332±0.033 OUR AVERAGE			
0.32 ±0.04	ABRAMS 75B	MRK1	$e^+e^- \to J/\psi\pi^+\pi^-$
0.36 ±0.06	WIIK 75	DASP	$e^+e^- \to J/\psi\pi^+\pi^-$

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

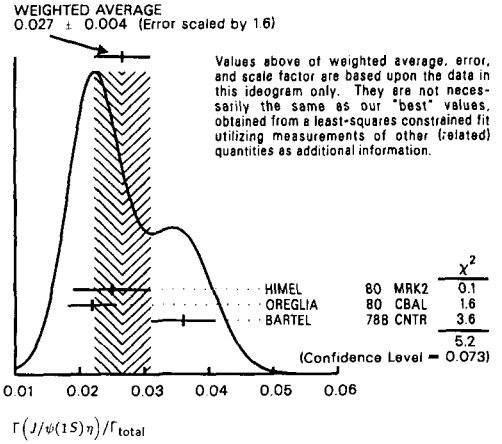
VALUE	DOCUMENT ID	TECN	COMMENT
0.184±0.027 OUR FIT			
0.18 ±0.06	WIIK 75	DASP	$e^+e^- \to J/\psi 2\pi^0$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.57±0.08 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.53±0.06	[8] TANENBAUM 76	MRK1	e^+e^-
0.64±0.15	[9] HILGER 75	SPEC	e^+e^-

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.027 ±0.004 OUR FIT Error includes scale factor of 1.7.					
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	$e^+e^- \to J/\psi 2\gamma$
0.036 ±0.005	164	BARTEL	78B	CNTR	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.035 ±0.009	17	[10] BRANDELIK	79B	DASP	$e^+e^- \to J/\psi 2\gamma$
0.043 ±0.008	44	[10] TANENBAUM	76	MRK1	e^+e^-



$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{total}$ 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	$\psi(2S) \to J/\psi 2\gamma$

[7] 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.
[8] Not independent of the TANENBAUM 76 result for Γ_6/Γ_7.
[9] Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.
[10] 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^- → hadrons

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
31± 7 OUR AVERAGE					
30± 8	42	FRANKLIN	83	MRK2	e^+e^-
35±15		ABRAMS	75	MRK1	e^+e^-

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{total}$ Γ_{13}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
16±4	[11] TANENBAUM	78	MRK1	e^+e^-

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
8±2	[11] TANENBAUM	78	MRK1	e^+e^-

$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma_{total}$ Γ_{15}/Γ

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

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{16}/Γ

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

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{total}$ Γ_{17}/Γ

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

$\Gamma(\bar{p}p)/\Gamma_{total}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.9±0.5 OUR AVERAGE					
1.4±0.8	4	BRANDELIK	79C	DASP	e^+e^-
2.3±0.7		FELDMAN	77	MRK1	e^+e^-

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
1.5±1.0	[11] TANENBAUM	78	MRK1	e^+e^-

$\Gamma(\bar{p}p\pi^0)/\Gamma_{total}$ Γ_{20}/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_{21}/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_{22}/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_{23}/Γ

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

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{total}$ Γ_{24}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<4	90	FELDMAN	77	MRK1	e^+e^-

$\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{total}$ Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2	90	FELDMAN	77	MRK1	e^+e^-

See key on page IV.1

Meson Full Listings ERRATA

$\psi(2S) = \psi(3685)$

$\Gamma(\rho\pi)/\Gamma_{total}$ Γ_{26}/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		[12] ABRAMS	75	MRK1	e^+e^-

$\Gamma(K^+K^-\pi^0)/\Gamma_{total}$ Γ_{27}/Γ

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

$\Gamma(K^+\overline{K}^*(892)^- + \text{c.c.})/\Gamma_{total}$ Γ_{28}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<1.79	90	0	FRANKLIN	83	MRK2	$e^+e^- \rightarrow$ hadrons

[11] Assuming entirely strong decay.
[12] Final state $\rho^0\pi^0$.

RADIATIVE DECAYS

$\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{total}$ Γ_{29}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
9.3±0.8 OUR AVERAGE				
9.9±0.5±0.8	[13] GAISER	86	CBAL	$e^+e^- \rightarrow \gamma X$
7.2±2.3	[13] BIDDICK	77	CNTR	$e^+e^- \rightarrow \gamma X$
7.5±2.6	[13] WHITAKER	76	MRK1	e^+e^-

$\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{total}$ Γ_{30}/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	[14] GAISER	86	CBAL	$e^+e^- \rightarrow \gamma X$
7.1±1.9	[15] BIDDICK	77	CNTR	$e^+e^- \rightarrow \gamma X$

$\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{total}$ Γ_{31}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
7.8±0.8 OUR FIT				
7.8±0.8 OUR AVERAGE				
8.0±0.5±0.7	[16] GAISER	86	CBAL	$e^+e^- \rightarrow \gamma X$
7.0±2.0	[15] BIDDICK	77	CNTR	$e^+e^- \rightarrow \gamma X$

$\Gamma(\gamma\eta_c(1S))/\Gamma_{total}$ Γ_{32}/Γ

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

$\Gamma(\gamma\eta_c(2S))/\Gamma_{total}$ Γ_{33}/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	$e^+e^- \rightarrow \gamma X$

$\Gamma(\gamma\pi^0)/\Gamma_{total}$ Γ_{34}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 54	95	[17] LIBERMAN	75	SPEC	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<100	90	WIIK	75	DASP	e^+e^-

$\Gamma(\gamma\eta'(958))/\Gamma_{total}$ Γ_{35}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
<0.11	90	[18] BARTEL	76	CNTR	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.6	90	[19] BRAUNSCH...	77	DASP	e^+e^-

$\Gamma(\gamma\eta)/\Gamma_{total}$ Γ_{36}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	90	YAMADA	77	DASP	$e^+e^- \rightarrow 3\gamma$

$\Gamma(\gamma\eta(1440) \rightarrow \gamma K\overline{K}\pi)/\Gamma_{total}$ Γ_{38}/Γ

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

[13] Angular distribution $(1+\cos^2\theta)$ assumed.
[14] Angular distribution $(1-0.189\cos^2\theta)$ assumed.
[15] Valid for isotropic distribution of the photon.
[16] Angular distribution $(1-0.052\cos^2\theta)$ assumed.
[17] Restated by us using $B(\psi(2S) \rightarrow \mu^+\mu^-) = 0.0077$.
[18] The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{total}$.
[19] Restated by us using total decay width 228 keV.

$\psi(2S)$ REFERENCES

ALEXANDER	89	NP B320 45	+Bonvicini, Dreil, Frey, Luth (LBL, MICH, SLAC)
GAISER	86	PR D34 711	+Bloom, Bulos, Godfrey+ (Crystal Ball Collab.)
FRANKLIN	83	PRL 51 963	+Franklin, Feldman, Abrams, Alam+ (LBL, SLAC)
EDWARDS	82C	PRL 48 70	+Partridge, Peck+ (CIT, HARV, PRIN, STAN, SLAC)
LEMOIGNE	82	PL 113B 509	+Barate, Astbury+ (SACL, LOIC, SHMP, IND)
HIMEL	80	PRL 44 920	+Abrams, Alam, Blocker+ (LBL, SLAC)
OREGLIA	80	PRL 45 959	+Partridge+ (SLAC, CIT, HARV, PRIN, STAN)
SCHARRE	80	PL 97B 329	+Trilling, Abrams, Alam, Blocker+ (SLAC, LBL)
ZHOLENTZ	80	PL 96B 214	+Kurdadze, Lelchuk, Mishnev+ (NOVO)
Also	81	SJNP 34 814	Zholentz, Kurdadze, Lelchuk+ (NOVO)
		Translated from YAF 34 1471.	
BRANDELIK	79B	NP B160 426	+Cords+ (AACH, DESY, HAMB, MPIM, TOKY)
BRANDELIK	79C	ZPHY C1 233	+ (AACH, DESY, HAMB, MPIM, TOKY)
BARTEL	78B	PL 79B 492	+Dittmann, Duinker, Olsson, O'Neill+ (DESY, HEID)
TANENBAUM	78	PR D17 1731	+Alam, Boyarski+ (SLAC, LBL)
BIDDICK	77	PRL 38 1324	+Burnett+ (UCSD, UMD, PAVI, PRIN, SLAC, STAN)
BRAUNSCH...	77	PL 67B 249	Braunschweig+ (AACH, DESY, HAMB, MPIM+)
BURMESTER	77	PL 66B 395	+Criegee+ (DESY, HAMB, SIEG, WUPP)
FELDMAN	77	PL 33C 285	+Perl (LBL, SLAC)
YAMADA	77	Hamburg Conf. 69	(DESY, TOKY)
BARTEL	76	PL 64B 483	+Duinker, Olsson, Steffen, Heintze+ (DESY, HEID)
TANENBAUM	76	PRL 36 402	+Abrams, Boyarski Bulos+ (SLAC, LBL) IG
WHITAKER	76	PRL 37 1596	+Tanenbaum, Abrams, Alam+ (SLAC, LBL)
ABRAMS	75	Stanford Symp. 25	(LBL)
ABRAMS	75B	PRL 34 1181	+Briggs, Chinowsky, Friedberg+ (LBL, SLAC)
BOYARSKI	75C	Palermo Conf. 54	+Breidenbach, Bulos, Abrams, Briggs+ (SLAC, LBL)
HILGER	75	PRL 35 625	+Beron, Ford, Hofstadter, Howell+ (STAN, PENN)
LIBERMAN	75	Stanford Symp. 55	(STAN)
LUTH	75	PRL 35 1124	+Boyarski, Lynch, Breidenbach+ (SLAC, LBL) JPC
WIIK	75	Stanford Symp. 69	(DESY)

OTHER RELATED PAPERS

BARATE	83	PL 121B 449	+Bareyre, Bonamy+ (SACL, LOIC, SHMP, IND)
FRANKLIN	83B	SLAC-254 Thesis	(STAN)
BARATE	81	PR D24 2994	+Astbury+ (SACL, LOIC, SHMP, CERN, IND)
PARTRIDGE	80B	PRL 45 1150	+Peck+ (CIT, HARV, PRIN, STAN, SLAC)
BURMESTER	77	PL 66B 395	+Criegee+ (DESY, HAMB, SIEG, WUPP)
SNYDER	76	PRL 36 1415	+Hom, Lederman, Appel+ (COLU, FNAL, STON)
AUBERT	75B	PRL 33 1624	+Becker, Biggs, Burger, Glenn+ (MIT, BNL)
BRAUNSCH...	75B	PL 57B 407	Braunschweig+ (AACH, DESY, MPIM, TOKY)
CAMERINI	75	PRL 35 483	+Learned, Prepost, Ash, Anderson+ (WISC, SLAC)
FELDMAN	75B	PRL 35 821	+Jean-Marie, Sadoulet, Vannucci+ (LBL, SLAC)
GRECO	75	PL 56B 367	+Pancheri-Srivastava, Srivastava (FRAS)
JACKSON	75	NIM 128 13	+Scharre (LBL)
SIMPSON	75	PRL 35 699	+Beron, Ford, Hilger, Hofstadter+ (STAN, PENN)
ABRAMS	74	PRL 33 1453	+Briggs, Augustin, Boyarski+ (LBL, SLAC)

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