$\eta'(958)$

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

$\eta'(958)$ 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	$J/\psi \to \gamma\eta'$
957.9 ±0.2 ±0.6	4800	WURZINGER	96	SPEC	1.68 $pd \to {}^3\mathrm{He}\eta'$
957.46 ±0.33		DUANE	74	MMS	$\pi^- p \to n\mathrm{MM}$
958.2 ±0.5	1414	DANBURG	73	HBC	2.2 $K^- p \to \Lambda\eta'$
958 ±1	400	JACOBS	73	HBC	2.9 $K^- p \to \Lambda\eta'$
956.1 ±1.1	3415	[1] BASILE	71	CNTR	1.6 $\pi^- p \to n\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
957.5 ±0.2		BAI	04J	BES2	$J/\psi \to \gamma\gamma\pi^+\pi^-$
959 ±1	630	[2] BELADIDZE	92C	VES	36 π^- Be $\to \pi^-\eta'\eta$Be
958 ±1	340	[2] ARMSTRONG	91B	OMEG	300 $pp \to pp\eta\pi^+\pi^-$
958.2 ±0.4	622	[2] AUGUSTIN	90	DM2	$J/\psi \to \gamma\eta\pi^+\pi^-$
957.8 ±0.2	2420	[2] AUGUSTIN	90	DM2	$J/\psi \to \gamma\gamma\pi^+\pi^-$
956.3 ±1.0	143	[2] GIDAL	87	MRK2	$e^+e^- \to e^+e^-\eta\pi^+\pi^-$
957.4 ±1.4	535	[3] BASILE	71	CNTR	1.6 $\pi^- p \to n\eta'$
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		$pp \to pp\eta'$
0.40 ±0.22	4800	WURZINGER	96	SPEC		1.68 $pd \to {}^3\mathrm{He}\eta'$
0.28 ±0.10	1000	BINNIE	79	MMS	0	$\pi^- p \to n\mathrm{MM}$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.20 ±0.04		BAI	04J	BES2		$J/\psi \to \gamma\gamma\pi^+\pi^-$

$\eta'(958)$ 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 $\pi^+\ \pi^-\ \gamma$)	(29.48 ±0.35) %	
Γ_3	$\rho^0\gamma$		
Γ_4	$\pi^0\pi^0\eta$	(22.4 ±0.5) %	

Γ_5	$\omega\gamma$		(2.52 ±0.07) %		
Γ_6	$\omega e^+ e^-$		(2.0 ±0.4) $\times 10^{-4}$		
Γ_7	$\gamma\gamma$		(2.307±0.033) %		
Γ_8	$3\pi^0$		(2.50 ±0.17) $\times 10^{-3}$		
Γ_9	$\mu^+\mu^-\gamma$		(1.13 ±0.28) $\times 10^{-4}$		
Γ_{10}	$\pi^+\pi^-\mu^+\mu^-$		(2.13 ±0.13) $\times 10^{-5}$		
Γ_{11}	$\pi^+\pi^-\pi^0$		(3.61 ±0.17) $\times 10^{-3}$		
Γ_{12}	$(\pi^+\pi^-\pi^0)$ S-wave		(3.8 ±0.5) $\times 10^{-3}$		
Γ_{13}	$\pi^\mp\rho^\pm$		(7.4 ±2.3) $\times 10^{-4}$		
Γ_{14}	$2(\pi^+\pi^-)$		(8.51 ±0.33) $\times 10^{-5}$		
Γ_{15}	$\pi^+\pi^- 2\pi^0$		(2.11 ±0.15) $\times 10^{-4}$		
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}	$\pi^+\pi^- e^+ e^-$		(2.43 ±0.06) $\times 10^{-3}$		
Γ_{22}	$\pi^+ e^- \nu_e$ + c.c.		< 2.1	$\times 10^{-4}$	90%
Γ_{23}	$\gamma e^+ e^-$		(4.80 ±0.15) $\times 10^{-4}$		
Γ_{24}	$\pi^0\gamma\gamma$		(3.20 ±0.24) $\times 10^{-3}$		
Γ_{25}	$\pi^0\gamma\gamma$(non resonant)		(6.2 ±0.9) $\times 10^{-4}$		
Γ_{26}	$\eta\gamma\gamma$		< 1.33	$\times 10^{-4}$	90%
Γ_{27}	$4\pi^0$		< 1.2	$\times 10^{-5}$	90%
Γ_{28}	$e^+ e^-$		< 5.6	$\times 10^{-9}$	90%
Γ_{29}	$e^+ e^- e^+ e^-$		(4.5 ±1.1) $\times 10^{-6}$		
Γ_{30}	invisible		< 2.1	$\times 10^{-4}$	90%
Γ_{31}	γDark Photon		5.0×10^{-07} to 3.50×10^{-06}		90%

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

Γ_{32}	$\pi^+\pi^-$	P,CP		< 1.8	$\times 10^{-5}$	90%
Γ_{33}	$\pi^0\pi^0$	P,CP		< 4	$\times 10^{-4}$	90%
Γ_{34}	$\pi^0 e^+ e^-$	C	[a]	< 1.4	$\times 10^{-3}$	90%
Γ_{35}	$\pi^0\rho^0$	C		< 4	%	90%
Γ_{36}	$\eta e^+ e^-$	C	[a]	< 2.4	$\times 10^{-3}$	90%
Γ_{37}	3γ	C		< 1.0	$\times 10^{-4}$	90%
Γ_{38}	$\mu^+\mu^-\pi^0$	C	[a]	< 6.0	$\times 10^{-5}$	90%
Γ_{39}	$\mu^+\mu^-\eta$	C	[a]	< 1.5	$\times 10^{-5}$	90%
Γ_{40}	$e\mu$	LF		< 4.7	$\times 10^{-4}$	90%
Γ_{41}	$\pi^+\pi^-$ ALP $\rightarrow$ $\pi^+\pi^- e^+ e^-$			< 1.9	$\times 10^{-5}$	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 21 branching ratios uses 53 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 69.5$ for 45 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle \delta p_i \delta p_j \right\rangle / (\delta p_i \cdot \delta p_j)$, 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	−24							
x_4	−77	−42						
x_5	−7	−6	−2					
x_7	−11	−7	9	−1				
x_8	−17	−9	19	−1	2			
x_{11}	−1	−1	−1	0	0	0		
x_{21}	−5	19	−9	−1	−2	−2	0	
Γ	11	−9	−2	1	−40	0	0	−2
	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 ±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_{21}	$\pi^+\pi^- e^+ e^-$	(4.57 ±0.19) × 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	$e^+e^- \to e^+e^-\pi^+\pi^-\gamma$
4.53±0.29±0.51	266	KARCH	92	CBAL	$e^+e^- \to e^+e^-\eta\pi^0\pi^0$
3.61±0.13±0.48		[2] BEHREND	91	CELL	$e^+e^- \to e^+e^-\eta'(958)$
4.6 ±1.1 ±0.6	23	BARU	90	MD1	$e^+e^- \to e^+e^-\pi^+\pi^-\gamma$
4.57±0.25±0.44		BUTLER	90	MRK2	$e^+e^- \to e^+e^-\eta'(958)$
5.08±0.24±0.71	547	[3] ROE	90	ASP	$e^+e^- \to e^+e^-2\gamma$

3.8 ±0.7 ±0.6	34	AIHARA	88C	TPC	$e^+e^- \to e^+e^-\eta\pi^+\pi^-$
4.9 ±0.5 ±0.5	136	[4] WILLIAMS	88	CBAL	$e^+e^- \to e^+e^-2\gamma$

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

4.7 ±0.6 ±0.9	143	[5] GIDAL	87	MRK2	$e^+e^- \to e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		[6] BARTEL	85E	JADE	$e^+e^- \to e^+e^-2\gamma$

[1] No non-resonant $\pi^+\pi^-$ contribution found.
[2] Reevaluated by us using $B(\eta' \to \rho(770)\gamma) = (30.2 \pm 1.3)\%$.
[3] Reevaluated by us using $B(\eta' \to \gamma\gamma) = (2.11 \pm 0.13)\%$.
[4] Reevaluated by us using $B(\eta' \to \gamma\gamma) = (2.11 \pm 0.13)\%$.
[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 $e^+e^- \to \pi\pi\eta$

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

$<2.0 \times 10^{-3}$	90	[2] ACHASOV	15	SND	0.958 $e^+e^- \to \pi\pi\eta$
$<2.4 \times 10^{-3}$	90	[2] AKHMETSHIN	15	CMD3	0.958 $e^+e^- \to \pi^+\pi^-\eta$

[1] Combining data of ACHASOV 15 and AKHMETSHIN 15.
[2] Using η and η' branching fractions from PDG 14.

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

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.

$\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{total}$ $\Gamma_7\Gamma_2/\Gamma$

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	$e^+e^- \to e^+e^-\rho(770)^0\gamma$
1.35±0.09±0.21		AIHARA	87	TPC	$e^+e^- \to e^+e^-\rho\gamma$
1.13±0.04±0.13	867	ALBRECHT	87B	ARG	$e^+e^- \to e^+e^-\rho\gamma$
1.53±0.09±0.21		ALTHOFF	84E	TASS	$e^+e^- \to e^+e^-\rho\gamma$
1.14±0.08±0.11	243	BERGER	84B	PLUT	$e^+e^- \to e^+e^-\rho\gamma$
1.73±0.34±0.35	95	JENNI	83	MRK2	$e^+e^- \to e^+e^-\rho\gamma$
1.49±0.13±0.027	213	BARTEL	82B	JADE	$e^+e^- \to e^+e^-\rho\gamma$

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

1.85±0.31±0.24	43	BEHREND	82C	CELL	$e^+e^- \to e^+e^-\rho\gamma$

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{total}$ $\Gamma_7\Gamma_4/\Gamma$

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	$e^+e^- \to e^+e^-\eta\pi^0\pi^0$

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

0.95±0.05±0.08	[2] KARCH	90	CBAL	$e^+e^- \to e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	[2,3] ANTREASYAN	87	CBAL	$e^+e^- \to e^+e^-\eta\pi^0\pi^0$

[1] Reevaluated by us using $B(\eta \to \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.
[2] Superseded by KARCH 92.
[3] Using BR($\eta \to 2\gamma$)=(38.9 ± 0.5)%.

$\eta'(958)$ Γ(i)Γ(e^+e^-)/Γ(total)

$\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_1\Gamma_{28}/\Gamma$

VALUE (10^{-3} eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.0	90	[1] AKHMETSHIN 15		CMD3	0.958 $e^+e^- \to \pi^+\pi^-\eta$

[1] AKHMETSHIN 15 reports $[\Gamma(\eta'(958) \to \pi^+\pi^-\eta) \times \Gamma(\eta'(958) \to e^+e^-)/\Gamma_{total}] \times [B(\eta \to 2\gamma)] < 4.1 \times 10^{-4}$ eV which we divide by our best value $B(\eta \to 2\gamma) = 39.36 \times 10^{-2}$.

$\eta'(958)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{total}$ 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	$J/\psi \to \gamma\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
42.4 ±1.1 ±0.4	1.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$

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

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{total}$ $0.2805\Gamma_1/\Gamma$

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 $K^-p \to \Lambda 2\pi^+2\pi^-\pi^0$
0.07 ±0.04	7	BADIER	65B	HBC	3 K^-p

$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{total}$ $0.7195\Gamma_1/\Gamma$

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

$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{total}$ 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	$J/\psi \to \gamma\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
28.7 ± 0.7 ±0.4	0.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$
32.9 ± 3.3	298	RITTENBERG	69	HBC	1.7–2.7 K^-p
20 ±10	20	LONDON	66	HBC	2.24 $K^-p \to \Lambda\pi^+\pi^-\gamma$
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
• • • We do not use the following data for averages, fits, limits, etc. • • •					
33.34±0.06±1.60	970k	[1] ABLIKIM	18C	BES3	$\eta'(958) \to \gamma\pi^+\pi^-$
34.43±0.52±1.97	970k	[2] ABLIKIM	18C	BES3	$\eta'(958) \to \gamma\pi^+\pi^-$

[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
0.694±0.014 OUR FIT Error includes scale factor of 1.1.				
0.683±0.020 OUR AVERAGE				
0.677±0.024±0.011	PEDLAR	09	CLE3	$J/\psi \to \eta'\gamma$
0.69 ±0.03	ABLIKIM	06E	BES2	$J/\psi \to \eta'\gamma$

$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))$ $\Gamma_2/0.714\Gamma_1$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.972±0.019 OUR FIT Error includes scale factor of 1.1.					
0.97 ±0.09 OUR AVERAGE					
0.70 ±0.22		AMSLER	04B	CBAR	$0\ \overline{p}p \to \pi^+\pi^-\eta$
1.07 ±0.17		BELADIDZE	92C	VES	$36\ \pi^-\text{Be} \to \pi^-\eta'\eta\text{Be}$
0.92 ±0.14	473	DANBURG	73	HBC	$2.2\ K^-p \to \Lambda X^0$
1.11 ±0.18	192	JACOBS	73	HBC	$2.9\ K^-p \to \Lambda X^0$

$\Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
22.4 ±0.6 OUR FIT Error includes scale factor of 1.1.					
21.36±0.10±0.92	52k	ABLIKIM	19T	BES	$J/\psi \to \gamma\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
23.5 ±1.3 ±0.4	3.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$

[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
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	$2.2\ \pi^+ d$

$\Gamma(\pi^0\pi^0\eta)/\Gamma(\pi^+\pi^-\eta)$ 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	$J/\psi \to \eta'\gamma$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.455±0.008 OUR FIT Error includes scale factor of 1.1.				
0.43 ±0.02 ±0.02	BARBERIS	98C	OMEG	$450\ pp \to p_f\eta' p_s$
• • • 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	$J/\psi \to \gamma\eta'$
2.55 ±0.03 ±0.16	33.2k	[1] ABLIKIM	15AD	BES3	$J/\psi \to \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.34 ±0.30 ±0.04	70	[2] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$

[1] Using $B(J/\psi \to \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \to \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.
[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	$J/\psi \to \eta'\gamma$
• • • 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*
0.113±0.004 OUR FIT				
0.147±0.016	ALDE	87B	GAM2	38 $\pi^- p \to n4\gamma$

$\Gamma(\omega e^+e^-)/\Gamma(\omega\gamma)$ 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	$J/\psi \to \eta'\gamma$

[1] Obtained from other ABLIKIM 15AD meausurements 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	$J/\psi \to \eta'\gamma$

[1] Using $B(J/\psi \to \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \to \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.438±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 $K^- p$

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
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 $K^- p$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.3896±0.0027 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 $K^- p \to \Lambda\pi^+\pi^-$ 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	$J/\psi \to \gamma\eta'$
1.99 $^{+0.31}_{-0.27}$ ±0.07	114	[1] WICHT	08	BELL	$B^\pm \to K^\pm\gamma\gamma$
2.00 ±0.18		[2] STANTON	80	SPEC	8.45 $\pi^- p \to n\pi^+\pi^- 2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.25 ±0.16 ±0.03	0.3k	[3] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$
1.8 ±0.2	6000	[4] APEL	79	NICE	15–40 $\pi^- p \to n2\gamma$
2.5 ±0.7		DUANE	74	MMS	$\pi^- p \to n$MM
1.71 ±0.33	68	DALPIAZ	72	CNTR	1.6 $\pi^- p \to nX^0$
2.0 $^{+0.8}_{-0.6}$	31	HARVEY	71	OSPK	3.65 $\pi^- p \to nX^0$

[1] WICHT 08 reports $[\Gamma(\eta'(958) \to \gamma\gamma)/\Gamma_{\text{total}}] \times [\text{B}(B^+ \to \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $\text{B}(B^+ \to \eta' K^+) = (7.04 \pm 0.25) \times 10^{-5}$. 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	$J/\psi \to \eta'\gamma$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.0782±0.0016 OUR FIT Error includes scale factor of 1.1.				
0.080 ±0.008	ABLIKIM	06E	BES2	$J/\psi \to \eta'\gamma$

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ 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 $\pi^- p \to n2\gamma$

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

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 $\pi^- p \to nX^0$

$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_4+0.09\Gamma_5+\Gamma_7)/\Gamma$

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 $\pi^- p \to n X^0$
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	$J/\psi \to \gamma(3\pi^0)$
4.79 ±0.59 ±1.14	183	[1] ABLIKIM	15P	BES3	$J/\psi \to K^+ K^- 3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.56 ±0.22 ±0.34	309	[2] ABLIKIM	12E	BES3	$J/\psi \to \gamma(3\pi^0)$

[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 $\pi^- p \to \eta' n$
74±15		ALDE	87B	GAM2	38 $\pi^- p \to n 6\gamma$
75±18		BINON	84	GAM2	30–40 $\pi^- p \to n 6\gamma$

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

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

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.13±0.13 OUR AVERAGE						
2.15±0.13±0.02		434	[1] ABLIKIM	24AK	BES3	$J/\psi \to \gamma\eta'$
1.94±0.37±0.02		53	[2] ABLIKIM	21I	BES3	$J/\psi \to \gamma\eta'(958)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 2.9	90		[3] ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$
<24	90		[4] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] ABLIKIM 24AK reports $(2.16 \pm 0.12 \pm 0.06) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \to \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [\text{B}(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[2] ABLIKIM 21I reports $(1.97 \pm 0.33 \pm 0.19) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \to \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [\text{B}(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[3] Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.
[4] 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	$J/\psi \to \gamma\eta'$

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

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.0	90	ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.61 ±0.18 OUR FIT					
3.61 ±0.18 OUR AVERAGE					
$3.591 \pm 0.054 \pm 0.174$	6067	ABLIKIM	17	BES3	$J/\psi \to \gamma(\pi^+\pi^-\pi^0)$
$4.28 \pm 0.49 \pm 1.11$	78	[1] ABLIKIM	15P	BES3	$J/\psi \to K^+K^-3\pi$
$3.7\ ^{+1.1}_{-0.9} \pm 0.4$		[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
• • • 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	$J/\psi \to \gamma(\pi^+\pi^-\pi^0)$

[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 ±0.4 OUR FIT Error includes scale factor of 1.1.					
$\mathbf{8.27^{+2.49}_{-2.12} \pm 0.04}$	20	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

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

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

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

[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±0.60±2.23	1231	[1] ABLIKIM	17	BES3	$J/\psi \to \gamma(\pi^\mp\rho^\pm)$

[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
8.51±0.32±0.10		1650	[1] ABLIKIM	24F	BES3	$J/\psi \to \gamma\eta'(958)$

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

8.3	±0.9	±0.1	199	[2,3]	ABLIKIM	14M	BES3	$J/\psi \to \gamma\eta'$
< 24			90	[4]	NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
<1000			90		RITTENBERG	69	HBC	1.7–2.7 $K^- p$

[1] ABLIKIM 24F reports $(8.56 \pm 0.25 \pm 0.23) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\text{B}(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] ABLIKIM 14M reports $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\text{B}(J/\psi(1S) \to \gamma\eta'(958))] = (4.40 \pm 0.35 \pm 0.30) \times 10^{-7}$ which we divide by our best value $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] Superseded by ABLIKIM 24F.

[4] 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
<0.6	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-))/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)] / [\text{B}(\eta \to 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $\text{B}(\eta \to 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.11±0.15±0.02		865	[1] ABLIKIM	24F	BES3	$J/\psi \to \gamma\eta'(958)$

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

1.78±0.38±0.02		84	[2,3]	ABLIKIM	14M	BES3	$J/\psi \to \gamma\eta'$
<27	90		[4]	NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] ABLIKIM 24F reports $(2.12 \pm 0.12 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\eta'(958) \to \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [\text{B}(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $\text{B}(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

[3] Superseded by ABLIKIM 24F.

[4] 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
<6	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)] / [\text{B}(\eta \to 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $\text{B}(\eta \to 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.01	95	DANBURG	73	HBC	2.2 $K^- p \to \Lambda X^0$
• • • 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_{17}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.002	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
<0.01	90	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

[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
<4	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)]$ $< 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.01	95	KALBFLEISCH	64B	HBC	$K^- p \to \Lambda 2(\pi^+\pi^-)$+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_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
< 3.1	90	[1] ABLIKIM	13U	BES3	$J/\psi \to \gamma 3(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 53	90	[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
<500	95	KALBFLEISCH	64B	HBC	$K^- p \to \Lambda 2(\pi^+\pi^-)$

[1] Using $B(J/\psi \to \gamma\eta'(958)) = (5.16 \pm 0.15) \times 10^{-3}$.
[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
<1.2	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to 3(\pi^+\pi^-))/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)]$ $< 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.36 \times 10^{-2}$.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.3 × 10⁻⁴	90	ABLIKIM	16M	BES3	$e^+e^- \to J/\psi \to$ hadrons

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.43±0.06 OUR FIT						
2.44±0.08±0.03		22725	[1] ABLIKIM	24AK	BES3	$J/\psi \to \gamma\eta'$

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

$2.11 \pm 0.12 \pm 0.14$	429	[2] ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$	
$2.5\ ^{+1.2}_{-0.9} \pm 0.5$		[3] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$	
<6	90	RITTENBERG	65	HBC	2.7 $K^- p$	

[1] ABLIKIM 24AK reports $(2.45 \pm 0.02 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\eta'(958) \to \pi^+\pi^- e^+ e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. 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_{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
5.72±0.17 OR FIT					
$\mathbf{5.51^{+3.00}_{-2.29} \pm 0.03}$	8	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to \pi^+\pi^- e^+ e^-)/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. 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
8.24±0.21 OR FIT					
8.20±0.16±0.27	2584	ABLIKIM	21J	BES3	$J/\psi \to \gamma\eta'$

• • • 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	$J/\psi \to \gamma\eta'$

[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	$J/\psi \to \phi\eta'$

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
4.80±0.14±0.05		7611	[1] ABLIKIM	24M	BES3	$e^+e^- \to J/\psi \to \gamma\eta'$

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

<9	90	BRIERE	00	CLEO	10.6 e^+e^-

[1] ABLIKIM 24M reports $(4.83 \pm 0.07 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\eta'(958) \to \gamma e^+ e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\gamma e^+ e^-)/\Gamma(\gamma\gamma)$ Γ_{23}/Γ_7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.13±0.09±0.07	864	ABLIKIM	15O	BES3	$J/\psi \to \gamma e^+ e^-$

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

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

$\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{24}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<37	90	ALDE	87B	GAM2	38 $\pi^- p \to n4\gamma$

$\Gamma(\pi^0\gamma\gamma(\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{25}/Γ

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

$\Gamma(\eta\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

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

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.2 × 10^{-5}	90	[1] ABLIKIM	24F	BES3	$J/\psi \to \gamma\eta'(958)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.94 \times 10^{-5}$	90	[2] ABLIKIM	20E	BES3	$J/\psi \to \eta'\gamma$
$<3.2 \times 10^{-4}$	90	DONSKOV	14	GAM4	32.5 $\pi^- p \to \eta' n$

[1] ABLIKIM 24F reports $< 1.24\times10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \to 4\pi^0)/\Gamma_{\text{total}}]$ × $[B(J/\psi(1S) \to \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

[2] Superseded by ABLIKIM 24F.

$\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{27}/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 $\pi^- p \to n8\gamma$

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

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

[1] Combining data of ACHASOV 15 and AKHMETSHIN 15 and using $\Gamma(\eta') = 0.198\pm0.009$ MeV.

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

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

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

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

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\mu^+\mu^-)$ Γ_{21}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
113.4±0.9±3.7	434	[1] ABLIKIM	24AK	BES3	$J/\psi \to \gamma\eta'$

[1] ABLIKIM 24AK value is not independent from the individual branching fraction measurements.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.1 \times 10^{-4}$	90	[1] ANDREEV	24D	NA64	CEX π^- Fe $\to \eta' X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<9.5 \times 10^{-4}$	90	[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] ANDREEV 24D result is based on 2.9×10^9 pions on active ^{26}Fe target.
[2] 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
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.1	90	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

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

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<2.4 \times 10^{-2}$	90	ABLIKIM	13	BES3	$J/\psi \to \phi\eta'$
$<6.69 \times 10^{-2}$	90	ABLIKIM	06Q	BES	$J/\psi \to \phi\eta'$

$\Gamma(\gamma\,\text{Dark Photon})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.5 to 3.5	90	7611	[1] ABLIKIM	24M	BES3	$e^+e^- \to J/\psi \to \gamma\eta'$

[1] For a dark photon decaying to e^+e^- in the mass range 0 to 0.7 GeV.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 0.18	90	[1] AAIJ	17D	LHCB	$D^+_{(s)} \to \pi^+\pi^-\pi^+$

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

$<$ 0.5	90	[2]	ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^+\pi^-$
$<$ 29	90	[3]	MORI	07A	BELL	$\gamma\gamma \to \pi^+\pi^-$
$<$ 3.3	90	[4]	MORI	07A	BELL	$\gamma\gamma \to \pi^+\pi^-$
$<$800	95		DANBURG	73	HBC	2.2 $K^- p \to \Lambda X^0$
$<$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 $[\Gamma(\eta'(958) \to \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] < 2.84\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.28\times10^{-3}$.

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

[4] Without interference with the $\gamma\gamma \to \pi^+\pi^-$ continuum.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4\times10^{-4}$	90	[1] ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^0\pi^0$

[1] ABLIKIM 11G reports $[\Gamma(\eta'(958) \to \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] < 2.84\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.28\times10^{-3}$.

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{33}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<45	90	ALDE	87B	GAM2	38 $\pi^- p \to n4\gamma$

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{34}/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 $K^- p$

$\Gamma(\pi^0\rho^0)/\Gamma_{\text{total}}$ Γ_{35}/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_{36}/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 $K^- p$

$\Gamma(3\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{37}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<4.6	90	ALDE	87B	GAM2	38 $\pi^- p \to n3\gamma$

$\Gamma(\mu^+\mu^-\pi^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

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

$\Gamma(\mu^+\mu^-\eta)/\Gamma_{\text{total}}$ Γ_{39}/Γ

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

$\Gamma(e\mu)/\Gamma_{\text{total}}$ Γ_{40}/Γ

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

$\Gamma(\pi^+\pi^-\text{ALP} \to \pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-e^+e^-)$ Γ_{41}/Γ_{21}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.8\times10^{-3}$	90	[1] ABLIKIM	24AK	BES3	$J/\psi \to \gamma\eta'$

[1] For a pseudoscalar ALP, with a mass in the range 0–500 MeV. The measured limit at the 90% credibility level as a function of the mass of ALP ranges from 0.1×10^{-3} to 7.8×10^{-3}.

$\eta'(958) \to \eta\pi\pi$ 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 $\eta'(958) \to \eta\pi^+\pi^-$ and $\eta'(958) \to \eta\pi^0\pi^0$ 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. • • •					
$-0.034\pm0.002\pm0.002$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.054\pm0.004\pm0.001$	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.033\pm0.005\pm0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.072\pm0.012\pm0.006$	7k	[2] AMELIN	05A	VES	28 $\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$
$-0.021\pm0.018\pm0.017$	6.7k	[3] BRIERE	00	CLEO	10.6 $e^+e^- \to \eta\pi^+\pi^- X$
$-0.058\pm0.013\pm0.003$	5.4k	[4] ALDE	86	GAM2	38 $\pi^- p \to n\eta\pi^0\pi^0$
$-0.08\ \pm0.03$		[4,5] KALBFLEISCH	74	RVUE	$\eta' \to \eta\pi^+\pi^-$

[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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.000\pm0.019\pm0.001$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$

$0.000 \pm 0.038 \pm 0.002$	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$	
$0.000 \pm 0.049 \pm 0.001$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$	
$0.0 \pm 0.1 \pm 0.0$	7k	[2] AMELIN	05A	VES	28 $\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$	
$-0.00 \pm 0.13 \pm 0.00$	5.4k	[3] ALDE	86	GAM2	38 $\pi^- p \to n\eta\pi^0\pi^0$	
0.0 ± 0.3		[3,4] KALBFLEISCH	74	RVUE	$\eta' \to \eta\pi^+\pi^-$	

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

[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	$\eta' \to \eta\pi^+\pi^-$
$-0.061 \pm 0.009 \pm 0.005$	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.059 \pm 0.012 \pm 0.004$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	[2] AMELIN	05A	VES	28 $\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	[3] ALDE	86	GAM2	38 $\pi^- p \to n\eta\pi^0\pi^0$
0		[3,4] KALBFLEISCH	74	RVUE	$\eta' \to \eta\pi^+\pi^-$

[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.

$\eta'(958) \to \eta\pi\pi$ 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 $\eta'(958) \to \eta\pi^+\pi^-$ and $\eta'(958) \to \eta\pi^0\pi^0$ 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	$\eta' \to \eta\pi^0\pi^0$

$-0.056\pm0.004\pm0.002$	351k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.087\pm0.009\pm0.006$	56k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.074\pm0.008\pm0.006$	124k		ADLARSON	18A	A2MM	$\eta' \to \eta\pi^0\pi^0$
$-0.072\pm0.007\pm0.008$		[2]	GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.047\pm0.011\pm0.003$	44k	[3]	ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.066\pm0.016\pm0.003$	15k	[4]	BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.127\pm0.016\pm0.008$	20k	[5]	DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[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 $\eta' \to \eta\pi^0\pi^0$ decay.
[5] From $\eta' \to \eta\pi^+\pi^-$ decay.

b decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.066\pm0.006\pm0.001$		[1] ABLIKIM	23AH	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.049\pm0.006\pm0.006$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.073\pm0.014\pm0.005$	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.063\pm0.014\pm0.005$	124k	ADLARSON	18A	A2MM	$\eta' \to \eta\pi^0\pi^0$
$-0.052\pm0.001\pm0.002$		[2] GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.069\pm0.019\pm0.009$	44k	[3] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.063\pm0.028\pm0.004$	15k	[4] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.106\pm0.028\pm0.014$	20k	[5] DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[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 $\eta' \to \eta\pi^0\pi^0$ decay.
[5] From $\eta' \to \eta\pi^+\pi^-$ decay.

c decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.0027\pm0.0024\pm0.0018$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$0.019\ \pm0.011\ \pm0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.107\ \pm0.096\ \pm0.003$	15k	[2] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$0.015\ \pm0.011\ \pm0.014$	20k	[3] DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[1] See ABLIKIM 11 for the full correlation matrix.
[2] From $\eta' \to \eta\pi^0\pi^0$ decay.
[3] From $\eta' \to \eta\pi^+\pi^-$ decay.

d decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.068\pm0.004\pm0.001$		[1] ABLIKIM	23AH	BES3	$\eta' \to \eta\pi^0\pi^0$

$-0.063 \pm 0.004 \pm 0.003$	351k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.074 \pm 0.009 \pm 0.004$	56k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.050 \pm 0.009 \pm 0.005$	124k		ADLARSON	18A	A2MM	$\eta' \to \eta\pi^0\pi^0$
$-0.051 \pm 0.008 \pm 0.006$		[2]	GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	[3]	ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	[4]	BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	[5]	DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[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 $\eta' \to \eta\pi^0\pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.
[5] From $\eta' \to \eta\pi^+\pi^-$ 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	$J/\psi \to \gamma(\pi^0\pi^0\pi^0)$
-0.59 ± 0.18	235	BLIK	08	GAMS	32 $\pi^- p \to \eta' n$
-0.1 ± 0.3		ALDE	87B	GAM2	38 $\pi^- p \to n3\pi^0$

$\eta'(958)$ 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	$2\gamma \to \pi^+\pi^-\gamma$
-0.069 ± 0.078	295	GRIGORIAN	75	STRC	2.1 $\pi^- p$
0.00 ± 0.10	103	KALBFLEISCH	75	HBC	2.18 $K^- p \to \Lambda\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.07 ± 0.08	152	RITTENBERG	65	HBC	2.1–2.7 $K^- p$

$\eta'(958) \to \gamma\ell^+\ell^-$ 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
1.53 ± 0.04 OUR AVERAGE					
1.524 ± 0.041	7611	[1] ABLIKIM	24M	BES3	$e^+e^- \to J/\psi \to \gamma\eta'$
1.7 ± 0.4	33	[1] VIKTOROV	80		25,33 $\pi^- p \to 2\mu\gamma$

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

1.30 ±0.19			[2] ABLIKIM	24AK	BES3	$\eta' \to \pi^+\pi^-\mu^+\mu^-$, $\pi^+\pi^-e^+e^-$
1.60 ±0.17 ±0.08		864	[1] ABLIKIM	15O	BES3	$\eta' \to \gamma e^+e^-$

[1] In 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.

[2] From a weighted average of the $\eta' \to \pi^+\pi^-e^+e^-$ and $\eta' \to \pi^+\pi^-\mu^+\mu^-$ values. The uncertainty is obtained by combining statistical and systematic uncertainties. TFF slope values go between 1.10 ± 0.21 GeV^{-2} and 1.61 ± 0.71 GeV^{-2} for $\eta' \to \pi^+\pi^-e^+e^-$, and between 2.37 ± 0.49 GeV^{-2} and 2.88 ± 0.25 GeV^{-2} for $\eta' \to \pi^+\pi^-\mu^+\mu^-$, according to the solution of the fitting function model.

$\eta'(958)$ REFERENCES

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ABLIKIM	24F	PR D109 032006	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	24M	PR D109 072001	M. Ablikim *et al.*	(BESIII Collab.)
ANDREEV	24D	PRL 133 121803	Yu.M. Andreev *et al.*	(NA64 Collab.)
ABLIKIM	23AH	PRL 130 081901	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	22E	PR D105 112010	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	21I	PR D103 072006	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	21J	PR D103 092005	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	20E	PR D101 032001	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	19AW	PR D100 052015	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	19T	PRL 122 142002	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	18	PR D97 012003	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	18C	PRL 120 242003	M. Ablikim *et al.*	(BESIII Collab.)
ADLARSON	18A	PR D98 012001	P. Adlarson *et al.*	(A2 Collab. at MAMI)
GONZALEZ-S...	18A	EPJ C78 758	S. Gonzalez-Solis, E. Passemar	(BEIJ, IND+)
AAIJ	17D	PL B764 233	R. Aaij *et al.*	(LHCb Collab.)
ABLIKIM	17	PRL 118 012001	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	17T	PR D96 012005	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	16M	PR D93 072008	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	15AD	PR D92 051101	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	15G	PR D92 012014	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	15O	PR D92 012001	M. Ablikim *et al.*	(BESIII Collab.)
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ACHASOV	15	PR D91 092010	M.N. Achasov *et al.*	(SND Collab.)
AKHMETSHIN	15	PL B740 273	R.R. Akhmetshin *et al.*	(CMD-3 Collab.)
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)
ABLIKIM	14M	PRL 112 251801	M. Ablikim *et al.*	(BESIII Collab.)
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PDG	14	CP C38 070001	K. Olive *et al.*	(PDG Collab.)
ABLIKIM	13	PR D87 012009	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	13G	PR D87 032006	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	13O	PR D87 092011	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	13U	PR D88 091502	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	12E	PRL 108 182001	M. Ablikim *et al.*	(BESIII Collab.)
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ABLIKIM	11	PR D83 012003	M. Ablikim *et al.*	(BESIII Collab.)
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MORI	07A	JPSJ 76 074102	T. Mori *et al.*	(BELLE Collab.)
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