OTHER RELATED PAPERS

BARATE	83	PL 121B 449	+Bareyre, Bonamy+	(SACL, LOIC, SHMP, IND)
FELDMAN	75B	PRL 35 821	+Jean-Marie, Sadoulet, Vannucci+	(LBL, SLAC)
Also Erratum.	75C	PRL 35 1189	Feldman	
TANENBAUM	75	PRL 35 1323	+Whitaker, Abrams+	(LBL, SLAC)

$\eta_c(2S)$ or $\eta_c(3590)$

$I^G(J^{PC}) = ?^?(?^{?+})$

OMITTED FROM SUMMARY TABLE

Our latest mini-review on this particle can be found in the 1984 edition. Needs confirmation.

$\eta_c(2S)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
3594.0±5.0	[1] EDWARDS	82C	CBAL	$e^+e^- \to \gamma X$

[1] Assuming mass of $\psi(2S)$ = 3686 MeV.

$\eta_c(2S)$ WIDTH

VALUE (MeV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95	EDWARDS	82C	CBAL	$e^+e^- \to \gamma X$

$\eta_c(2S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	hadrons	seen
Γ_2	$\gamma\gamma$	

$\eta_c(2S)$ BRANCHING RATIOS

Γ(hadrons)/Γ_{total} **Γ_1/Γ**

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
seen	EDWARDS	82C	CBAL	$e^+e^- \to \gamma X$

$\Gamma(\gamma\gamma)/\Gamma_{total}$ **Γ_2/Γ**

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.01	90	LEE	85	CBAL	$\psi' \to$ photons

$\eta_c(2S)$ REFERENCES

LEE	85	SLAC 282		(SLAC)
EDWARDS	82C	PRL 48 70	+Partridge, Peck+	(CIT, HARV, PRIN, STAN, SLAC)

OTHER RELATED PAPERS

OREGLIA	82	PR D25 2259	+Partridge+	(SLAC, CIT, HARV, PRIN, STAN)
PORTER	81	SLAC Summer Inst. 355	+Edwards+	(CIT, HARV, PRIN, STAN, SLAC)
BARTEL	78B	PL 79B 492	+Dittmann, Duinker, Olsson, O'Neill+	(DESY, HEIDP)

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

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

$\psi(2S)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3686.00±0.09 OUR AVERAGE					
3686.02±0.09±0.27		ARMSTRONG	93B	SPEC	$\overline{p}p \to e^+e^-$
3686.00±0.10	413	ZHOLENTZ	80	OLYA	e^+e^-

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

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
589.07±0.13 OUR AVERAGE				
589.7 ±1.2	LEMOIGNE	82	GOLI	190 GeV π^- Be $\to 2\mu$
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*		*TECN*	*COMMENT*
277±31 OUR AVERAGE Error includes scale factor of 1.1.				
306±36±16	ARMSTRONG	93B	SPEC	$\overline{p}p \to e^+e^-$
243±43	[2] PDG	92	RVUE	

[2] 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^-	(8.8 ±1.3) $\times 10^{-3}$	
Γ_4	$\mu^+\mu^-$	(7.7 ±1.7) $\times 10^{-3}$	
	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) $\times 10^{-4}$	
	Hadronic decays		
Γ_{11}	$3(\pi^+\pi^-)\pi^0$	(3.5 ±1.6) $\times 10^{-3}$	
Γ_{12}	$2(\pi^+\pi^-)\pi^0$	(3.1 ±0.7) $\times 10^{-3}$	
Γ_{13}	$\pi^+\pi^-K^+K^-$	(1.6 ±0.4) $\times 10^{-3}$	
Γ_{14}	$\pi^+\pi^-p\overline{p}$	(8.0 ±2.0) $\times 10^{-4}$	
Γ_{15}	$K^+\overline{K}^*(892)^0\pi^-$ + c.c.	(6.7 ±2.5) $\times 10^{-4}$	
Γ_{16}	$2(\pi^+\pi^-)$	(4.5 ±1.0) $\times 10^{-4}$	
Γ_{17}	$\rho^0\pi^+\pi^-$	(4.2 ±1.5) $\times 10^{-4}$	
Γ_{18}	$\overline{p}p$	(1.9 ±0.5) $\times 10^{-4}$	
Γ_{19}	$3(\pi^+\pi^-)$	(1.5 ±1.0) $\times 10^{-4}$	
Γ_{20}	$\overline{p}p\pi^0$	(1.4 ±0.5) $\times 10^{-4}$	
Γ_{21}	K^+K^-	(1.0 ±0.7) $\times 10^{-4}$	
Γ_{22}	$\pi^+\pi^-\pi^0$	(9 ±5) $\times 10^{-5}$	
Γ_{23}	$\pi^+\pi^-$	(8 ±5) $\times 10^{-5}$	
Γ_{24}	$\Lambda\overline{\Lambda}$	< 4 $\times 10^{-4}$	CL=90%
Γ_{25}	$\Xi^-\overline{\Xi}^+$	< 2 $\times 10^{-4}$	CL=90%
Γ_{26}	$\rho\pi$	< 8.3 $\times 10^{-5}$	CL=90%
Γ_{27}	$K^+K^-\pi^0$	< 2.96 $\times 10^{-5}$	CL=90%
Γ_{28}	$K^+\overline{K}^*(892)^-$ + c.c.	< 1.79 $\times 10^{-5}$	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) $\times 10^{-3}$	
Γ_{33}	$\gamma\eta_c(2S)$		
Γ_{34}	$\gamma\pi^0$	< 5.4 $\times 10^{-3}$	CL=95%
Γ_{35}	$\gamma\eta'(958)$	< 1.1 $\times 10^{-3}$	CL=90%
Γ_{36}	$\gamma\eta$		
Γ_{37}	$\gamma\gamma$	< 1.6 $\times 10^{-4}$	CL=90%
Γ_{38}	$\gamma\eta(1440) \to \gamma K\overline{K}\pi$	[a] < 1.2 $\times 10^{-4}$	CL=90%
	Mode needed for fitting purposes		
Γ_{39}	1. − other fit modes	(30 ±4) %	

[a] See the "Note on the $\eta(1440)$" in the $\eta(1440)$ Full Listings.

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 χ^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}