$\eta'(958)$

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

$\eta'(958)$ 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*
0.197±0.009 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	$\pi^+\pi^-\eta$	(42.9 ±0.7) %	
Γ_2	$\rho^0\gamma$(including non-resonant $\pi^+\ \pi^-\ \gamma$)	(29.1 ±0.5) %	
Γ_3	$\pi^0\pi^0\eta$	(22.3 ±0.8) %	
Γ_4	$\omega\gamma$	(2.62±0.13) %	

Γ_5	$\omega e^+ e^-$		(2.0 $\pm$0.4) $\times 10^{-4}$		
Γ_6	$\gamma\gamma$		(2.21$\pm$0.08) %		
Γ_7	$3\pi^0$		(2.20$\pm$0.20) $\times 10^{-3}$		
Γ_8	$\mu^+ \mu^- \gamma$		(1.08$\pm$0.27) $\times 10^{-4}$		
Γ_9	$\pi^+ \pi^- \mu^+ \mu^-$		$<$ 2.9	$\times 10^{-5}$	90%
Γ_{10}	$\pi^+ \pi^- \pi^0$		(3.82$\pm$0.35) $\times 10^{-3}$		
Γ_{11}	$\pi^0 \rho^0$		$<$ 4	%	90%
Γ_{12}	$2(\pi^+ \pi^-)$		(8.5 $\pm$0.9) $\times 10^{-5}$		
Γ_{13}	$\pi^+ \pi^- 2\pi^0$		(1.8 $\pm$0.4) $\times 10^{-4}$		
Γ_{14}	$2(\pi^+ \pi^-)$ neutrals		$<$ 1	%	95%
Γ_{15}	$2(\pi^+ \pi^-)\pi^0$		$<$ 1.9	$\times 10^{-3}$	90%
Γ_{16}	$2(\pi^+ \pi^-)2\pi^0$		$<$ 1	%	95%
Γ_{17}	$3(\pi^+ \pi^-)$		$<$ 3.1	$\times 10^{-5}$	90%
Γ_{18}	$\pi^+ \pi^- e^+ e^-$		(2.4 $^{+1.3}_{-1.0}$) $\times 10^{-3}$		
Γ_{19}	$\pi^+ e^- \nu_e +$ c.c.		$<$ 2.1	$\times 10^{-4}$	90%
Γ_{20}	$\gamma e^+ e^-$		(4.70$\pm$0.30) $\times 10^{-4}$		
Γ_{21}	$\pi^0 \gamma\gamma$		$<$ 8	$\times 10^{-4}$	90%
Γ_{22}	$4\pi^0$		$<$ 3.2	$\times 10^{-4}$	90%
Γ_{23}	$e^+ e^-$		$<$ 5.6	$\times 10^{-9}$	90%
Γ_{24}	invisible		$<$ 5	$\times 10^{-4}$	90%

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

Γ_{25}	$\pi^+ \pi^-$	P, CP		$<$ 6	$\times 10^{-5}$	90%
Γ_{26}	$\pi^0 \pi^0$	P, CP		$<$ 4	$\times 10^{-4}$	90%
Γ_{27}	$\pi^0 e^+ e^-$	C	[a]	$<$ 1.4	$\times 10^{-3}$	90%
Γ_{28}	$\eta e^+ e^-$	C	[a]	$<$ 2.4	$\times 10^{-3}$	90%
Γ_{29}	3γ	C		$<$ 1.0	$\times 10^{-4}$	90%
Γ_{30}	$\mu^+ \mu^- \pi^0$	C	[a]	$<$ 6.0	$\times 10^{-5}$	90%
Γ_{31}	$\mu^+ \mu^- \eta$	C	[a]	$<$ 1.5	$\times 10^{-5}$	90%
Γ_{32}	$e\mu$	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 16 branching ratios uses 46 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 52.8$ for 38 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	−2							
x_3	−77	−58						
x_4	−11	−13	2					
x_6	−29	−25	32	−1				
x_7	−24	−19	30	0	9			
x_{10}	0	−2	−2	0	−1	−1		
x_{18}	−4	−6	−5	−1	−3	−2	0	
Γ	25	5	−19	3	−71	−5	1	3
	x_1	x_2	x_3	x_4	x_6	x_7	x_{10}	x_{18}

	Mode	Rate (MeV)
Γ_1	$\pi^+\pi^-\eta$	0.085 ±0.004
Γ_2	$\rho^0\gamma$(including non-resonant $\pi^+\ \pi^-\ \gamma$)	0.0574 ±0.0028
Γ_3	$\pi^0\pi^0\eta$	0.0440 ±0.0023
Γ_4	$\omega\gamma$	0.00517±0.00035
Γ_6	$\gamma\gamma$	0.00435±0.00013
Γ_7	$3\pi^0$	$(4.3 \pm 0.4) \times 10^{-4}$
Γ_{10}	$\pi^+\pi^-\pi^0$	$(7.5 \pm 0.8) \times 10^{-4}$
Γ_{18}	$\pi^+\pi^-e^+e^-$	$(4.7\ ^{+2.6}_{-1.9}) \times 10^{-4}$

$\eta'(958)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_6

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.35±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_{23}

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.

$\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{total}$ $\Gamma_6\Gamma_2/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
1.27±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	83B	CELL	$e^+e^- \to e^+e^-\rho\gamma$

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{total}$ $\Gamma_6\Gamma_3/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
0.97±0.05 OUR FIT				
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 ± 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)

$\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_1\Gamma_{23}/\Gamma$

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 [$\Gamma(\eta'(958) \to \pi^+\pi^-\eta) \times \Gamma(\eta'(958) \to e^+e^-)/\Gamma_{total}$] × [B($\eta \to 2\gamma$)] < 4.1×10^{-4} eV which we divide by our best value B($\eta \to 2\gamma$) = 39.41×10^{-2}.

$\eta'(958)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.429±0.007 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.424±0.011±0.004	1.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$

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

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{total}$ $0.286\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1228±0.0020 OUR FIT					
• • • 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

$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{total}$ $0.714\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.307±0.005 OUR FIT					
• • • 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	EVTS	DOCUMENT ID		TECN	COMMENT
0.291±0.005 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.287±0.007±0.004	0.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$
0.329±0.033	298	RITTENBERG	69	HBC	1.7–2.7 K^-p
0.2 ±0.1	20	LONDON	66	HBC	2.24 $K^-p \to \Lambda\pi^+\pi^-\gamma$
0.34 ±0.09	35	BADIER	65B	HBC	3 K^-p

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.678±0.017 OUR FIT				
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
0.950±0.024 OUR FIT					
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 π^- Be $\to \pi^-\eta'\eta$ 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_3/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.223±0.008 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.235±0.013±0.004	3.2k	[1] PEDLAR	09	CLEO	$J/\psi \to \gamma\eta'$

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

$\Gamma(\pi^0\pi^0\eta(3\pi^0\text{decay}))/\Gamma_{\text{total}}$ $0.321\Gamma_3/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0716±0.0026 OUR FIT					
• • • 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_3/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.519±0.026 OUR FIT				
0.555±0.043±0.013	PEDLAR	09	CLE3	$J/\psi \to \eta'\gamma$

$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi\pi\eta)$ $\Gamma_2/(\Gamma_1+\Gamma_3)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.446±0.012 OUR FIT				
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_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.62±0.13 OUR FIT					
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±0.16)×10^{-3} and B($\omega \to \pi^+\pi^-\pi^0$) = (89.2±0.7)%.
[2] Not independent of other η' branching fractions and ratios in PEDLAR 09.

$\Gamma(\omega\gamma)/\Gamma(\pi^+\pi^-\eta)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0610±0.0033 OUR FIT					
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_4/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
0.117±0.007 OUR FIT				
0.147±0.016	ALDE	87B	GAM2	38 $\pi^- p \to n4\gamma$

$\Gamma(\omega e^+ e^-)/\Gamma(\omega\gamma)$ Γ_5/Γ_4

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_5/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 $B(\omega \to \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

$\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/[\Gamma(\pi^+\pi^-\eta)+\Gamma(\pi^0\pi^0\eta)+\Gamma(\omega\gamma)]$ $\Gamma_2/(\Gamma_1+\Gamma_3+\Gamma_4)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.429±0.011 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.25 ±0.14	DAUBER	64	HBC	1.95 $K^- p$

$[\Gamma(\pi^0\pi^0\eta(\text{charged decay}))+\Gamma(\omega(\text{charged decay})\gamma)]/\Gamma_{\text{total}}$ $(0.286\Gamma_3+0.89\Gamma_4)/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0871±0.0026 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.045 ±0.029	42	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

$\Gamma(\pi^+\pi^-\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_1+0.286\Gamma_3+0.89\Gamma_4)/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.394±0.004 OUR FIT					
• • • 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_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.21±0.08 OUR FIT					
2.00±0.15 OUR AVERAGE					
$1.98^{+0.31}_{-0.27}\pm0.07$	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 $\text{B}(B^+ \to \eta' K^+) = (7.06 \pm 0.25) \times 10^{-5}$. 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_6/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.0514±0.0022 OUR FIT				
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_6/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
0.0758±0.0033 OUR FIT				
0.080 ±0.008	ABLIKIM	06E	BES2	$J/\psi \to \eta'\gamma$

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_6/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
0.099±0.004 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 $\pi^- p \to n2\gamma$

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_6/0.714\Gamma_3$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.139±0.006 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.188±0.058	16	APEL	72	OSPK	3.8 $\pi^- p \to nX^0$

$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_3+0.09\Gamma_4+\Gamma_6)/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.184±0.006 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.185±0.022	535	BASILE	71	CNTR	1.6 $\pi^- p \to nX^0$
0.189±0.026	123	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

$\Gamma(3\pi^0)/\Gamma_{total}$ Γ_7/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.20±0.20 OUR FIT					
3.7 ±0.4 OUR AVERAGE					
4.79±0.59±1.14	183	[1] ABLIKIM	15P	BES3	$J/\psi \to K^+K^-3\pi$
3.56±0.22±0.34	309	ABLIKIM	12E	BES3	$J/\psi \to \gamma(3\pi^0)$

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

$\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_7/Γ_3

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
99± 9 OUR FIT					
78±10 OUR AVERAGE					
86±19	235	BLIK	08	GAMS	32 $\pi^- p \to \eta' n$
74±15		ALDE	87B	GAM2	38 $\pi^- p \to n6\gamma$
75±18		BINON	84	GAM2	30–40 $\pi^- p \to n6\gamma$

$\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_8/Γ_6

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

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.29	90	[1] ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$
<2.4	90	[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.
[2] Not independent of measured value of Γ_9/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_9/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 $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma$(including non-resonant $\pi^+\pi^-\gamma))$ Γ_9/Γ_2

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

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.82±0.35 OUR FIT					
3.9 ±0.4 OUR AVERAGE					
4.28±0.49±1.11	78	[1] ABLIKIM	15P	BES3	$J/\psi \to K^+K^-3\pi$
3.83±0.15±0.39	1014	ABLIKIM	12E	BES3	$J/\psi \to \gamma(\pi^+\pi^-\pi^0)$
$3.7\ ^{+1.1}_{-0.9}\ \pm0.4$		[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] We have added all systematic uncertainties in quadrature to a single value.
[2] Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{10}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
8.9 ±0.8 OUR FIT					
$\mathbf{8.28^{+2.49}_{-2.12}\pm0.04}$	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 $B(\eta \to 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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_{11}/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_{12}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
8.5±0.9±0.3		199	[1] ABLIKIM	14M	BES3	$J/\psi \to \gamma\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 24	90		[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
<1000	90		RITTENBERG	69	HBC	1.7–2.7 $K^- p$

[1] ABLIKIM 14M reports $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] = (4.40 \pm 0.35 \pm 0.30) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.15 \pm 0.16) \times 10^{-3}$. 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_{12}/Γ_1 from NAIK 09.

$\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{12}/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 $[\Gamma(\eta'(958) \to 2(\pi^+\pi^-))/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.8±0.4±0.1		84	[1] ABLIKIM	14M	BES3	$J/\psi \to \gamma\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<27	90		[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] ABLIKIM 14M reports $[\Gamma(\eta'(958) \to \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] = (9.38 \pm 1.79 \pm 0.89) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.15 \pm 0.16) \times 10^{-3}$. 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_{13}/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{13}/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 $[\Gamma(\eta'(958) \to \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(2(\pi^+\pi^-)\text{ neutrals})/\Gamma_{\text{total}}$ Γ_{14}/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_{15}/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	$J/\psi \rightarrow \gamma\eta'$
<0.01	90	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

[1] Not independent of measured value of Γ_{15}/Γ_1 from NAIK 09.

$\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{15}/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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(2(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/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_{17}/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_{17}/Γ_1 from NAIK 09.

$\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{17}/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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 $^{+1.3}_{-1.0}$ OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					

$2.11 \pm 0.12 \pm 0.14$	429	[1] ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$
$2.5\ ^{+1.2}_{-0.9} \pm 0.5$		[2] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$
<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_{18}/Γ_1 from NAIK 09.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$5.6\ ^{+3.0}_{-2.2}$ OUR FIT					
$5.52^{+3.00}_{-2.30} \pm 0.03$	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 $B(\eta \to 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^- e^+ e^-)/\Gamma(\rho^0\gamma$(including non-resonant $\pi^+\pi^-\gamma$)) Γ_{18}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$7.2 \pm 0.4 \pm 0.5$	429	ABLIKIM	13O	BES3	$J/\psi \to \gamma\eta'$

$\Gamma(\pi^+ e^-\nu_e$ + c.c.)/$\Gamma(\pi^+\pi^-\eta)$ Γ_{19}/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_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
• • • 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_{20}/Γ_6

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

$\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{21}/Γ_3

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

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.2 \times 10^{-4}$	90	DONSKOV	14	GAM4	32.5 $\pi^- p \to \eta' n$

$\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{22}/Γ_3

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 $\pi^- p \to n8\gamma$

$\Gamma(e^+e^-)/\Gamma_{total}$ Γ_{23}/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 $\Gamma(\eta') = 0.198 \pm 0.009$ MeV.
[2] Using $\Gamma_{\eta'(958)} = 198 \pm 9$ keV, $B(\eta'(958) \to \pi^+\pi^-\eta) = (42.9 \pm 0.7)\%$, and $B(\eta \to \gamma\gamma) = (39.41 \pm 0.20)\%$.

$\Gamma(\text{invisible})/\Gamma_{total}$ Γ_{24}/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	$J/\psi \to \gamma\eta'$

[1] Not independent of measured value of Γ_{24}/Γ_1 from NAIK 09.

$\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{24}/Γ_6

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

$\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ Γ_{24}/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 $[\Gamma(\eta'(958) \to \text{invisible})/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 0.6	90	[1] ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 29	90	[2] MORI	07A	BELL	$\gamma\gamma \to \pi^+\pi^-$
< 3.3	90	[3] 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] ABLIKIM 11G reports $[\Gamma(\eta'(958) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.15 \times 10^{-3}$.
[2] Taking into account interference with the $\gamma\gamma \to \pi^+\pi^-$ continuum.
[3] Without interference with the $\gamma\gamma \to \pi^+\pi^-$ continuum.

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ Γ_{26}/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 $[\Gamma(\eta'(958) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] < 2.84\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.15\times10^{-3}$.

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{26}/Γ_3

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

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

$\Gamma(\eta e^+ e^-)/\Gamma_{total}$ Γ_{28}/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_{29}/Γ_3

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

$\Gamma(\mu^+\mu^-\pi^0)/\Gamma_{total}$ Γ_{30}/Γ

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

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

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

$\Gamma(e\mu)/\Gamma_{total}$ Γ_{32}/Γ

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

$\eta'(958) \to \eta\pi\pi$ 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(α) decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.033 \pm 0.005 \pm 0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	[2] AMELIN	05A	VES	28 $\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	[3] BRIERE	00	CLEO	10.6 $e^+e^- \to \eta\pi^+\pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	[4] ALDE	86	GAM2	38 $\pi^- p \to n\eta\pi^0\pi^0$
-0.08 ± 0.03		[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 Im(α) = 0, $C = 0$, and $D = 0$.
[4] Assuming $C = 0$.
[5] From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

Im(α) decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.000 \pm 0.049 \pm 0.001$	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. • • •					
$+0.018 \pm 0.009 \pm 0.003$	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. • • •					
$-0.059 \pm 0.012 \pm 0.004$	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. • • •					
$-0.047 \pm 0.011 \pm 0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	[2] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	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.

b decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.069 \pm 0.019 \pm 0.009$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	[2] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	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.

c decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$+0.019 \pm 0.011 \pm 0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	[2] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$0.015 \pm 0.011 \pm 0.014$	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. • • •					
$-0.073 \pm 0.012 \pm 0.003$	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	[2] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	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. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.
[3] 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*
1.62±0.17 OUR AVERAGE					
1.60±0.17±0.08	864	[1] ABLIKIM	15O	BES3	$J/\psi \to \gamma e^+ e^-$
1.7 ±0.4	33	[1] VIKTOROV	80		25,33 $\pi^- p \to 2\mu\gamma$

[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.

$\eta'(958)$ REFERENCES

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ABLIKIM	15G	PR D92 012014	M. Ablikim *et al.*	(BES III Collab.)
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MORI	07A	JPSJ 76 074102	T. Mori *et al.*	(BELLE Collab.)
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AMELIN	05A	PAN 68 372 Translated from YAF 68 401.	D.V. Amelin *et al.*	(VES Collab.)
AMSLER	04B	EPJ C33 23	C. Amsler *et al.*	(Crystal Barrel Collab.)
BAI	04J	PL B594 47	J.Z. Bai *et al.*	(BES Collab.)
BRIERE	00	PRL 84 26	R. Briere *et al.*	(CLEO Collab.)
ACCIARRI	98Q	PL B418 399	M. Acciarri *et al.*	(L3 Collab.)
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BARTEL	82B	PL 113B 190	W. Bartel *et al.*	(JADE Collab.)
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STANTON	80	PL B92 353	N.R. Stanton *et al.*	(OSU, CARL, MCGI+)
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