η

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

We have omitted some results that have been superseded by later experiments. The omitted results may be found in our 1988 edition Physics Letters **B204** (1988).

η MASS

The new measurements from CLEO-c and KLOE seem to resolve the obvious inconsistency of the previously available high-precision η mass measurements by NA48 (LAI 02) and GEM (ABDEL-BARY 05) in favor of the higher η mass from NA48. Therefore we now use only the results from LAI 02, MILLER 07, and AMBROSINO 07B for our η mass average.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
547.853±0.024 OUR AVERAGE					
547.874±0.007±0.029		AMBROSINO	07B	KLOE	$e^+e^- \to \phi \to \eta\gamma$
547.785±0.017±0.057	16k	MILLER	07	CLEO	$\psi(2S) \to J/\psi\eta$
547.843±0.030±0.041	1134	LAI	02	NA48	$\eta \to 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
547.311±0.028±0.032		[1] ABDEL-BARY	05	SPEC	$dp \to {}^3\mathrm{He}\,X$
547.12 ±0.06 ±0.25		KRUSCHE	95D	SPEC	$\gamma p \to \eta p$, threshold
547.30 ±0.15		PLOUIN	92	SPEC	$dp \to \eta\,{}^3\mathrm{He}$
547.45 ±0.25		DUANE	74	SPEC	$\pi^- p \to n$ neutrals
548.2 ±0.65		FOSTER	65C	HBC	
549.0 ±0.7	148	FOELSCHE	64	HBC	
548.0 ±1.0	91	ALFF-...	62	HBC	
549.0 ±1.2	53	BASTIEN	62	HBC	

[1] ABDEL-BARY 05 disagrees significantly with the measurements of similar precision by LAI 02, MILLER 07, and AMBROSINO 07B. See comment in the header.

η WIDTH

This is the partial decay rate $\Gamma(\eta \to \gamma\gamma)$ divided by the fitted branching fraction for that mode. See the note at the start of the $\Gamma(2\gamma)$ data block, next below.

VALUE (keV)	*DOCUMENT ID*
1.30±0.07 OUR FIT	

η DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Neutral modes			
Γ_1	neutral modes		(71.91 ± 0.34) %	S=1.2
Γ_2	2γ	[a]	(39.31 ± 0.20) %	S=1.1
Γ_3	$3\pi^0$		(32.56 ± 0.23) %	S=1.1
Γ_4	$\pi^0 2\gamma$		$(4.4\pm1.5)\times10^{-4}$	S=2.0
Γ_5	$\pi^0\pi^0\gamma\gamma$		$< 1.2 \times 10^{-3}$	CL=90%
Γ_6	4γ		$< 2.8 \times 10^{-4}$	CL=90%
Γ_7	invisible		$< 6 \times 10^{-4}$	CL=90%

Charged modes

Γ_8	charged modes		(28.06 ± 0.34) %	S=1.2
Γ_9	$\pi^+ \pi^- \pi^0$		(22.73 ± 0.28) %	S=1.2
Γ_{10}	$\pi^+ \pi^- \gamma$		(4.60 ± 0.16) %	S=2.1
Γ_{11}	$e^+ e^- \gamma$		$(6.8 \pm 0.8) \times 10^{-3}$	S=1.7
Γ_{12}	$\mu^+ \mu^- \gamma$		$(3.1 \pm 0.4) \times 10^{-4}$	
Γ_{13}	$e^+ e^-$		$< 7.7 \times 10^{-5}$	CL=90%
Γ_{14}	$\mu^+ \mu^-$		$(5.8 \pm 0.8) \times 10^{-6}$	
Γ_{15}	$e^+ e^- e^+ e^-$		$< 6.9 \times 10^{-5}$	CL=90%
Γ_{16}	$\pi^+ \pi^- e^+ e^-$		$(4.2 \pm 1.2) \times 10^{-4}$	
Γ_{17}	$\pi^+ \pi^- 2\gamma$		$< 2.0 \times 10^{-3}$	
Γ_{18}	$\pi^+ \pi^- \pi^0 \gamma$		$< 5 \times 10^{-4}$	CL=90%
Γ_{19}	$\pi^0 \mu^+ \mu^- \gamma$		$< 3 \times 10^{-6}$	CL=90%

Charge conjugation (*C*), Parity (*P*), Charge conjugation × Parity (*CP*), or Lepton Family number (*LF*) violating modes

Γ_{20}	$\pi^0 \gamma$	*C*	$< 9 \times 10^{-5}$	CL=90%
Γ_{21}	$\pi^+ \pi^-$	*P,CP*	$< 1.3 \times 10^{-5}$	CL=90%
Γ_{22}	$\pi^0 \pi^0$	*P,CP*	$< 3.5 \times 10^{-4}$	CL=90%
Γ_{23}	$\pi^0 \pi^0 \gamma$	*C*	$< 5 \times 10^{-4}$	CL=90%
Γ_{24}	$\pi^0 \pi^0 \pi^0 \gamma$	*C*	$< 6 \times 10^{-5}$	CL=90%
Γ_{25}	3γ	*C*	$< 1.6 \times 10^{-5}$	CL=90%
Γ_{26}	$4\pi^0$	*P,CP*	$< 6.9 \times 10^{-7}$	CL=90%
Γ_{27}	$\pi^0 e^+ e^-$	*C* [b]	$< 4 \times 10^{-5}$	CL=90%
Γ_{28}	$\pi^0 \mu^+ \mu^-$	*C* [b]	$< 5 \times 10^{-6}$	CL=90%
Γ_{29}	$\mu^+ e^- + \mu^- e^+$	*LF*	$< 6 \times 10^{-6}$	CL=90%

[a] Due to removing an old measurement from the average, this is 0.11 keV larger than the width we gave in our 2002 edition, 1.18 ± 0.11 keV. See the $\Gamma(2\gamma)$ data block in the Data Listings.

[b] *C* parity forbids this to occur as a single-photon process.

CONSTRAINED FIT INFORMATION

An overall fit to a decay rate and 20 branching ratios uses 49 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 50.9$ for 41 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_3	26							
x_4	−2	−2						
x_9	−64	−71	−2					
x_{10}	−44	−45	−1	11				
x_{11}	−11	−11	0	−10	−4			
x_{12}	0	0	0	−1	0	0		
x_{16}	−1	−1	0	−2	−1	0	0	
Γ	−10	−3	0	6	4	1	0	0
	x_2	x_3	x_4	x_9	x_{10}	x_{11}	x_{12}	x_{16}

	Mode	Rate (keV)	Scale factor
Γ_2	2γ	[a] 0.510 ±0.026	
Γ_3	$3\pi^0$	0.423 ±0.022	
Γ_4	$\pi^0 2\gamma$	(5.7 ±2.0) × 10^{-4}	1.9
Γ_9	$\pi^+\pi^-\pi^0$	0.295 ±0.016	
Γ_{10}	$\pi^+\pi^-\gamma$	0.060 ±0.004	1.2
Γ_{11}	$e^+e^-\gamma$	0.0089±0.0011	1.5
Γ_{12}	$\mu^+\mu^-\gamma$	(4.0 ±0.6) × 10^{-4}	
Γ_{16}	$\pi^+\pi^-e^+e^-$	(5.5 ±1.5) × 10^{-4}	

η DECAY RATES

$\Gamma(2\gamma)$ Γ_2

See the table immediately above giving the fitted decay rates. Following the advice of NEFKENS 02, we have removed the Primakoff-effect measurement from the average. See also the "Note on the Decay Width $\Gamma(\eta \to \gamma\gamma)$," in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1451, for a discussion of the various measurements.

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.510±0.026 OUR FIT					
0.510±0.026 OUR AVERAGE					
0.51 ±0.12 ±0.05	36	BARU	90	MD1	$e^+e^- \to e^+e^-\eta$
0.490±0.010±0.048	2287	ROE	90	ASP	$e^+e^- \to e^+e^-\eta$
0.514±0.017±0.035	1295	WILLIAMS	88	CBAL	$e^+e^- \to e^+e^-\eta$
0.53 ±0.04 ±0.04		BARTEL	85E	JADE	$e^+e^- \to e^+e^-\eta$

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

0.64 ±0.14 ±0.13		AIHARA	86	TPC	$e^+e^- \to e^+e^-\eta$
0.56 ±0.16	56	WEINSTEIN	83	CBAL	$e^+e^- \to e^+e^-\eta$
0.324±0.046		BROWMAN	74B	CNTR	Primakoff effect
1.00 ±0.22		[2] BEMPORAD	67	CNTR	Primakoff effect

[2] BEMPORAD 67 gives $\Gamma(2\gamma) = 1.21 \pm 0.26$ keV assuming $\Gamma(2\gamma)/\Gamma(\text{total}) = 0.314$. Bemporad private communication gives $\Gamma(2\gamma)^2/\Gamma(\text{total}) = 0.380 \pm 0.083$. We evaluate this using $\Gamma(2\gamma)/\Gamma(\text{total}) = 0.38 \pm 0.01$. Not included in average because the uncertainty resulting from the separation of the coulomb and nuclear amplitudes has apparently been underestimated.

η BRANCHING RATIOS

Neutral modes

$\Gamma(\text{neutral modes})/\Gamma_{\text{total}}$ — $\Gamma_1/\Gamma = (\Gamma_2+\Gamma_3+\Gamma_4)/\Gamma$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.7191±0.0034 OUR FIT	Error includes scale factor of 1.2.				
0.705 ±0.008	16k	BASILE	71D	CNTR	MM spectrometer
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.79 ±0.08		BUNIATOV	67	OSPK	

$\Gamma(2\gamma)/\Gamma_{\text{total}}$ — Γ_2/Γ

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
39.31±0.20 OUR FIT	Error includes scale factor of 1.1.				
39.49±0.17±0.30	65k	ABEGG	96	SPEC	$pd \to {}^3\text{He}\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
38.45±0.40±0.36	14k	[3] LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$

[3] Not independent of other results listed for LOPEZ 07. Assuming decays of $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\gamma$, and $e^+e^-\gamma$ account for all η decays within a contribution of 0.3% to the systematic error.

$\Gamma(2\gamma)/\Gamma(\text{neutral modes})$ — $\Gamma_2/\Gamma_1 = \Gamma_2/(\Gamma_2+\Gamma_3+\Gamma_4)$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.5466±0.0019 OUR FIT					
0.548 ±0.023 OUR AVERAGE	Error includes scale factor of 1.5.				
0.535 ±0.018		BUTTRAM	70	OSPK	
0.59 ±0.033		BUNIATOV	67	OSPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.52 ±0.09	88	ABROSIMOV	80	HLBC	
0.60 ±0.14	113	KENDALL	74	OSPK	
0.57 ±0.09		STRUGALSKI	71	HLBC	
0.579 ±0.052		FELDMAN	67	OSPK	
0.416 ±0.044		DIGIUGNO	66	CNTR	Error doubled
0.44 ±0.07		GRUNHAUS	66	OSPK	
0.39 ±0.06		[4] JONES	66	CNTR	

[4] This result from combining cross sections from two different experiments.

$\Gamma(3\pi^0)/\Gamma_{total}$ — Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
32.56±0.23 OUR FIT	Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
34.03±0.56±0.49	1821	[5] LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$

[5] Not independent of other results listed for LOPEZ 07. Assuming decays of $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\gamma$, and $e^+e^-\gamma$ account for all η decays within a contribution of 0.3% to the systematic error.

$\Gamma(3\pi^0)/\Gamma(\text{neutral modes})$ — $\Gamma_3/\Gamma_1 = \Gamma_3/(\Gamma_2+\Gamma_3+\Gamma_4)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.4528±0.0019 OUR FIT					
0.439 ±0.024		BUTTRAM	70	OSPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.44 ±0.08	75	ABROSIMOV	80	HLBC	
0.32 ±0.09		STRUGALSKI	71	HLBC	
0.41 ±0.033		BUNIATOV	67	OSPK	Not indep. of $\Gamma(2\gamma)/\Gamma(\text{neutral modes})$
0.177 ±0.035		FELDMAN	67	OSPK	
0.209 ±0.054		DIGIUGNO	66	CNTR	Error doubled
0.29 ±0.10		GRUNHAUS	66	OSPK	

$\Gamma(3\pi^0)/\Gamma(2\gamma)$ — Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.828±0.006 OUR FIT					
0.829±0.007 OUR AVERAGE					
0.884±0.022±0.019	1821	LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$
0.817±0.012±0.032	17.4k	[6] AKHMETSHIN	05	CMD2	$e^+e^- \to \phi \to \eta\gamma$
0.826±0.024		ACHASOV	00D	SND	$e^+e^- \to \phi \to \eta\gamma$
0.832±0.005±0.012		KRUSCHE	95D	SPEC	$\gamma p \to \eta p$, threshold
0.841±0.034		AMSLER	93	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
0.822±0.009		ALDE	84	GAM2	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.796±0.016±0.016		ACHASOV	00	SND	See ACHASOV 00D
0.91 ±0.14		COX	70B	HBC	
0.75 ±0.09		DEVONS	70	OSPK	
0.88 ±0.16		BALTAY	67D	DBC	
1.1 ±0.2		CENCE	67	OSPK	
1.25 ±0.39		BACCI	63	CNTR	Inverse BR reported

[6] Uses result from AKHMETSHIN 01B.

$\Gamma(\pi^0 2\gamma)/\Gamma_{total}$ — Γ_4/Γ

Early results are summarized in the review by LANDSBERG 85.

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
4.4±1.5 OUR FIT	Error includes scale factor of 2.0.					
3.5±0.7±0.6		1.6k	[7,8] PRAKHOV	05	CRYB	p(720 MeV/c) $\pi^- \to n\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<8.4	90	7	ACHASOV	01D	SND	$e^+e^- \to \phi \to \eta\gamma$
<30	90	0	DAVYDOV	81	GAM2	$\pi^- p \to \eta n$

[7] Normalized using $\Gamma(\eta \to 2\gamma)/\Gamma = 0.3943 \pm 0.0026$.
[8] This measurement and the independent analysis of the same data by KNECHT 04 both imply a lower value of $\Gamma(\pi^0 2\gamma)$ than the one obtained by ALDE 84 from $\Gamma(\pi^0 2\gamma)/\Gamma(2\gamma)$.

$\Gamma(\pi^0 2\gamma)/\Gamma(2\gamma)$ — Γ_4/Γ_2

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
1.1±0.4 OUR FIT Error includes scale factor of 1.9.						
1.8±0.4		ALDE	84	GAM2	0	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
2.5±0.6	70	BINON	82	GAM2		See ALDE 84

$\Gamma(\pi^0 2\gamma)/\Gamma(3\pi^0)$ — Γ_4/Γ_3

VALUE (units 10^{-4})	*DOCUMENT ID*		*TECN*	*COMMENT*
14 ±5 OUR FIT Error includes scale factor of 1.9.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.3±2.8±1.4	[9] KNECHT	04	CRYB	$\pi^- p \to n\eta$

[9] Independent analysis of same data as PRAKHOV 05.

$\Gamma(\pi^0\pi^0\gamma\gamma)/\Gamma_{total}$ — Γ_5/Γ

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.2 × 10^{-3}	90	[10] NEFKENS	05A	CRYB	p(720 MeV/c) $\pi^- \to n\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.0 \times 10^{-3}$	90	BLIK	07	GAM4	$\pi^- p \to \eta n$

[10] Measurement is done in limited $\gamma\gamma$ energy range.

$\Gamma(4\gamma)/\Gamma_{total}$ — Γ_6/Γ

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<2.8 × 10^{-4}	90	BLIK	07	GAM4	$\pi^- p \to \eta n$

$\Gamma(\text{invisible})/\Gamma(2\gamma)$ — Γ_7/Γ_2

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.65 × 10^{-3}	90	[11] ABLIKIM	06Q	BES2	$J/\psi \to \phi\eta$

[11] Based on 58M J/ψ decays.

Charged modes

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

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
22.73±0.28 OUR FIT Error includes scale factor of 1.2.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
22.60±0.35±0.29	3915	[12] LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$

[12] Not independent of other results listed for LOPEZ 07. Assuming decays of $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\gamma$, and $e^+e^-\gamma$ account for all η decays within a contribution of 0.3% to the systematic error.

$\Gamma(\text{neutral modes})/\Gamma(\pi^+\pi^-\pi^0)$ — $\Gamma_1/\Gamma_9 = (\Gamma_2+\Gamma_3+\Gamma_4)/\Gamma_9$

VALUE	EVTS	DOCUMENT ID		TECN
3.16±0.05 OUR FIT Error includes scale factor of 1.2.				
3.26±0.30 OUR AVERAGE				
2.54±1.89	74	KENDALL	74	OSPK
3.4 ±1.1	29	AGUILAR-...	72B	HBC
2.83±0.80	70	[13] BLOODWO...	72B	HBC
3.6 ±0.6	244	FLATTE	67B	HBC
2.89±0.56		ALFF-...	66	HBC
3.6 ±0.8	50	KRAEMER	64	DBC
3.8 ±1.1		PAULI	64	DBC

[13] Error increased from published value 0.5 by Bloodworth (private communication).

$\Gamma(2\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_2/Γ_9

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.729±0.028 OUR FIT Error includes scale factor of 1.2.					
1.70 ±0.04 OUR AVERAGE					
1.704±0.032±0.026	3915	[14] LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$
1.61 ±0.14		ABLIKIM	06E	BES2	$e^+e^- \to J/\psi \to \eta\gamma$
1.78 ±0.10 ±0.13	1077	AMSLER	95	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
1.72 ±0.25	401	BAGLIN	69	HLBC	
1.61 ±0.39		FOSTER	65	HBC	

[14] LOPEZ 07 reports $\Gamma(\eta \to \pi^+\pi^-\pi^0)$ / $\Gamma(\eta \to 2\gamma) = \Gamma_9/\Gamma_2 = 0.587 \pm 0.011 \pm 0.009$.

$\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_3/Γ_9

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.432±0.026 OUR FIT Error includes scale factor of 1.2.					
1.48 ±0.05 OUR AVERAGE					
1.46 ±0.03 ±0.09		ACHASOV	06A	SND	$e^+e^- \to \eta\gamma$
1.52 ±0.04 ±0.08	23k	[15] AKHMETSHIN	01B	CMD2	$e^+e^- \to \phi \to \eta\gamma$
1.44 ±0.09 ±0.10	1627	AMSLER	95	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
$1.50\ ^{+0.15}_{-0.29}$	199	BAGLIN	69	HLBC	
$1.47\ ^{+0.20}_{-0.17}$		BULLOCK	68	HLBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.3 ±0.4		BAGLIN	67B	HLBC	
0.90 ±0.24		FOSTER	65	HBC	
2.0 ±1.0		FOELSCHE	64	HBC	
0.83 ±0.32		CRAWFORD	63	HBC	

[15] AKHMETSHIN 01B uses results from AKHMETSHIN 99F.

$\Gamma(\pi^+\pi^-\pi^0)/[\Gamma(2\gamma)+\Gamma(3\pi^0)]$ — $\Gamma_9/(\Gamma_2+\Gamma_3)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.316 ±0.005 OUR FIT Error includes scale factor of 1.2.				
0.304 ±0.012	ACHASOV	00D	SND	$e^+e^- \to \phi \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.3141±0.0081±0.0058	ACHASOV	00B	SND	See ACHASOV 00D

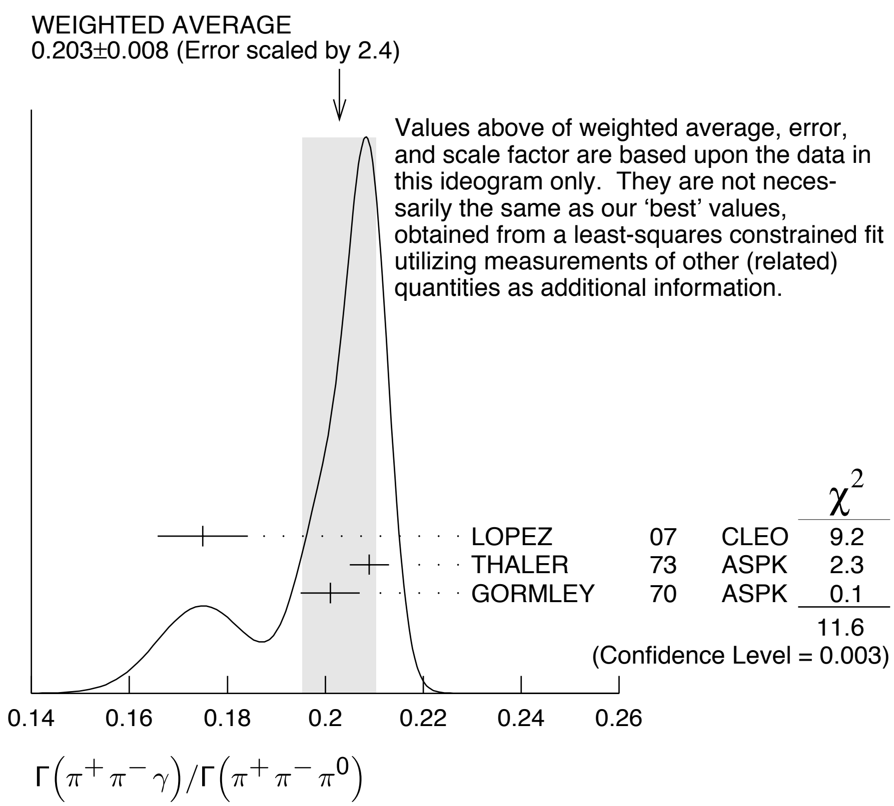
$\Gamma(\pi^+\pi^-\gamma)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.60±0.16 OUR FIT	Error includes scale factor of 2.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.96±0.14±0.14	859	[16] LOPEZ	07	CLEO	$\psi(2S) \rightarrow J/\psi\eta$

[16] Not independent of other results listed for LOPEZ 07. Assuming decays of $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\gamma$, and $e^+e^-\gamma$ account for all η decays within a contribution of 0.3% to the systematic error.

$\Gamma(\pi^+\pi^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{10}/Γ_9

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.202±0.007 OUR FIT	Error includes scale factor of 2.4.				
0.203±0.008 OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.				
0.175±0.007±0.006	859	LOPEZ	07	CLEO	$\psi(2S) \rightarrow J/\psi\eta$
0.209±0.004	18k	THALER	73	ASPK	
0.201±0.006	7250	GORMLEY	70	ASPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.28 ±0.04		BALTAY	67B	DBC	
0.25 ±0.035		LITCHFIELD	67	DBC	
0.30 ±0.06		CRAWFORD	66	HBC	
0.196±0.041		FOSTER	65C	HBC	



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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
6.8 ±0.8 OUR FIT Error includes scale factor of 1.7.					
6.3 ±1.0 OUR AVERAGE Error includes scale factor of 1.6.					
5.15±0.62±0.74	283	ACHASOV	01B	SND	$e^+e^- \to \phi \to \eta\gamma$
7.10±0.64±0.46	323	AKHMETSHIN	01	CMD2	$e^+e^- \to \phi \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9.4 ±0.7 ±0.5	172	[17] LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$

[17] Not independent of other results listed for LOPEZ 07. Assuming decays of $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\gamma$, and $e^+e^-\gamma$ account for all η decays within a contribution of 0.3% to the systematic error.

$\Gamma(e^+e^-\gamma)/\Gamma(\pi^+\pi^-\gamma)$ — Γ_{11}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.149±0.019 OUR FIT Error includes scale factor of 1.7.					
0.237±0.021±0.015	172	LOPEZ	07	CLEO	$\psi(2S) \to J/\psi\eta$

$\Gamma(e^+e^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{11}/Γ_9

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
3.0±0.4 OUR FIT Error includes scale factor of 1.7.					
2.1±0.5	80	JANE	75B	OSPK	See the erratum

$\Gamma(\text{neutral modes})/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^+\pi^-\gamma)+\Gamma(e^+e^-\gamma)]$ — $\Gamma_1/(\Gamma_9+\Gamma_{10}+\Gamma_{11}) = (\Gamma_2+\Gamma_3+\Gamma_4)/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$

VALUE	EVTS	DOCUMENT ID		TECN
2.57±0.04 OUR FIT Error includes scale factor of 1.2.				
2.64±0.23		BALTAY	67B	DBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.5 ±1.0	280	[18] JAMES	66	HBC
3.20±1.26	53	[18] BASTIEN	62	HBC
2.5 ±1.0	10	[18] PICKUP	62	HBC

[18] These experiments are not used in the averages as they do not separate clearly $\eta \to \pi^+\pi^-\pi^0$ and $\eta \to \pi^+\pi^-\gamma$ from each other. The reported values thus probably contain some unknown fraction of $\eta \to \pi^+\pi^-\gamma$.

$\Gamma(2\gamma)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^+\pi^-\gamma)+\Gamma(e^+e^-\gamma)]$ — $\Gamma_2/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$

VALUE	EVTS	DOCUMENT ID		TECN
1.403±0.023 OUR FIT Error includes scale factor of 1.2.				
1.1 ±0.4 OUR AVERAGE				
1.51 ±0.93	75	KENDALL	74	OSPK
0.99 ±0.48		CRAWFORD	63	HBC

$\Gamma(\mu^+\mu^-\gamma)/\Gamma_{total}$ — Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
3.1±0.4 OUR FIT					
3.1±0.4	600	DZHELYADIN	80	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.5±0.75	100	BUSHNIN	78	SPEC	See DZHELYADIN 80

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<0.77 \times 10^{-4}$	90	BROWDER	97B	CLE2	$e^+e^- \simeq$ 10.5 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<2 \times 10^{-4}$	90	WHITE	96	SPEC	$pd \rightarrow \eta^3$He
$<3 \times 10^{-4}$	90	DAVIES	74	RVUE	Uses ESTEN 67

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ — Γ_{14}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
5.8±0.8 OUR AVERAGE						
$5.7\pm0.7\pm0.5$		114	ABEGG	94	SPEC	$pd \rightarrow \eta^3$He
6.5 ± 2.1		27	DZHELYADIN	80B	SPEC	$\pi^- p \rightarrow \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$5.6^{+0.6}_{-0.7}\pm0.5$		100	KESSLER	93	SPEC	See ABEGG 94
<20	95	0	WEHMANN	68	OSPK	

$\Gamma(\mu^+\mu^-)/\Gamma(2\gamma)$ — Γ_{14}/Γ_2

VALUE (units 10^{-5})	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.9 ± 2.2	HYAMS	69	OSPK

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.9 \times 10^{-5}$	90	AKHMETSHIN	01	CMD2	$e^+e^- \rightarrow \phi \rightarrow \eta\gamma$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
4.2±1.2 OUR FIT						
4.1±1.1 OUR AVERAGE						
$4.3\pm1.3\pm0.4$	16	BARGHOLTZ	07	CNTR	0	$pd \rightarrow {}^3$He η
$3.7^{+2.5}_{-1.8}\pm0.3$	4	AKHMETSHIN	01	CMD2		$e^+e^- \rightarrow \phi \rightarrow \eta\gamma$

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\gamma)$ — Γ_{16}/Γ_{10}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
0.92±0.25 OUR FIT				
2.6 ±2.6	1	GROSSMAN	66	HBC

$\Gamma(\pi^+\pi^-2\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{17}/Γ_9

VALUE	CL%	DOCUMENT ID		TECN
$< 9 \times 10^{-3}$		PRICE	67	HBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<16 \times 10^{-3}$	95	BALTAY	67B	DBC

$\Gamma(\pi^+\pi^-\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{18}/Γ_9

VALUE	CL%	EVTS	DOCUMENT ID		TECN
<0.24 × 10^{-2}	90	0	THALER	73	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.7 × 10^{-2}	90		ARNOLD	68	HLBC
<1.6 × 10^{-2}	95		BALTAY	67B	DBC
<7.0 × 10^{-2}			FLATTE	67	HBC
<0.9 × 10^{-2}			PRICE	67	HBC

$\Gamma(\pi^0\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ — Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3 × 10^{-6}	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$

Forbidden modes

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ — Γ_{20}/Γ

Forbidden by angular momentum conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<9 × 10^{-5}	90	NEFKENS	05A	CRYB	p(720 MeV/c) $\pi^- \to n\eta$

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

Forbidden by P and CP invariance.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 0.13 × 10^{-4}	90	16M	AMBROSINO	05A	KLOE	$e^+e^- \to \phi \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 3.3 × 10^{-4}	90		AKHMETSHIN	99B	CMD2	$e^+e^- \to \phi \to \eta\gamma$
< 9 × 10^{-4}	90		AKHMETSHIN	97C	CMD2	See AKHMETSHIN 99B
<15 × 10^{-4}		0	THALER	73	ASPK	

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

Forbidden by P and CP invariance.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.5 × 10^{-4}	90	BLIK	07	GAM4	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<4.3 × 10^{-4}	90	AKHMETSHIN	99C	CMD2	$e^+e^- \to \phi \to \eta\gamma$
<6 × 10^{-4}	90	[19] ACHASOV	98	SND	$e^+e^- \to \phi \to \eta\gamma$

[19] ACHASOV 98 observes one event in a $\pm 3\sigma$ region around the η mass, while a Monte Carlo calculation gives 10 ± 5 events. The limit here is the Poisson upper limit for one observed event and no background.

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ — Γ_{23}/Γ

Forbidden by C invariance.

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
< 5 × 10^{-4}	90	NEFKENS	05	CRYB	0	p(720 MeV/c) $\pi^- \to n\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<17 × 10^{-4}	90	BLIK	07	GAM4		$\pi^- p \to \eta n$

$\Gamma(\pi^0\pi^0\pi^0\gamma)/\Gamma_{total}$ — Γ_{24}/Γ

Forbidden by C invariance.

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
< 6 × 10^{-5}	90	NEFKENS	05	CRYB	0	p(720 MeV/c) $\pi^- \to n\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<24 \times 10^{-5}$	90	BLIK	07	GAM4		$\pi^- p \to \eta n$

$\Gamma(3\gamma)/\Gamma_{total}$ — Γ_{25}/Γ

Forbidden by C invariance.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<16 \times 10^{-5}$	90	BLIK	07	GAM4	$\pi^- p \to \eta n$
$< 4 \times 10^{-5}$	90	NEFKENS	05A	CRYB	p(720 MeV/c) $\pi^- \to n\eta$

$\Gamma(3\gamma)/\Gamma(2\gamma)$ — Γ_{25}/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	CHG
$<1.2 \times 10^{-3}$	95	ALDE	84	GAM2	0

$\Gamma(3\gamma)/\Gamma(3\pi^0)$ — Γ_{25}/Γ_3

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.9 × 10^{-5}	90	ALOISIO	04	KLOE	$\phi \to \eta\gamma$

$\Gamma(4\pi^0)/\Gamma_{total}$ — Γ_{26}/Γ

Forbidden by P and CP invariance.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 6.9 × 10^{-7}	90	PRAKHOV	00	CRYB	$\pi^- p \to n\eta$, 720 MeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<200 \times 10^{-7}$	90	BLIK	07	GAM4	$\pi^- p \to \eta n$

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

C parity forbids this to occur as a single-photon process.

VALUE	CL%	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 1.6 \times 10^{-4}$	90	MARTYNOV	76	HLBC
$< 8.4 \times 10^{-4}$	90	BAZIN	68	DBC
$<70 \times 10^{-4}$		RITTENBERG	65	HBC

$\Gamma(\pi^0 e^+ e^-)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{27}/Γ_9

C parity forbids this to occur as a single-photon process.

VALUE	CL%	EVTS	DOCUMENT ID		TECN
< 1.9 × 10^{-4}	90		JANE	75	OSPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 42 \times 10^{-4}$	90		BAGLIN	67	HLBC
$< 16 \times 10^{-4}$	90	0	BILLING	67	HLBC
$< 77 \times 10^{-4}$		0	FOSTER	65B	HBC
$<110 \times 10^{-4}$			PRICE	65	HBC

$\Gamma(\pi^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$ — Γ_{28}/Γ

C parity forbids this to occur as a single-photon process.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 5 \times 10^{-6}$	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<500 \times 10^{-6}$		WEHMANN	68	OSPK	

$[\Gamma(\mu^+ e^-) + \Gamma(\mu^- e^+)]/\Gamma_{\text{total}}$ — Γ_{29}/Γ

Forbidden by lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6 \times 10^{-6}$	90	WHITE	96	SPEC	$p d \to \eta\, ^3$He

η *C*-NONCONSERVING DECAY PARAMETERS

$\pi^+ \pi^- \pi^0$ LEFT-RIGHT ASYMMETRY PARAMETER

Measurements with an error $> 1.0 \times 10^{-2}$ have been omitted.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
0.09±0.17 OUR AVERAGE				
0.28±0.26	165k	JANE	74	OSPK
−0.05±0.22	220k	LAYTER	72	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ±0.5	37k	[20] GORMLEY	68C	ASPK

[20] The GORMLEY 68C asymmetry is probably due to unmeasured (**E** × **B**) spark chamber effects. New experiments with (**E** × **B**) controls don't observe an asymmetry.

$\pi^+ \pi^- \pi^0$ SEXTANT ASYMMETRY PARAMETER

Measurements with an error $> 2.0 \times 10^{-2}$ have been omitted.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
0.18±0.16 OUR AVERAGE				
0.20±0.25	165k	JANE	74	OSPK
0.10±0.22	220k	LAYTER	72	ASPK
0.5 ±0.5	37k	GORMLEY	68C	WIRE

$\pi^+ \pi^- \pi^0$ QUADRANT ASYMMETRY PARAMETER

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
−0.17±0.17 OUR AVERAGE				
−0.30±0.25	165k	JANE	74	OSPK
−0.07±0.22	220k	LAYTER	72	ASPK

$\pi^+ \pi^- \gamma$ LEFT-RIGHT ASYMMETRY PARAMETER

Measurements with an error $> 2.0 \times 10^{-2}$ have been omitted.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
0.9 ±0.4 OUR AVERAGE				
1.2 ±0.6	35k	JANE	74B	OSPK
0.5 ±0.6	36k	THALER	72	ASPK
1.22±1.56	7257	GORMLEY	70	ASPK

$\pi^+\pi^-\gamma$ PARAMETER β (*D*-wave)

Sensitive to a *D*-wave contribution: $dN/d\cos\theta = \sin^2\theta \ (1 + \beta \ \cos^2\theta)$.

VALUE	EVTS	DOCUMENT ID		TECN
−0.02 ±0.07 OUR AVERAGE		Error includes scale factor of 1.3.		
0.11 ±0.11	35k	JANE	74B	OSPK
−0.060±0.065	7250	GORMLEY	70	WIRE
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.12 ±0.06		[21] THALER	72	ASPK

[21] The authors don't believe this indicates *D*-wave because the dependence of β on the γ energy is inconsistent with the theoretical prediction. A $\cos^2\theta$ dependence can also come from *P*- and *F*-wave interference.

ENERGY DEPENDENCE OF $\eta \rightarrow 3\pi$ DALITZ PLOTS

PARAMETERS FOR $\eta \rightarrow \pi^+\pi^-\pi^0$

See the "Note on η Decay Parameters" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1454. The following experiments fit to one or more of the coefficients *a*, *b*, *c*, *d*, or *e* for $|\text{matrix element}|^2 = 1 + ay + by^2 + cx + dx^2 + exy$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
	3230	[22] ABELE	98D	CBAR	$\overline{p}p \rightarrow \pi^0\pi^0\eta$ at rest
	1077	[23] AMSLER	95	CBAR	$\overline{p}p \rightarrow \pi^+\pi^-\eta$ at rest
	81k	LAYTER	73	ASPK	
	220k	LAYTER	72	ASPK	
	1138	CARPENTER	70	HBC	
	349	DANBURG	70	DBC	
	7250	GORMLEY	70	WIRE	
	526	BAGLIN	69	HLBC	
	7170	CNOPS	68	OSPK	
	37k	GORMLEY	68C	WIRE	
	1300	CLPWY	66	HBC	
	705	LARRIBE	66	HBC	

[22] ABELE 98D obtains $a = -1.22 \pm 0.07$ and $b = 0.22 \pm 0.11$ when *c* (our *d*) is fixed at 0.06.
[23] AMSLER 95 fits to $(1+ay+by^2)$ and obtains $a=-0.94 \pm 0.15$ and $b=0.11 \pm 0.27$.

α PARAMETER FOR $\eta \rightarrow 3\pi^0$

See the "Note on η Decay Parameters" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1454. The value here is of α in $|\text{matrix element}|^2 = 1 + 2\alpha z$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.031±0.004 OUR AVERAGE					
−0.026±0.010±0.010	75k	BASHKANOV	07	WASA	$pp \rightarrow pp\eta$
−0.010±0.021±0.010	12k	ACHASOV	01C	SND	$e^+e^- \rightarrow \phi \rightarrow \eta\gamma$
−0.031±0.004	1M	TIPPENS	01	CRYB	$\pi^- p \rightarrow n\eta$, 720 MeV
−0.052±0.017±0.010	98k	ABELE	98C	CBAR	$\overline{p}p \rightarrow 5\pi^0$
−0.022±0.023	50k	ALDE	84	GAM2	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−0.32 ±0.37	192	BAGLIN	70	HLBC	

η REFERENCES

AMBROSINO	07B	JHEP 0712 073	F. Ambrosino *et al.*	(KLOE Collab.)
BARGHOLTZ	07	PL B644 299	Chr. Bargholtz *et al.*	(CELSIUS/WASA Collab.)
BASHKANOV	07	PR C76 048201	M. Bashkanov *et al.*	(CELSIUS/WASA Collab.)
BLIK	07	PAN 70 693	A.M. Blik *et al.*	(GAMS Collab.)
		Translated from YAF 70 724.		
LOPEZ	07	PRL 99 122001	A. Lopez *et al.*	(CLEO Collab.)
MILLER	07	PRL 99 122002	D.H. Miller *et al.*	(CLEO Collab.)
ABLIKIM	06E	PR D73 052008	M. Ablikim *et al.*	(BES Collab.)
ABLIKIM	06Q	PRL 97 202002	M. Ablikim *et al.*	(BES Collab.)
ACHASOV	06A	PR D74 014016	M.N. Achasov *et al.*	(SND Collab.)
ABDEL-BARY	05	PL B619 281	M. Abdel-Bary *et al.*	(GEM Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AMBROSINO	05A	PL B606 276	F. Ambrosino *et al.*	(KLOE Collab.)
NEFKENS	05	PRL 94 041601	B.M.K. Nefkens *et al.*	(BNL Crystal Ball Collab.)
NEFKENS	05A	PR C72 035212	B.M.K. Nefkens *et al.*	(BNL Crystal Ball Collab.)
PRAKHOV	05	PR C72 025201	S. Prakhov *et al.*	(BNL Crystal Ball Collab.)
ALOISIO	04	PL B591 49	A. Aloisio *et al.*	(KLOE Collab.)
KNECHT	04	PL B589 14	N. Knecht *et al.*	
LAI	02	PL B533 196	A. Lai *et al.*	(CERN NA48 Collab.)
NEFKENS	02	PS T99 114	B.M.K. Nefkens, J.W. Price	(UCLA)
ACHASOV	01B	PL B504 275	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	01C	JETPL 73 451	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
		Translated from ZETFP 73 511.		
ACHASOV	01D	NP B600 3	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
TIPPENS	01	PRL 87 192001	W.B. Tippens *et al.*	(BNL Crystal Ball Collab.)
ACHASOV	00	EPJ C12 25	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00B	JETP 90 17	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
		Translated from ZETF 117 22.		
ACHASOV	00D	JETPL 72 282	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
		Translated from ZETFP 72 411.		
PRAKHOV	00	PRL 84 4802	S. Prakhov *et al.*	(BNL Crystal Ball Collab.)
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
ABELE	98C	PL B417 193	A. Abele *et al.*	(Crystal Barrel Collab.)
ABELE	98D	PL B417 197	A. Abele *et al.*	(Crystal Barrel Collab.)
ACHASOV	98	PL B425 388	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
BROWDER	97B	PR D56 5359	T.E. Browder *et al.*	(CLEO Collab.)
ABEGG	96	PR D53 11	R. Abegg *et al.*	(Saturne SPES2 Collab.)
WHITE	96	PR D53 6658	D.B. White *et al.*	(Saturne SPES2 Collab.)
AMSLER	95	PL B346 203	C. Amsler *et al.*	(Crystal Barrel Collab.)
KRUSCHE	95D	ZPHY A351 237	B. Krusche *et al.*	(TAPS + A2 Collab.)
ABEGG	94	PR D50 92	R. Abegg *et al.*	(Saturne SPES2 Collab.)
AMSLER	93	ZPHY C58 175	C. Amsler *et al.*	(Crystal Barrel Collab.)
KESSLER	93	PRL 70 892	R.S. Kessler *et al.*	(Saturne SPES2 Collab.)
PLOUIN	92	PL B276 526	F. Plouin *et al.*	(Saturne SPES4 Collab.)
BARU	90	ZPHY C48 581	S.E. Baru *et al.*	(MD-1 Collab.)
ROE	90	PR D41 17	N.A. Roe *et al.*	(ASP Collab.)
WILLIAMS	88	PR D38 1365	D.A. Williams *et al.*	(Crystal Ball Collab.)
AIHARA	86	PR D33 844	H. Aihara *et al.*	(TPC-2γ Collab.)
BARTEL	85E	PL 160B 421	W. Bartel *et al.*	(JADE Collab.)
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)
ALDE	84	ZPHY C25 225	D.M. Alde *et al.*	(SERP, BELG, LAPP)
Also		SJNP 40 918	D.M. Alde *et al.*	(SERP, BELG, LAPP)
		Translated from YAF 40 1447.		
WEINSTEIN	83	PR D28 2896	A.J. Weinstein *et al.*	(Crystal Ball Collab.)
BINON	82	SJNP 36 391	F.G. Binon *et al.*	(SERP, BELG, LAPP+)
		Translated from YAF 36 670.		
Also		NC 71A 497	F.G. Binon *et al.*	(SERP, BELG, LAPP+)
DAVYDOV	81	LNC 32 45	V.A. Davydov *et al.*	(SERP, BELG, LAPP+)
Also		SJNP 33 825	V.A. Davydov *et al.*	(SERP, BELG, LAPP+)
		Translated from YAF 33 1534.		
DZHELYADIN	81	PL 105B 239	R.I. Dzhelyadin *et al.*	(SERP)
Also		SJNP 33 822	R.I. Dzhelyadin *et al.*	(SERP)
		Translated from YAF 33 1529.		
ABROSIMOV	80	SJNP 31 195	A.T. Abrosimov *et al.*	(JINR)
		Translated from YAF 31 371.		

DZHELYADIN	80	PL 94B 548	R.I. Dzhelyadin *et al.*	(SERP)
Also		SJNP 32 516	R.I. Dzhelyadin *et al.*	(SERP)
		Translated from YAF 32 998.		
DZHELYADIN	80B	PL 97B 471	R.I. Dzhelyadin *et al.*	(SERP)
Also		SJNP 32 518	R.I. Dzhelyadin *et al.*	(SERP)
		Translated from YAF 32 1002.		
BUSHNIN	78	PL 79B 147	Y.B. Bushnin *et al.*	(SERP)
Also		SJNP 28 775	Y.B. Bushnin *et al.*	(SERP)
		Translated from YAF 28 1507.		
MARTYNOV	76	SJNP 23 48	A.S. Martynov *et al.*	(JINR)
		Translated from YAF 23 93.		
JANE	75	PL 59B 99	M.R. Jane *et al.*	(RHEL, LOWC)
JANE	75B	PL 59B 103	M.R. Jane *et al.*	(RHEL, LOWC)
Also		PL 73B 503	M.R. Jane	
Erratum in private communication.				
BROWMAN	74B	PRL 32 1067	A. Browman *et al.*	(CORN, BING)
DAVIES	74	NC 24A 324	J.D. Davies, J.G. Guy, R.K.P. Zia	(BIRM, RHEL+)
DUANE	74	PRL 32 425	A. Duane *et al.*	(LOIC, SHMP)
JANE	74	PL 48B 260	M.R. Jane *et al.*	(RHEL, LOWC, SUSS)
JANE	74B	PL 48B 265	M.R. Jane *et al.*	(RHEL, LOWC, SUSS)
KENDALL	74	NC 21A 387	B.N. Kendall *et al.*	(BROW, BARI, MIT)
LAYTER	73	PR D7 2565	J.G. Layter *et al.*	(COLU)
THALER	73	PR D7 2569	J.J. Thaler *et al.*	(COLU)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez *et al.*	(BNL)
BLOODWO...	72B	NP B39 525	I.J. Bloodworth *et al.*	(TNTO)
LAYTER	72	PRL 29 316	J.G. Layter *et al.*	(COLU)
THALER	72	PRL 29 313	J.J. Thaler *et al.*	(COLU)
BASILE	71D	NC 3A 796	M. Basile *et al.*	(CERN, BGNA, STRB)
STRUGALSKI	71	NP B27 429	Z.S. Strugalski *et al.*	(JINR)
BAGLIN	70	NP B22 66	C. Baglin *et al.*	(EPOL, MADR, STRB)
BUTTRAM	70	PRL 25 1358	M.T. Buttram, M.N. Kreisler, R.E. Mischke	(PRIN)
CARPENTER	70	PR D1 1303	D.W. Carpenter *et al.*	(DUKE)
COX	70B	PRL 24 534	B. Cox, L. Fortney, J.P. Golson	(DUKE)
DANBURG	70	PR D2 2564	J.S. Danburg *et al.*	(LRL)
DEVONS	70	PR D1 1936	S. Devons *et al.*	(COLU, SYRA)
GORMLEY	70	PR D2 501	M. Gormley *et al.*	(COLU, BNL)
Also		Thesis Nevis 181	M. Gormley	(COLU)
BAGLIN	69	PL 29B 445	C. Baglin *et al.*	(EPOL, UCB, MADR, STRB)
Also		NP B22 66	C. Baglin *et al.*	(EPOL, MADR, STRB)
HYAMS	69	PL 29B 128	B.D. Hyams *et al.*	(CERN, MPIM)
ARNOLD	68	PL 27B 466	R.G. Arnold *et al.*	(STRB, MADR, EPOL+)
BAZIN	68	PRL 20 895	M.J. Bazin *et al.*	(PRIN, QUKI)
BULLOCK	68	PL 27B 402	F.W. Bullock *et al.*	(LOUC)
CNOPS	68	PRL 21 1609	A.M. Cnops *et al.*	(BNL, ORNL, UCND+)
GORMLEY	68C	PRL 21 402	M. Gormley *et al.*	(COLU, BNL)
WEHMANN	68	PRL 20 748	A.W. Wehmann *et al.*	(HARV, CASE, SLAC+)
BAGLIN	67	PL 24B 637	C. Baglin *et al.*	(EPOL, UCB)
BAGLIN	67B	BAPS 12 567	C. Baglin *et al.*	(EPOL, UCB)
BALTAY	67B	PRL 19 1498	C. Baltay *et al.*	(COLU, STON)
BALTAY	67D	PRL 19 1495	C. Baltay *et al.*	(COLU, BRAN)
BEMPORAD	67	PL 25B 380	C. Bemporad *et al.*	(PISA, BONN)
Also		Private Comm.	I. Ion	
BILLING	67	PL 25B 435	K.D. Billing *et al.*	(LOUC, OXF)
BUNIATOV	67	PL 25B 560	S.A. Bunyatov *et al.*	(CERN, KARL)
CENCE	67	PRL 19 1393	R.J. Cence *et al.*	(HAWA, LRL)
ESTEN	67	PL 24B 115	M.J. Esten *et al.*	(LOUC, OXF)
FELDMAN	67	PRL 18 868	M. Feldman *et al.*	(PENN)
FLATTE	67	PRL 18 976	S.M. Flatte	(LRL)
FLATTE	67B	PR 163 1441	S.M. Flatte, C.G. Wohl	(LRL)
LITCHFIELD	67	PL 24B 486	P.J. Litchfield *et al.*	(RHEL, SACL)
PRICE	67	PRL 18 1207	L.R. Price, F.S. Crawford	(LRL)
ALFF-...	66	PR 145 1072	C. Alff-Steinberger *et al.*	(COLU, RUTG)
CLPWY	66	PR 149 1044	C. Baltay	(SCUC, LRL, PURD, WISC, YALE)
CRAWFORD	66	PRL 16 333	F.S. Crawford, L.R. Price	(LRL)
DIGIUGNO	66	PRL 16 767	G. di Giugno *et al.*	(NAPL, TRST, FRAS)
GROSSMAN	66	PR 146 993	R.A. Grossman, L.R. Price, F.S. Crawford	(LRL)
GRUNHAUS	66	Thesis	J. Grunhaus	(COLU)
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)
JONES	66	PL 23 597	W.G. Jones *et al.*	(LOIC, RHEL)
LARRIBE	66	PL 23 600	A. Larribe *et al.*	(SACL, RHEL)
FOSTER	65	PR 138 B652	M. Foster *et al.*	(WISC, PURD)

FOSTER	65B	Athens Conf.	M. Foster, M. Good, M. Meer	(WISC)
FOSTER	65C	Thesis	M. Foster	(WISC)
PRICE	65	PRL 15 123	L.R. Price, F.S. Crawford	(LRL)
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)
FOELSCHE	64	PR 134 B1138	H.W.J. Foelsche, H.L. Kraybill	(YALE)
KRAEMER	64	PR 136 B496	R.W. Kraemer *et al.*	(JHU, NWES, WOOD)
PAULI	64	PL 13 351	E. Pauli, A. Muller	(SACL)
BACCI	63	PRL 11 37	C. Bacci *et al.*	(ROMA, FRAS)
CRAWFORD	63	PRL 10 546	F.S.Jr. Crawford, L.J. Lloyd, E.C. Fowler	(LRL+)
Also		PRL 16 907	F.S. Crawford, L.J. Lloyd, E.C. Fowler	(LRL+)
ALFF-...	62	PRL 9 322	C. Alff-Steinberger *et al.*	(COLU, RUTG)
BASTIEN	62	PRL 8 114	P.L. Bastien *et al.*	(LRL)
PICKUP	62	PRL 8 329	E. Pickup, D.K. Robinson, E.O. Salant	(CNRC+)