

$\eta'(958)$

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

$\eta'(958)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
957.78 ± 0.06	OUR AVERAGE			
957.793 ± 0.054 ± 0.036	3.9k	LIBBY	08	CLEO $J/\psi \rightarrow \gamma \eta'$
957.9 ± 0.2 ± 0.6	4800	WURZINGER	96	SPEC 1.68 $pd \rightarrow {}^3\text{He} \eta'$
957.46 ± 0.33		DUANE	74	MMS $\pi^- p \rightarrow n \text{MM}$
958.2 ± 0.5	1414	DANBURG	73	HBC 2.2 $K^- p \rightarrow \Lambda \eta'$
958 ± 1	400	JACOBS	73	HBC 2.9 $K^- p \rightarrow \Lambda \eta'$
956.1 ± 1.1	3415	¹ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n \eta'$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
957.5 ± 0.2		BAI	04J	BES2 $J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
959 ± 1	630	² BELADIDZE	92C	VES 36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
958 ± 1	340	² ARMSTRONG	91B	OMEG 300 $pp \rightarrow pp \eta \pi^+ \pi^-$
958.2 ± 0.4	622	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
957.8 ± 0.2	2420	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
956.3 ± 1.0	143	² GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
957.4 ± 1.4	535	³ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n \eta'$
957 ± 1		RITTENBERG	69	HBC 1.7–2.7 $K^- p$

¹ Using all η' decays.² Systematic uncertainty not estimated.³ Using η' decays into neutrals. Not independent of the other listed BASILE 71 η' mass measurement.

$\eta'(958)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.188 ± 0.006	OUR FIT				
0.230 ± 0.021	OUR AVERAGE				
0.226 ± 0.017 ± 0.014	2300	CZERWINSKI	10	MMS	$pp \rightarrow pp \eta'$
0.40 ± 0.22	4800	WURZINGER	96	SPEC	1.68 $pd \rightarrow {}^3\text{He} \eta'$
0.28 ± 0.10	1000	BINNIE	79	MMS	0 $\pi^- p \rightarrow n \text{MM}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.20 ± 0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$

$\eta'(958)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\pi^+ \pi^- \eta$	(42.5 ± 0.5) %	
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	(29.5 ± 0.4) %	
Γ_3 $\rho^0 \gamma$		
Γ_4 $\pi^0 \pi^0 \eta$	(22.4 ± 0.5) %	

Γ_5	$\omega\gamma$		$(2.52 \pm 0.07) \%$	
Γ_6	$\omega e^+ e^-$		$(2.0 \pm 0.4) \times 10^{-4}$	
Γ_7	$\gamma\gamma$		$(2.307 \pm 0.033) \%$	
Γ_8	$3\pi^0$		$(2.50 \pm 0.17) \times 10^{-3}$	
Γ_9	$\mu^+ \mu^- \gamma$		$(1.13 \pm 0.28) \times 10^{-4}$	
Γ_{10}	$\pi^+ \pi^- \mu^+ \mu^-$		$(1.9 \pm 0.4) \times 10^{-5}$	
Γ_{11}	$\pi^+ \pi^- \pi^0$		$(3.61 \pm 0.17) \times 10^{-3}$	
Γ_{12}	$(\pi^+ \pi^- \pi^0)$ S-wave		$(3.8 \pm 0.5) \times 10^{-3}$	
Γ_{13}	$\pi^\mp \rho^\pm$		$(7.4 \pm 2.3) \times 10^{-4}$	
Γ_{14}	$2(\pi^+ \pi^-)$		$(8.3 \pm 0.9) \times 10^{-5}$	
Γ_{15}	$\pi^+ \pi^- 2\pi^0$		$(1.8 \pm 0.4) \times 10^{-4}$	
Γ_{16}	$2(\pi^+ \pi^-)$ neutrals	< 1	$\%$	95%
Γ_{17}	$2(\pi^+ \pi^-)\pi^0$	< 1.8	$\times 10^{-3}$	90%
Γ_{18}	$2(\pi^+ \pi^-)2\pi^0$	< 1	$\%$	95%
Γ_{19}	$3(\pi^+ \pi^-)$	< 3.1	$\times 10^{-5}$	90%
Γ_{20}	$K^\pm \pi^\mp$	< 4	$\times 10^{-5}$	90%
Γ_{21}	$\pi^+ \pi^- e^+ e^-$		$(2.42 \pm 0.10) \times 10^{-3}$	
Γ_{22}	$\pi^+ e^- \nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%
Γ_{23}	$\gamma e^+ e^-$		$(4.91 \pm 0.27) \times 10^{-4}$	
Γ_{24}	$\pi^0 \gamma \gamma$		$(3.20 \pm 0.24) \times 10^{-3}$	
Γ_{25}	$\pi^0 \gamma \gamma$ (non resonant)		$(6.2 \pm 0.9) \times 10^{-4}$	
Γ_{26}	$\eta \gamma \gamma$	< 1.33	$\times 10^{-4}$	90%
Γ_{27}	$4\pi^0$	< 4.94	$\times 10^{-5}$	90%
Γ_{28}	$e^+ e^-$	< 5.6	$\times 10^{-9}$	90%
Γ_{29}	$e^+ e^- e^+ e^-$		$(4.5 \pm 1.1) \times 10^{-6}$	
Γ_{30}	invisible	< 6	$\times 10^{-4}$	90%

**Charge conjugation (C), Parity (P),
Lepton family number (LF) violating modes**

Γ_{31}	$\pi^+ \pi^-$	P, CP	< 1.8	$\times 10^{-5}$	90%
Γ_{32}	$\pi^0 \pi^0$	P, CP	< 4	$\times 10^{-4}$	90%
Γ_{33}	$\pi^0 e^+ e^-$	C	[a] < 1.4	$\times 10^{-3}$	90%
Γ_{34}	$\pi^0 \rho^0$	C	< 4	$\%$	90%
Γ_{35}	$\eta e^+ e^-$	C	[a] < 2.4	$\times 10^{-3}$	90%
Γ_{36}	3γ	C	< 1.0	$\times 10^{-4}$	90%
Γ_{37}	$\mu^+ \mu^- \pi^0$	C	[a] < 6.0	$\times 10^{-5}$	90%
Γ_{38}	$\mu^+ \mu^- \eta$	C	[a] < 1.5	$\times 10^{-5}$	90%
Γ_{39}	$e\mu$	LF	< 4.7	$\times 10^{-4}$	90%

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

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, 2 combinations of partial widths obtained from integrated cross section, and 20 branching ratios uses 52 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 69.5$ for 44 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including 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_2	-25							
x_4	-75	-43						
x_5	-7	-6	-2					
x_7	-11	-7	9	-1				
x_8	-17	-10	19	0	2			
x_{11}	-1	-1	-1	0	0	0		
x_{21}	-8	30	-14	-2	-2	-3	0	
Γ	11	-10	-1	1	-40	0	0	-3
	x_1	x_2	x_4	x_5	x_7	x_8	x_{11}	x_{21}

Mode	Rate (MeV)
Γ_1 $\pi^+ \pi^- \eta$	0.0799 \pm 0.0029
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	0.0554 \pm 0.0019
Γ_4 $\pi^0 \pi^0 \eta$	0.0421 \pm 0.0017
Γ_5 $\omega \gamma$	0.00474 \pm 0.00020
Γ_7 $\gamma \gamma$	0.00434 \pm 0.00013
Γ_8 $3\pi^0$	(4.7 \pm 0.4) $\times 10^{-4}$
Γ_{11} $\pi^+ \pi^- \pi^0$	(6.8 \pm 0.4) $\times 10^{-4}$
Γ_{21} $\pi^+ \pi^- e^+ e^-$	(4.54 \pm 0.23) $\times 10^{-4}$

$\eta'(958)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$						Γ_7
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT		
4.34 \pm 0.14 OUR FIT						
4.28 \pm 0.19 OUR AVERAGE						
4.17 \pm 0.10 \pm 0.27	2000	¹ ACCIARRI	98Q L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$		
4.53 \pm 0.29 \pm 0.51	266	KARCH	92 CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$		
3.61 \pm 0.13 \pm 0.48		² BEHREND	91 CELL	$e^+ e^- \rightarrow e^+ e^- \eta'(958)$		
4.6 \pm 1.1 \pm 0.6	23	BARU	90 MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$		
4.57 \pm 0.25 \pm 0.44		BUTLER	90 MRK2	$e^+ e^- \rightarrow e^+ e^- \eta'(958)$		
5.08 \pm 0.24 \pm 0.71	547	³ ROE	90 ASP	$e^+ e^- \rightarrow e^+ e^- 2\gamma$		

$3.8 \pm 0.7 \pm 0.6$	34	AIHARA	88C	TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
$4.9 \pm 0.5 \pm 0.5$	136	⁴ WILLIAMS	88	CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.7 \pm 0.6 \pm 0.9$	143	⁵ GIDAL	87	MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ± 0.9		⁶ BARTEL	85E	JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

¹ No non-resonant $\pi^+\pi^-$ contribution found.

² Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.

³ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁴ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁵ Superseded by BUTLER 90.

⁶ Systematic error not evaluated.

$\Gamma(e^+e^-)$

Γ_{28}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<1.1 \times 10^{-3}$	90	^{1,2} ACHASOV 15	SND	$0.958 e^+e^- \rightarrow \pi\pi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<2.0 \times 10^{-3}$	90	² ACHASOV 15	SND	$0.958 e^+e^- \rightarrow \pi\pi\eta$
$<2.4 \times 10^{-3}$	90	² AKHMETSHIN 15	CMD3	$0.958 e^+e^- \rightarrow \pi^+\pi^-\eta$

¹ Combining data of ACHASOV 15 and AKHMETSHIN 15.

² Using η and η' branching fractions from PDG 14.

$\eta'(958) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

This combination of a partial width with the partial width into $\gamma\gamma$ and with the total width is obtained from the integrated cross section into channel(i) in the $\gamma\gamma$ annihilation.

$\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$

$\Gamma_7\Gamma_2/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28 ± 0.04 OUR FIT				
1.26 ± 0.07 OUR AVERAGE				Error includes scale factor of 1.2.
$1.09 \pm 0.04 \pm 0.13$		BEHREND 91	CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
$1.35 \pm 0.09 \pm 0.21$		AIHARA 87	TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
$1.13 \pm 0.04 \pm 0.13$	867	ALBRECHT 87B	ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
$1.53 \pm 0.09 \pm 0.21$		ALTHOFF 84E	TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
$1.14 \pm 0.08 \pm 0.11$	243	BERGER 84B	PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
$1.73 \pm 0.34 \pm 0.35$	95	JENNI 83	MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
$1.49 \pm 0.13 \pm 0.027$	213	BARTEL 82B	JADE	$e^+e^- \rightarrow e^+e^-\rho\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.85 \pm 0.31 \pm 0.24$	43	BEHREND 82C	CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$

$\Gamma_7\Gamma_4/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.04 OUR FIT			Error includes scale factor of 1.1.
$0.92 \pm 0.06 \pm 0.11$	¹ KARCH 92	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.95 \pm 0.05 \pm 0.08$	² KARCH 90	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
$1.00 \pm 0.08 \pm 0.10$	^{2,3} ANTREASYAN 87	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

¹ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.

² Superseded by KARCH 92.

³ Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.

$\eta'(958) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_{28}/\Gamma$
VALUE (10^{-3} eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.0	90	¹ AKHMETSHIN 15	CMD3	$0.958 e^+e^- \rightarrow \pi^+\pi^-\eta$	
¹ AKHMETSHIN 15 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta) \times \Gamma(\eta'(958) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 4.1 \times 10^{-4}$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.					

$\eta'(958)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
42.5 ± 0.5 OUR FIT		Error includes scale factor of 1.1.			
41.24 ± 0.08 ± 1.24	312k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
42.4 ± 1.1 ± 0.4	1.2k	¹ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$	
¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.					

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{\text{total}}$					0.2804Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.1191 ± 0.0015 OUR FIT		Error includes scale factor of 1.1.			
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.123 ± 0.014	107	RITTENBERG 69	HBC	1.7–2.7 K^-p	
0.10 ± 0.04	10	LONDON	66	HBC $2.24 K^-p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$	
0.07 ± 0.04	7	BADIER	65B	HBC $3 K^-p$	

$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$					0.7196Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.306 ± 0.004 OUR FIT		Error includes scale factor of 1.1.			
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.314 ± 0.026	281	RITTENBERG 69	HBC	1.7–2.7 K^-p	

$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
29.5 ± 0.4 OUR FIT		Error includes scale factor of 1.1.			
29.90 ± 0.03 ± 0.55	913k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
28.7 ± 0.7 ± 0.4	0.2k	¹ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$	
32.9 ± 3.3	298	RITTENBERG 69	HBC	1.7–2.7 K^-p	
20 ± 10	20	LONDON	66	HBC $2.24 K^-p \rightarrow \Lambda \pi^+ \pi^- \gamma$	
34 ± 9	35	BADIER	65B	HBC $3 K^-p$	

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$33.34 \pm 0.06 \pm 1.60$	970k	¹ ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$
$34.43 \pm 0.52 \pm 1.97$	970k	² ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$

¹ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$, $\omega(782)$, and box anomaly components.

² From a fit to $\pi^+\pi^-$ mass using $\rho(770)$, $\omega(782)$, and $\rho(1450)$ components.

 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi^+\pi^-\eta)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.694 ± 0.014 OUR FIT Error includes scale factor of 1.1.

0.683 ± 0.020 OUR AVERAGE

$0.677 \pm 0.024 \pm 0.011$	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta'\gamma$
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0.69 ± 0.03	ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta'\gamma$
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 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))$ $\Gamma_2/0.714\Gamma_1$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.972 ± 0.020 OUR FIT Error includes scale factor of 1.1.

0.97 ± 0.09 OUR AVERAGE

0.70 ± 0.22		AMSLER	04B	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\eta$
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1.07 ± 0.17		BELADIDZE	92C	VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
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0.92 ± 0.14	473	DANBURG	73	HBC	$2.2 K^- p \rightarrow \Lambda X^0$
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1.11 ± 0.18	192	JACOBS	73	HBC	$2.9 K^- p \rightarrow \Lambda X^0$
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 $\Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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22.4 ± 0.6 OUR FIT Error includes scale factor of 1.1.

21.36 ± 0.10 ± 0.92	52k	ABLIKIM	19T	BES	$J/\psi \rightarrow \gamma\eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$23.5 \pm 1.3 \pm 0.4$	3.2k	¹ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
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¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

 $\Gamma(\pi^0\pi^0\eta(3\pi^0\text{ decay}))/\Gamma_{\text{total}}$ $0.321\Gamma_4/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.0718 ± 0.0018 OUR FIT Error includes scale factor of 1.1.

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

0.11 ± 0.06	4	BENSINGER	70	DBC	$2.2 \pi^+ d$
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 $\Gamma(\pi^0\pi^0\eta)/\Gamma(\pi^+\pi^-\eta)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.527 ± 0.019 OUR FIT Error includes scale factor of 1.1.

0.555 ± 0.043 ± 0.013	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta'\gamma$
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 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi\pi\eta)$ $\Gamma_2/(\Gamma_1+\Gamma_4)$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.454 ± 0.009 OUR FIT Error includes scale factor of 1.1.

0.43 ± 0.02 ± 0.02	BARBERIS	98C	OMEG 450	$pp \rightarrow p_f \eta' p_s$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ± 0.15	DAVIS	68	HBC	$5.5 K^- p$
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$\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.52 ± 0.07 OUR FIT**2.50 ± 0.07 OUR AVERAGE**2.489 ± 0.018 ± 0.074 23k ABLIKIM 19T BES $J/\psi \rightarrow \gamma\eta'$ 2.55 ± 0.03 ± 0.16 33.2k ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$

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

2.34 ± 0.30 ± 0.04 70 ² PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ¹ Using $B(J/\psi \rightarrow \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.² Not independent of other η' branching fractions and ratios in PEDLAR 09. $\Gamma(\omega\gamma)/\Gamma(\pi^+\pi^-\eta)$ Γ_5/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.0593 ± 0.0018 OUR FIT Error includes scale factor of 1.1.**0.055 ± 0.007 ± 0.001** PEDLAR 09 CLE3 $J/\psi \rightarrow \eta'\gamma$

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

0.068 ± 0.013 68 ZANFINO 77 ASPK $8.4 \pi^- p$ $\Gamma(\omega\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_5/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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0.113 ± 0.004 OUR FIT**0.147 ± 0.016**ALDE 87B GAM2 $38 \pi^- p \rightarrow n4\gamma$ $\Gamma(\omega e^+ e^-)/\Gamma(\omega\gamma)$ Γ_6/Γ_5

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

7.71 ± 1.34 ± 0.54 ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$ ¹ Obtained from other ABLIKIM 15AD measurements with common systematics taken into account. $\Gamma(\omega e^+ e^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.97 ± 0.34 ± 0.17 66 ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$ ¹ Using $B(J/\psi \rightarrow \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$. $\Gamma(\rho^0\gamma \text{ (including non-resonant } \pi^+\pi^-\gamma)) / [\Gamma(\pi^+\pi^-\eta) + \Gamma(\pi^0\pi^0\eta) + \Gamma(\omega\gamma)]$ $\Gamma_2/(\Gamma_1+\Gamma_4+\Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.437 ± 0.008 OUR FIT Error includes scale factor of 1.1.

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

0.25 ± 0.14 DAUBER 64 HBC $1.95 K^- p$ $[\Gamma(\pi^0\pi^0\eta \text{ (charged decay)}) + \Gamma(\omega \text{ (charged decay)}\gamma)]/\Gamma_{\text{total}}$ **(0.286 Γ_4 +0.89 Γ_5)/ Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.0864 ± 0.0017 OUR FIT Error includes scale factor of 1.1.

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

0.045 ± 0.029 42 RITTENBERG 69 HBC $1.7\text{--}2.7 K^- p$

$\Gamma(\pi^+\pi^-\text{ neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_1+0.286\Gamma_4+0.89\Gamma_5)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3897±0.0028 OUR FIT				Error includes scale factor of 1.1.

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

0.4 ±0.1	39	LONDON	66 HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^-$ neutrals
0.35 ±0.06	33	BADIER	65B HBC	3 $K^- p$

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.307±0.035 OUR FIT				Error includes scale factor of 1.1.

2.31 ±0.06 OUR AVERAGE Error includes scale factor of 1.8.

2.331±0.012±0.035	71k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma \eta'$
1.99 $^{+0.31}_{-0.27}$ ±0.07	114	¹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
2.00 ±0.18		² STANTON	80 SPEC	8.45 $\pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$

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

2.25 ±0.16 ±0.03	0.3k	³ PEDLAR	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
1.8 ±0.2	6000	⁴ APEL	79 NICE	15–40 $\pi^- p \rightarrow n 2\gamma$
2.5 ±0.7		DUANE	74 MMS	$\pi^- p \rightarrow n \text{MM}$
1.71 ±0.33	68	DALPIAZ	72 CNTR	1.6 $\pi^- p \rightarrow n X^0$
2.0 $^{+0.8}_{-0.6}$	31	HARVEY	71 OSPK	3.65 $\pi^- p \rightarrow n X^0$

¹ WICHT 08 reports $[\Gamma(\eta'(958) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta' K^+) = (7.04 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Includes APEL 79 result.

³ Not independent of other η' branching fractions and ratios in PEDLAR 09.

⁴ Data is included in STANTON 80 evaluation.

 $\Gamma(\gamma\gamma)/\Gamma(\pi^+\pi^-\eta)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.0543±0.0012 OUR FIT			Error includes scale factor of 1.1.

0.053 ±0.004 ±0.001 PEDLAR 09 CLE3 $J/\psi \rightarrow \eta' \gamma$

 $\Gamma(\gamma\gamma)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_7/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
0.0783±0.0016 OUR FIT			Error includes scale factor of 1.1.

0.080 ±0.008 ABLIKIM 06E BES2 $J/\psi \rightarrow \eta' \gamma$

 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_7/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
0.1031±0.0028 OUR FIT			

0.105 ±0.010 OUR AVERAGE Error includes scale factor of 1.9.

0.091 ±0.009	AMSLER	93 CBAR	0.0 $\bar{p} p$
0.112 ±0.002 ±0.006	ALDE	87B GAM2	38 $\pi^- p \rightarrow n 2\gamma$

 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_7/0.714\Gamma_4$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.144±0.004 OUR FIT				

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

0.188±0.058	16	APEL	72 OSPK	3.8 $\pi^- p \rightarrow n X^0$
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$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_4+0.09\Gamma_5+\Gamma_7)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.185±0.004 OUR FIT				Error includes scale factor of 1.1.

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

0.185±0.022	535	BASILE	71	CNTR	1.6 $\pi^- p \rightarrow n X^0$
0.189±0.026	123	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.50 ±0.17 OUR FIT				
3.57 ±0.26 OUR AVERAGE				

3.522±0.082±0.254	2015	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$
4.79 ±0.59 ±1.14	183	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

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

3.56 ±0.22 ±0.34	309	² ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$
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¹ We have added all systematic uncertainties in quadrature to a single value.

² Superseded by ABLIKIM 17.

 $\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_8/Γ_4

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
112± 8 OUR FIT				
78±10 OUR AVERAGE				

86±19	235	BLIK	08	GAMS	32 $\pi^- p \rightarrow \eta' n$
74±15		ALDE	87B	GAM2	38 $\pi^- p \rightarrow n6\gamma$
75±18		BINON	84	GAM2	30–40 $\pi^- p \rightarrow n6\gamma$

 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_9/Γ_7

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
4.9±1.2	33	VIKTOROV	80	CNTR	25,33 $\pi^- p \rightarrow 2\mu\gamma$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.94±0.37±0.02		53	¹ ABLIKIM	21I	BES3 $J/\psi \rightarrow \gamma\eta'(958)$

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

< 2.9	90	² ABLIKIM	130	BES3	$J/\psi \rightarrow \gamma\eta'$
<24	90	³ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 21I reports $(1.97 \pm 0.33 \pm 0.19) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.

³ Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{10}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{10}/Γ_2

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	ABLIKIM	130	BES3 $J/\psi \rightarrow \gamma\eta'$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.61 \pm 0.18 OUR FIT				
3.61 \pm 0.18 OUR AVERAGE				

3.591 \pm 0.054 \pm 0.174	6067	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
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4.28 \pm 0.49 \pm 1.11	78	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+K^-3\pi$
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3.7 $^{+1.1}_{-0.9}$ \pm 0.4		² NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.83 \pm 0.15 \pm 0.39	1014	³ ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
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¹ We have added all systematic uncertainties in quadrature to a single value.

² Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.

³ Superseded by ABLIKIM 17.

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 \pm 0.4 OUR FIT	Error includes scale factor of 1.1.			

8.27 $^{+2.49}_{-2.12}$ \pm 0.04	20	¹ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21^{+6}_{-5} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
37.63 \pm 0.77 \pm 5.00	6580	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$

¹ We have added all systematic uncertainties in quadrature .

 $\Gamma(\pi^\mp \rho^\pm)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.44 \pm 0.60 \pm 2.23	1231	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma(\pi^\mp \rho^\pm)$

¹ We have added all systematic uncertainties in quadrature .

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.3 \pm 0.9 \pm 0.1		199	¹ ABLIKIM	14M	BES3 $J/\psi \rightarrow \gamma\eta'$

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

< 24	90	² NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
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<1000	90	RITTENBERG	69	HBC	1.7–2.7 K^-p
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¹ ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ = $(4.40 \pm 0.35 \pm 0.30) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.

$\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{14}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<0.6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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$1.78 \pm 0.38 \pm 0.02$		84	¹ ABLIKIM	14M	BES3 $J/\psi \rightarrow \gamma\eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<27	90	² NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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¹ ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] = (9.38 \pm 1.79 \pm 0.89) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent of measured value of Γ_{15}/Γ_1 from NAIK 09.

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{15}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.01	95	DANBURG	73	HBC $2.2 K^- p \rightarrow \Lambda X^0$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.01	90	RITTENBERG	69	HBC $1.7-2.7 K^- p$
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 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.002	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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<0.01	90	RITTENBERG	69	HBC $1.7-2.7 K^- p$
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¹ Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{17}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<4	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

 $\Gamma(2(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.01	95	KALBFLEISCH	64B	HBC $K^- p \rightarrow \Lambda 2(\pi^+\pi^-)+MM$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.01	90	LONDON	66	HBC Compilation
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$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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< 3.1	90	¹ ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 53	90	² NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
< 500	95	KALBFLEISCH	64B HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$

¹ Using $B(J/\psi \rightarrow \gamma \eta'(958)) = (5.16 \pm 0.15) \times 10^{-3}$.

² Not independent of measured value of Γ_{19}/Γ_1 from NAIK 09.

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{19}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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< 1.2	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

 $\Gamma(K^\pm\pi^\mp)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{20}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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< 1.3 $\times 10^{-4}$	90	ABLIKIM	16M BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
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 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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2.42 \pm 0.10 OUR FIT

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

2.11 \pm 0.12 \pm 0.14	429	¹ ABLIKIM	13O BES3	$J/\psi \rightarrow \gamma \eta'$
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2.5 $^{+1.2}_{-0.9} \pm 0.5$		² NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
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< 6	90	RITTENBERG	65 HBC	2.7 $K^- p$
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¹ Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.

² Not independent of measured value of Γ_{21}/Γ_1 from NAIK 09.

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{21}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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5.69 \pm 0.25 OUR FIT

5.51 $^{+3.00}_{-2.30} \pm 0.03$	8	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
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¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{21}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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8.20 \pm 0.31 OUR FIT

8.20 \pm 0.16 \pm 0.27	2584	ABLIKIM	21J BES3	$J/\psi \rightarrow \gamma \eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

7.2 \pm 0.4 \pm 0.5	429	¹ ABLIKIM	13O BES3	$J/\psi \rightarrow \gamma \eta'$
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¹ Superseded by ABLIKIM 21J.

$\Gamma(\pi^+ e^- \nu_e + \text{c.c.})/\Gamma(\pi^+ \pi^- \eta)$ Γ_{22}/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	ABLIKIM	13G	BES3 $J/\psi \rightarrow \phi \eta'$

 $\Gamma(\gamma e^+ e^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.9	90	BRIERE	00	CLEO $10.6 e^+ e^-$
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 $\Gamma(\gamma e^+ e^-)/\Gamma(\gamma\gamma)$ Γ_{23}/Γ_7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.13 ± 0.09 ± 0.07	864	ABLIKIM	150	BES3 $J/\psi \rightarrow \gamma e^+ e^-$
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 $\Gamma(\pi^0 \gamma\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.20 ± 0.07 ± 0.23	3.4k	ABLIKIM	17T	BES3 $J/\psi \rightarrow \gamma \eta'$
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 $\Gamma(\pi^0 \gamma\gamma)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{24}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<37	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 4\gamma$
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 $\Gamma(\pi^0 \gamma\gamma (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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6.16 ± 0.64 ± 0.67	655	ABLIKIM	17T	BES3 $J/\psi \rightarrow \gamma \eta'$
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 $\Gamma(\eta\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.33 × 10⁻⁴	90	ABLIKIM	19AW	BES3 $J/\psi \rightarrow \gamma \eta' \rightarrow \gamma\gamma\gamma 2\gamma$
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 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<4.94 × 10⁻⁵	90	ABLIKIM	20E	BES3 $J/\psi \rightarrow \eta' \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.2 × 10 ⁻⁴	90	DONSKOV	14	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
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 $\Gamma(4\pi^0)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{27}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<23	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 8\gamma$
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 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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< 5.6 × 10⁻⁹	90	¹ ACHASOV	15	SND $0.958 e^+ e^- \rightarrow \pi \pi \eta$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<12 × 10 ⁻⁹	90	² AKHMETSHIN	15	CMD3 $0.958 e^+ e^- \rightarrow \pi^+ \pi^- \eta$
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< 2.1 × 10 ⁻⁷	90	VOROBYEV	88	ND $e^+ e^- \rightarrow \pi^+ \pi^- \eta$
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¹ Combining data of ACHASOV 15 and AKHMETSHIN 15 and using $\Gamma(\eta') = 0.198 \pm 0.009$ MeV.

² Using $\Gamma_{\eta'(958)} = 198 \pm 9$ keV, $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (42.9 \pm 0.7)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$.

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.1 \pm 0.1$	30	¹ ABLIKIM	22E	BES3 $J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 22E reports $(4.5 \pm 1.0 \pm 0.5) \times 10^{-6}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow e^+ e^- e^+ e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<9.5 90 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ Not independent of measured value of Γ_{30}/Γ_1 from NAIK 09.

$\Gamma(\text{invisible})/\Gamma(\pi^+ \pi^- \eta)$ Γ_{30}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.1 90 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

$\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{30}/Γ_7

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
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<2.4 90 ABLIKIM 13 BES3 $J/\psi \rightarrow \phi\eta'$

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

<6.69 90 ABLIKIM 06Q BES $J/\psi \rightarrow \phi\eta'$

$\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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< 0.18 90 ¹ AAIJ 17D LHCb $D_{(s)}^+ \rightarrow \pi^+ \pi^- \pi^+$

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

< 0.5 90 ² ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^+ \pi^-$

< 29 90 ³ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+ \pi^-$

< 3.3 90 ⁴ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+ \pi^-$

<800 95 DANBURG 73 HBC $2.2 K^- p \rightarrow \Lambda X^0$

<200 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$

¹ Using branching fractions of $D_{(s)}^+$ decays from PDG 15.

² ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

³ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+ \pi^-$ continuum.

⁴ Without interference with the $\gamma\gamma \rightarrow \pi^+ \pi^-$ continuum.

$\Gamma(\pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-4}$	90	¹ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.28 \times 10^{-3}$.

 $\Gamma(\pi^0 \pi^0)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{32}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<45	90	ALDE 87B	GAM2	$38 \pi^- p \rightarrow n 4 \gamma$

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	90	BRIERE 00	CLEO	$10.6 e^+ e^-$

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

<13	90	RITTENBERG 65	HBC	$2.7 K^- p$
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 $\Gamma(\pi^0 \rho^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	RITTENBERG 65	HBC	$2.7 K^- p$

 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	BRIERE 00	CLEO	$10.6 e^+ e^-$

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

<11	90	RITTENBERG 65	HBC	$2.7 K^- p$
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 $\Gamma(3\gamma)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{36}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	ALDE 87B	GAM2	$38 \pi^- p \rightarrow n 3 \gamma$

 $\Gamma(\mu^+ \mu^- \pi^0)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	90	DZHELYADIN 81	CNTR	$30 \pi^- p \rightarrow \eta' n$

 $\Gamma(\mu^+ \mu^- \eta)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	DZHELYADIN 81	CNTR	$30 \pi^- p \rightarrow \eta' n$

 $\Gamma(e\mu)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.7	90	BRIERE 00	CLEO	$10.6 e^+ e^-$

$\eta'(958) \rightarrow \eta\pi\pi$ DECAY PARAMETERS

$$|\text{MATRIX ELEMENT}|^2 = |1 + \alpha Y|^2 + CX + DX^2$$

X and Y are Dalitz variables; α is complex and C , and D are real-valued. Parameters C and D are not necessarily equal to c and d , respectively, in the generalized parameterization following this one. May be different for $\eta'(958) \rightarrow \eta\pi^+\pi^-$ and $\eta'(958) \rightarrow \eta\pi^0\pi^0$ decays. Because of different initial assumptions and strong correlations of the parameters we do not average the parameters in the section below.

Re(α) decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.034 \pm 0.002 \pm 0.002$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^+\pi^-$
$-0.054 \pm 0.004 \pm 0.001$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^0\pi^0$
$-0.033 \pm 0.005 \pm 0.003$	44k	¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	² AMELIN	05A	VES $28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	³ BRIERE	00	CLEO $10.6 e^+e^- \rightarrow \eta\pi^+\pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	⁴ ALDE	86	GAM2 $38 \pi^- p \rightarrow n\eta\pi^0\pi^0$
-0.08 ± 0.03		^{4,5} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta\pi^+\pi^-$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.

⁴ Assuming $C = 0$.

⁵ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

Im(α) decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.000 \pm 0.019 \pm 0.001$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^+\pi^-$
$0.000 \pm 0.038 \pm 0.002$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^0\pi^0$
$0.000 \pm 0.049 \pm 0.001$	44k	¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	² AMELIN	05A	VES $28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	³ ALDE	86	GAM2 $38 \pi^- p \rightarrow n\eta\pi^0\pi^0$
0.0 ± 0.3		^{3,4} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta\pi^+\pi^-$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $C = 0$.

⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

C decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.0027 \pm 0.0024 \pm 0.0015$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^+\pi^-$

$0.018 \pm 0.009 \pm 0.003$	44k	¹ ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	² AMELIN	05A	VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

D decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.053 \pm 0.004 \pm 0.004$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.061 \pm 0.009 \pm 0.005$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.059 \pm 0.012 \pm 0.004$	44k	¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	² AMELIN	05A	VES $28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	³ ALDE	86	GAM2 $38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{3,4} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta \pi^+ \pi^-$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $C = 0$.

⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

$\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS

$$|\text{MATRIX ELEMENT}|^2 \propto 1 + a Y + b Y^2 + c X + d X^2$$

X and Y are Dalitz variables and a , b , c , and d are real-valued parameters. May be different for $\eta'(958) \rightarrow \eta \pi^+ \pi^-$ and $\eta'(958) \rightarrow \eta \pi^0 \pi^0$ decays. We do not average measurements in the section below because parameter values from each experiment are strongly correlated.

a decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.077 \pm 0.003 \pm 0.001$		¹ ABLIKIM	23AH	BES3 $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.056 \pm 0.004 \pm 0.002$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.087 \pm 0.009 \pm 0.006$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.074 \pm 0.008 \pm 0.006$	124k	ADLARSON	18A	A2MM $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.072 \pm 0.007 \pm 0.008$		² GONZALEZ-S.	18A	RVUE $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	³ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	⁴ BLIK	09	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	⁵ DOROFEEV	07	VES $27 \pi^- p \rightarrow \eta' n, \pi^- A \rightarrow \eta' \pi^- A^*$

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

b decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.066 \pm 0.006 \pm 0.001$		¹ ABLIKIM	23AH BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.049 \pm 0.006 \pm 0.006$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.073 \pm 0.014 \pm 0.005$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.014 \pm 0.005$	124k	ADLARSON	18A A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.052 \pm 0.001 \pm 0.002$		² GONZALEZ-S..18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	³ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	⁴ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	⁵ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

c decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.0027 \pm 0.0024 \pm 0.0018$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.019 \pm 0.011 \pm 0.003$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ See ABLIKIM 11 for the full correlation matrix.

² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

d decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.068 \pm 0.004 \pm 0.001$		¹ ABLIKIM	23AH BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.004 \pm 0.003$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.074 \pm 0.009 \pm 0.004$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.050 \pm 0.009 \pm 0.005$	124k	ADLARSON	18A A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.051 \pm 0.008 \pm 0.006$		² GONZALEZ-S..18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	³ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	⁴ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	⁵ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

$\eta'(958)$ β PARAMETER

$|\text{MATRIX ELEMENT}|^2 = (1 + 2\beta Z)$

See the "Note on η Decay Parameters" in our 1994 edition Physical Review
D50 1173 (1994), p. 1454.

β decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.61 ± 0.08	OUR AVERAGE	Error includes scale factor of 1.2.		
$-0.640 \pm 0.046 \pm 0.047$	1.8k	ABLIKIM	15G BES3	$J/\psi \rightarrow \gamma(\pi^0 \pi^0 \pi^0)$
-0.59 ± 0.18	235	BLIK	08 GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE	87B GAM2	$38 \pi^- p \rightarrow n 3\pi^0$

$\eta'(958)$ C-NONCONSERVING DECAY PARAMETER

See the note on η decay parameters in the Stable Particle Particle Listings
for definition of this parameter.

DECAY ASYMMETRY PARAMETER FOR $\pi^+ \pi^- \gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.03 ± 0.04	OUR AVERAGE			
-0.019 ± 0.056		AIHARA	87 TPC	$2\gamma \rightarrow \pi^+ \pi^- \gamma$
-0.069 ± 0.078	295	GRIGORIAN	75 STRC	$2.1 \pi^- p$
0.00 ± 0.10	103	KALBFLEISCH	75 HBC	$2.18 K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.07 ± 0.08	152	RITTENBERG	65 HBC	$2.1-2.7 K^- p$

$\eta'(958) \rightarrow \gamma \ell^+ \ell^-$ TRANSITION FORM FACTOR SLOPE

Related to the effective virtual meson mass Λ , via slope $\approx \Lambda^{-2}$. See e.g. LANDS-
BERG 85, eq. (3.8), for a detailed definition.

VALUE (GeV^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.62 ± 0.17	OUR AVERAGE			
$1.60 \pm 0.17 \pm 0.08$	864	¹ ABLIKIM	150 BES3	$J/\psi \rightarrow \gamma e^+ e^-$
1.7 ± 0.4	33	¹ VIKTOROV	80	$25,33 \pi^- p \rightarrow 2\mu\gamma$

¹In the single-pole Ansatz where slope = $1/(\Lambda^2 + \gamma^2)$ with Λ , γ being a Breit-Wigner mass, width for the effective contributing vector meson.

$\eta'(958)$ REFERENCES

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ABLIKIM	21J	PR D103 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20E	PR D101 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AW	PR D100 052015	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19T	PRL 122 142002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18	PR D97 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADLARSON	18A	PR D98 012001	P. Adlarson <i>et al.</i>	(A2 Collab. at MAMI)
GONZALEZ-S...	18A	EPJ C78 758	S. Gonzalez-Solis, E. Passemar	(BEIJ, IND+)
AAIJ	17D	PL B764 233	R. Aaij <i>et al.</i>	(LHCb Collab.)
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ABLIKIM	15AD	PR D92 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	15	PR D91 092010	M.N. Achasov <i>et al.</i>	(SND Collab.)
AKHMETSHIN	15	PL B740 273	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)
ABLIKIM	14M	PRL 112 251801	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DONSKOV	14	MPL A29 1450213	S. Donskov <i>et al.</i>	(GAMS-4 π Collab.)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
ABLIKIM	13	PR D87 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13O	PR D87 092011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
CZERWINSKI	10	PRL 105 122001	E. Czerwinski <i>et al.</i>	(COSY-11 Collab.)
BLIK	09	PAN 72 231	A.M. Blik <i>et al.</i>	(IHEP (Protvino))
		Translated from YAF 72 258.		
NAIK	09	PRL 102 061801	P. Naik <i>et al.</i>	(CLEO Collab.)
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)
BLIK	08	PAN 71 2124	A. Blik <i>et al.</i>	(GAMS-4 π Collab.)
		Translated from YAF 71 2161.		
LIBBY	08	PRL 101 182002	J. Libby <i>et al.</i>	(CLEO Collab.)
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)
DOROFEEV	07	PL B651 22	V. Dorofeev <i>et al.</i>	(VES Collab.)
MORI	07A	JPSJ 76 074102	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06Q	PRL 97 202002	M. Ablikim <i>et al.</i>	(BES Collab.)
AMELIN	05A	PAN 68 372	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 68 401.		
AMSLER	04B	EPJ C33 23	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRIERE	00	PRL 84 26	R. Briere <i>et al.</i>	(CLEO Collab.)
ACCIARRI	98Q	PL B418 399	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
WURZINGER	96	PL B374 283	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)
PDG	94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)
AMSLER	93	ZPHY C58 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitjukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BEHREND	91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)
KARCH	90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)
ROE	90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
		Translated from YAF 48 436.		
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)
BINON	84	PL 140B 264	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP+)
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)
BARTEL	82B	PL 113B 190	W. Bartel <i>et al.</i>	(JADE Collab.)
BEHREND	82C	PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
Also		PL 125B 518 (errat.)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)

DZHELADIN	81	PL 105B 239	R.I. Dzhelyadin <i>et al.</i>	(SERP)
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)
ZANFINO	77	PRL 38 930	C. Z Anfino <i>et al.</i>	(CARL, MCGI, OHIO+)
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+) JP
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i>	(CERN)
BASILE	71	NC 3A 371	M. Basile <i>et al.</i>	(CERN, BGNA, STRB)
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i>	(MINN, MICH)
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i>	(WISC)
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i>	(NWES, ANL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IJP
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i>	(UCLA) JP
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP