

$\eta'(958)$

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

$\eta'(958)$ 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}	$\pi^+ \pi^- \mu^+ \mu^-$		$(2.0 \pm 0.4) \times 10^{-5}$	
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}	$\pi^0 \rho^0$	< 4	$\%$	90%
Γ_{15}	$2(\pi^+ \pi^-)$		$(8.4 \pm 0.9) \times 10^{-5}$	
Γ_{16}	$\pi^+ \pi^- 2\pi^0$		$(1.8 \pm 0.4) \times 10^{-4}$	
Γ_{17}	$2(\pi^+ \pi^-)$ neutrals	< 1	$\%$	95%
Γ_{18}	$2(\pi^+ \pi^-) \pi^0$	< 1.8	$\times 10^{-3}$	90%
Γ_{19}	$2(\pi^+ \pi^-) 2\pi^0$	< 1	$\%$	95%
Γ_{20}	$3(\pi^+ \pi^-)$	< 3.1	$\times 10^{-5}$	90%
Γ_{21}	$K^\pm \pi^\mp$	< 4	$\times 10^{-5}$	90%
Γ_{22}	$\pi^+ \pi^- e^+ e^-$		$(2.42 \pm 0.10) \times 10^{-3}$	
Γ_{23}	$\pi^+ e^- \nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%
Γ_{24}	$\gamma e^+ e^-$		$(4.91 \pm 0.27) \times 10^{-4}$	
Γ_{25}	$\pi^0 \gamma \gamma$		$(3.20 \pm 0.24) \times 10^{-3}$	
Γ_{26}	$\pi^0 \gamma \gamma$ (non resonant)		$(6.2 \pm 0.9) \times 10^{-4}$	
Γ_{27}	$\eta \gamma \gamma$	< 1.33	$\times 10^{-4}$	90%
Γ_{28}	$4\pi^0$	< 4.94	$\times 10^{-5}$	90%
Γ_{29}	$e^+ e^-$	< 5.6	$\times 10^{-9}$	90%
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}	$\eta e^+ e^-$	C	[a] < 2.4	$\times 10^{-3}$	90%
Γ_{35}	3γ	C	< 1.0	$\times 10^{-4}$	90%
Γ_{36}	$\mu^+ \mu^- \pi^0$	C	[a] < 6.0	$\times 10^{-5}$	90%
Γ_{37}	$\mu^+ \mu^- \eta$	C	[a] < 1.5	$\times 10^{-5}$	90%
Γ_{38}	$e\mu$	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_{22}	-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_{22}

Mode	Rate (MeV)
Γ_1 $\pi^+ \pi^- \eta$	0.0799 ± 0.0029
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	0.0554 ± 0.0019
Γ_4 $\pi^0 \pi^0 \eta$	0.0421 ± 0.0017
Γ_5 $\omega \gamma$	0.00474 ± 0.00020
Γ_7 $\gamma \gamma$	0.00434 ± 0.00013
Γ_8 $3\pi^0$	(4.7 ± 0.4) × 10 ⁻⁴
Γ_{11} $\pi^+ \pi^- \pi^0$	(6.8 ± 0.4) × 10 ⁻⁴
Γ_{22} $\pi^+ \pi^- e^+ e^-$	(4.54 ± 0.23) × 10 ⁻⁴

$\eta'(958)$ PARTIAL WIDTHS

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

3.8 ±0.7 ±0.6	34	AIHARA	88C	TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 ±0.5 ±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 ±0.6 ±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_{29}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.1 × 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 × 10 ⁻³	90	² ACHASOV 15	SND	0.958 $e^+e^- \rightarrow \pi\pi\eta$
<2.4 × 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 ± 0.04 ± 0.13		BEHREND 91	CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
1.35 ± 0.09 ± 0.21		AIHARA 87	TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.13 ± 0.04 ± 0.13	867	ALBRECHT 87B	ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.53 ± 0.09 ± 0.21		ALTHOFF 84E	TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.14 ± 0.08 ± 0.11	243	BERGER 84B	PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.73 ± 0.34 ± 0.35	95	JENNI 83	MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.49 ± 0.13 ± 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 ± 0.31 ± 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 ± 0.06 ± 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±0.05±0.08 ² KARCH 90 CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
 1.00±0.08±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 $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.

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

$\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{29}/\Gamma$

VALUE (10^{-3} eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<1.0	90	¹ AKHMETSHIN 15	CMD3	0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$
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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
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42.5 ± 0.5 OUR FIT Error includes scale factor of 1.1.

41.24±0.08±1.24	312k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

42.4 ± 1.1 ± 0.4	1.2k	¹ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$
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¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{\text{total}}$ **0.2804** Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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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
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0.10 ± 0.04	10	LONDON 66	HBC	2.24 $K^-p \rightarrow \Lambda 2\pi^+ 2\pi^-\pi^0$
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0.07 ± 0.04	7	BADIER 65B	HBC	3 K^-p
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$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$ **0.7196** Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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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
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$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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29.5 ± 0.4 OUR FIT Error includes scale factor of 1.1.

29.90± 0.03±0.55	913k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$28.7 \pm 0.7 \pm 0.4$	0.2k	¹ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
32.9 ± 3.3	298	RITTENBERG	69	HBC	$1.7\text{--}2.7 K^- p$
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
<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	

• • • 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
<u>VALUE</u>		<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	

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	$J/\psi \rightarrow \eta' \gamma$
0.69 ± 0.03		ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta' \gamma$

$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))/\Gamma(\pi^+ \pi^- \eta (\text{neutral decay}))$					$\Gamma_2/0.714\Gamma_1$
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	

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	$0 \bar{p} p \rightarrow \pi^+ \pi^- \eta$
1.07 ± 0.17		BELADIDZE	92C	VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
0.92 ± 0.14	473	DANBURG	73	HBC	$2.2 K^- p \rightarrow \Lambda X^0$
1.11 ± 0.18	192	JACOBS	73	HBC	$2.9 K^- p \rightarrow \Lambda X^0$

$\Gamma(\pi^0 \pi^0 \eta)/\Gamma_{\text{total}}$					Γ_4/Γ
<u>VALUE (units 10^{-2})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	

22.4 ± 0.6 OUR FIT Error includes scale factor of 1.1.

21.36 ± 0.10 ± 0.92 52k ABLIKIM 19T BES $J/\psi \rightarrow \gamma \eta'$

• • • 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.

$\Gamma(\pi^0 \pi^0 \eta (3\pi^0 \text{ decay}))/\Gamma_{\text{total}}$					$0.321\Gamma_4/\Gamma$
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	

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
0.527±0.019 OUR FIT Error includes scale factor of 1.1.			
0.555±0.043±0.013	PEDLAR	09 CLE3	$J/\psi \rightarrow \eta'\gamma$

 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi\pi\eta)$ $\Gamma_2/(\Gamma_1+\Gamma_4)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.454±0.009 OUR FIT Error includes scale factor of 1.1.			
0.43 ±0.02 ±0.02	BARBERIS	98C OMEG	450 $p\bar{p} \rightarrow p_f\eta'p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.31 ±0.15	DAVIS	68 HBC	5.5 K^-p

 $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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
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 π^-p

 $\Gamma(\omega\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_5/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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
• • • 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
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 $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.				

$$\frac{\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / [\Gamma(\pi^+ \pi^- \eta) + \Gamma(\pi^0 \pi^0 \eta) + \Gamma(\omega \gamma)]}{\Gamma_2 / (\Gamma_1 + \Gamma_4 + \Gamma_5)}$$

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 $K^- p$
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$$\frac{[\Gamma(\pi^0 \pi^0 \eta (\text{charged decay})) + \Gamma(\omega (\text{charged decay}) \gamma)] / \Gamma_{\text{total}}}{(0.286\Gamma_4 + 0.89\Gamma_5) / \Gamma}$$

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	1.7–2.7 $K^- p$
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$$\frac{\Gamma(\pi^+ \pi^- \text{ neutrals}) / \Gamma_{\text{total}}}{(0.714\Gamma_1 + 0.286\Gamma_4 + 0.89\Gamma_5) / \Gamma}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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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 $K^- p \rightarrow \Lambda \pi^+ \pi^- \text{ neutrals}$
0.35 ± 0.06	33	BADIER	65B	HBC	3 $K^- p$

$$\frac{\Gamma(\gamma \gamma) / \Gamma_{\text{total}}}{\Gamma_7 / \Gamma}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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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.

$$\frac{\Gamma(\gamma \gamma) / \Gamma(\pi^+ \pi^- \eta)}{\Gamma_7 / \Gamma_1}$$

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

0.053 ± 0.004 ± 0.001	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
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$$\Gamma(\gamma\gamma)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma)) \quad \Gamma_7/\Gamma_2$$

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 $J/\psi \rightarrow \eta'\gamma$

$$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta) \quad \Gamma_7/\Gamma_4$$

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 $\pi^- p \rightarrow n2\gamma$

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

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 $\pi^- p \rightarrow nX^0$
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$$\Gamma(\text{neutrals})/\Gamma_{\text{total}} \quad (0.714\Gamma_4+0.09\Gamma_5+\Gamma_7)/\Gamma$$

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 $\pi^- p \rightarrow nX^0$
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0.189±0.026	123	RITTENBERG	69	HBC 1.7–2.7 $K^- p$
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$$\Gamma(3\pi^0)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

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 $J/\psi \rightarrow K^+K^-\pi$

• • • 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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¹We have added all systematic uncertainties in quadrature to a single value.

²Superseded by ABLIKIM 17.

$$\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta) \quad \Gamma_8/\Gamma_4$$

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 $\pi^- p \rightarrow n6\gamma$

$$\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma) \quad \Gamma_9/\Gamma_7$$

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
$1.95 \pm 0.37 \pm 0.03$		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 $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$. 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
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3.61 ± 0.18 OUR FIT

3.61 ± 0.18 OUR AVERAGE

$3.591 \pm 0.054 \pm 0.174$	6067	ABLIKIM	17 BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
$4.28 \pm 0.49 \pm 1.11$	78	¹ ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$
$3.7 \begin{smallmatrix} +1.1 \\ -0.9 \end{smallmatrix} \pm 0.4$		² NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

• • • 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.

$\Gamma((\pi^+\pi^-\pi^0) \text{ S-wave})/\Gamma_{\text{total}}$ 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
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$7.44 \pm 0.60 \pm 2.23$ ¹ ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma(\pi^\mp\rho^\pm)$

¹ We have added all systematic uncertainties in quadrature .

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 ± 0.4 OUR FIT					Error includes scale factor of 1.1.
8.27^{+2.49}_{-2.12} ± 0.04		20	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

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.

$\Gamma(\pi^0\rho^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

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

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.4 ± 0.9 ± 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	$J/\psi \rightarrow \gamma\eta'$
<1000	90	RITTENBERG 69	HBC		1.7–2.7 K^-p

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 $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$. 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.

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

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_{16}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.79 ± 0.38 ± 0.02		84	¹ ABLIKIM	14M	BES3 $J/\psi \rightarrow \gamma\eta'$

• • • 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 $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$. 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_{16}/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{16}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

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_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	DANBURG 73	HBC	2.2 $K^- p \rightarrow \Lambda X^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.01	90	RITTENBERG 69	HBC	1.7–2.7 $K^- p$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.002	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
<0.01	90	RITTENBERG 69	HBC	1.7–2.7 $K^- p$

¹ Not independent of measured value of Γ_{18}/Γ_1 from NAIK 09.

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{18}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$

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_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)+MM$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.01	90	LONDON 66	HBC	Compilation

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	¹ ABLIKIM 13U	BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
• • • 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_{20}/Γ_1 from NAIK 09.

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{20}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$

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_{21}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 $\times 10^{-4}$	90	ABLIKIM 16M	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

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

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

2.11±0.12±0.14 429 ¹ ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma\eta'$ 2.5 $^{+1.2}_{-0.9}$ ±0.5 ² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <6 90 RITTENBERG 65 HBC 2.7 K^-p ¹ Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.² Not independent of measured value of Γ_{22}/Γ_1 from NAIK 09. $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{22}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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5.69±0.25 OUR FIT5.51 $^{+3.00}_{-2.30}$ ±0.03 8 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

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_{22}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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8.20±0.31 OUR FIT8.20±0.16±0.27 2584 ABLIKIM 21J BES3 $J/\psi \rightarrow \gamma\eta'$

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

7.2 ±0.4 ±0.5 429 ¹ ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma\eta'$ ¹ Superseded by ABLIKIM 21J. $\Gamma(\pi^+e^-\nu_e + \text{c.c.})/\Gamma(\pi^+\pi^-\eta)$ Γ_{23}/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<5.0 90 ABLIKIM 13G BES3 $J/\psi \rightarrow \phi\eta'$ $\Gamma(\gamma e^+e^-)/\Gamma_{\text{total}}$ Γ_{24}/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^- $\Gamma(\gamma e^+e^-)/\Gamma(\gamma\gamma)$ Γ_{24}/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 $J/\psi \rightarrow \gamma e^+e^-$ $\Gamma(\pi^0\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{25}/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 $J/\psi \rightarrow \gamma\eta'$

$\Gamma(\pi^0 \gamma \gamma (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.16 \pm 0.64 \pm 0.67$	655	ABLIKIM 17T	BES3	$J/\psi \rightarrow \gamma \eta'$

 $\Gamma(\pi^0 \gamma \gamma)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{25}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<37	90	ALDE 87B	GAM2	$38 \pi^- p \rightarrow n 4 \gamma$

 $\Gamma(\eta \gamma \gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.33×10^{-4}	90	ABLIKIM 19AW	BES3	$J/\psi \rightarrow \gamma \eta' \rightarrow \gamma \gamma \gamma 2 \gamma$

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.94×10^{-5}	90	ABLIKIM 20E	BES3	$J/\psi \rightarrow \eta' \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 3.2×10^{-4}	90	DONSKOV 14	GAM4	$32.5 \pi^- p \rightarrow \eta' n$

 $\Gamma(4\pi^0)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{28}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<23	90	ALDE 87B	GAM2	$38 \pi^- p \rightarrow n 8 \gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6×10^{-9}	90	¹ ACHASOV 15	SND	$0.958 e^+ e^- \rightarrow \pi \pi \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 12×10^{-9}	90	² AKHMETSHIN 15	CMD3	$0.958 e^+ e^- \rightarrow \pi^+ \pi^- \eta$
< 2.1×10^{-7}	90	VOROBYEV 88	ND	$e^+ e^- \rightarrow \pi^+ \pi^- \eta$

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 $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.20)\%$.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
• • • 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.

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

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

$\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ 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 $J/\psi \rightarrow \gamma\eta'$
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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 $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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< 0.18	90	¹ AAIJ	17D	LHCB $D_{(s)}^+ \rightarrow \pi^+\pi^-\pi^+$
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

< 0.5	90	² ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-$
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< 29	90	³ MORI	07A	BELL $\gamma\gamma \rightarrow \pi^+\pi^-$
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< 3.3	90	⁴ MORI	07A	BELL $\gamma\gamma \rightarrow \pi^+\pi^-$
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<800	95	DANBURG	73	HBC $2.2 K^-p \rightarrow \Lambda\chi^0$
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<200	90	RITTENBERG	69	HBC $1.7\text{--}2.7 K^-p$
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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 $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.25 \times 10^{-3}$.

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
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< 4×10^{-4}	90	¹ ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma\pi^0\pi^0$
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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 $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.25 \times 10^{-3}$.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<45	90	ALDE	87B	GAM2 $38 \pi^-p \rightarrow n4\gamma$
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 $\Gamma(\pi^0e^+e^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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< 1.4	90	BRIERE	00	CLEO $10.6 e^+e^-$
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● ● ● 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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 $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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< 2.4	90	BRIERE	00	CLEO $10.6 e^+e^-$
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● ● ● 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_{35}/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_{36}/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_{37}/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_{38}/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.

$Re(\alpha)$ 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.

$Im(\alpha)$ decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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. ● ● ●				
$-0.056 \pm 0.004 \pm 0.002$	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	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.072 \pm 0.007 \pm 0.008$		¹ GONZALEZ-S..18A	RVUE	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	² ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	³ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	⁴ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

² See ABLIKIM 11 for the full correlation matrix.

³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay.

⁴ 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. ● ● ●				
$-0.049 \pm 0.006 \pm 0.006$	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	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.052 \pm 0.001 \pm 0.002$		¹ GONZALEZ-S..18A	RVUE	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	² ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	³ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	⁴ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

² See ABLIKIM 11 for the full correlation matrix.

³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay.

⁴ 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**

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

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.² See ABLIKIM 11 for the full correlation matrix.³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.⁴ From $\eta' \rightarrow \eta\pi^+\pi^-$ decay.

$\eta'(958)$ β PARAMETER

|MATRIX ELEMENT|² = (1 + 2 β Z)

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-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 $38 \pi^- p \rightarrow n3\pi^0$

 $\eta'(958)$ C-NONCONSERVING DECAY PARAMETERSee the note on η decay parameters in the Stable Particle Particle Listings for definition of this parameter.**DECAY ASYMMETRY PARAMETER FOR $\pi^+\pi^-\gamma$**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-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. LANDSBERG 85, eq. (3.8), for a detailed definition.

VALUE (GeV ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.62±0.17 OUR AVERAGE				
1.60±0.17±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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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.)
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DONSKOV	14	MPL A29 1450213	S. Donskov <i>et al.</i>	(GAMS-4 π Collab.)
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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.)
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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.)
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		Translated from YAF 71 2161.		
LIBBY	08	PRL 101 182002	J. Libby <i>et al.</i>	(CLEO Collab.)
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MORI	07A	JPSJ 76 074102	T. Mori <i>et al.</i>	(BELLE Collab.)
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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.)
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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 (erratum)	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)
		Translated from YAF 32	1005.	
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. Zanfino <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