$\eta'(958)$

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

$\eta'(958)$ 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*
0.196±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	$\pi^+\pi^-\eta$	(42.6 ±0.7) %	
Γ_2	$\rho^0\gamma$(including non-resonant $\pi^+\ \pi^-\ \gamma$)	(28.9 ±0.5) %	
Γ_3	$\rho^0\gamma$		
Γ_4	$\pi^0\pi^0\eta$	(22.8 ±0.8) %	

Γ_5	$\omega\gamma$		(2.62±0.13) %		
Γ_6	$\omega e^+ e^-$		(2.0 ±0.4) × 10^{-4}		
Γ_7	$\gamma\gamma$		(2.22±0.08) %		
Γ_8	$3\pi^0$		(2.54±0.18) × 10^{-3}		
Γ_9	$\mu^+\mu^-\gamma$		(1.09±0.27) × 10^{-4}		
Γ_{10}	$\pi^+\pi^-\mu^+\mu^-$		< 2.9	× 10^{-5}	90%
Γ_{11}	$\pi^+\pi^-\pi^0$		(3.61±0.17) × 10^{-3}		
Γ_{12}	$(\pi^+\pi^-\pi^0)$ S-wave		(3.8 ±0.5) × 10^{-3}		
Γ_{13}	$\pi^\mp\rho^\pm$		(7.4 ±2.3) × 10^{-4}		
Γ_{14}	$\pi^0\rho^0$		< 4	%	90%
Γ_{15}	$2(\pi^+\pi^-)$		(8.4 ±0.9) × 10^{-5}		
Γ_{16}	$\pi^+\pi^-2\pi^0$		(1.8 ±0.4) × 10^{-4}		
Γ_{17}	$2(\pi^+\pi^-)$ neutrals		< 1	%	95%
Γ_{18}	$2(\pi^+\pi^-)\pi^0$		< 1.8	× 10^{-3}	90%
Γ_{19}	$2(\pi^+\pi^-)2\pi^0$		< 1	%	95%
Γ_{20}	$3(\pi^+\pi^-)$		< 3.1	× 10^{-5}	90%
Γ_{21}	$K^\pm\pi^\mp$		< 4	× 10^{-5}	90%
Γ_{22}	$\pi^+\pi^- e^+ e^-$		(2.4 $^{+1.3}_{-1.0}$) × 10^{-3}		
Γ_{23}	$\pi^+ e^- \nu_e$ + c.c.		< 2.1	× 10^{-4}	90%
Γ_{24}	$\gamma e^+ e^-$		(4.73±0.30) × 10^{-4}		
Γ_{25}	$\pi^0\gamma\gamma$		(3.20±0.24) × 10^{-3}		
Γ_{26}	$\pi^0\gamma\gamma$(non resonant)		(6.2 ±0.9) × 10^{-4}		
Γ_{27}	$4\pi^0$		< 3.2	× 10^{-4}	90%
Γ_{28}	$e^+ e^-$		< 5.6	× 10^{-9}	90%
Γ_{29}	invisible		< 5	× 10^{-4}	90%

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

Γ_{30}	$\pi^+\pi^-$	*P*,*CP*		< 1.8	× 10^{-5}	90%
Γ_{31}	$\pi^0\pi^0$	*P*,*CP*		< 4	× 10^{-4}	90%
Γ_{32}	$\pi^0 e^+ e^-$	*C*	[a]	< 1.4	× 10^{-3}	90%
Γ_{33}	$\eta e^+ e^-$	*C*	[a]	< 2.4	× 10^{-3}	90%
Γ_{34}	3γ	*C*		< 1.1	× 10^{-4}	90%
Γ_{35}	$\mu^+\mu^-\pi^0$	*C*	[a]	< 6.0	× 10^{-5}	90%
Γ_{36}	$\mu^+\mu^-\eta$	*C*	[a]	< 1.5	× 10^{-5}	90%
Γ_{37}	$e\mu$	*LF*		< 4.7	× 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 $\chi^2 = 62.7$ 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	−3							
x_4	−76	−58						
x_5	−10	−13	1					
x_7	−27	−24	29	−1				
x_8	−23	−18	28	0	8			
x_{11}	0	−1	−1	0	−1	0		
x_{22}	−5	−6	−5	−1	−3	−2	0	
Γ	24	4	−17	3	−71	−4	1	3
	x_1	x_2	x_4	x_5	x_7	x_8	x_{11}	x_{22}

	Mode	Rate (MeV)
Γ_1	$\pi^+\pi^-\eta$	0.084 ±0.004
Γ_2	$\rho^0\gamma$(including non-resonant $\pi^+\ \pi^-\ \gamma$)	0.0567 ±0.0027
Γ_4	$\pi^0\pi^0\eta$	0.0448 ±0.0023
Γ_5	$\omega\gamma$	0.00514±0.00035
Γ_7	$\gamma\gamma$	0.00436±0.00013
Γ_8	$3\pi^0$	$(5.0 \pm 0.4) \times 10^{-4}$
Γ_{11}	$\pi^+\pi^-\pi^0$	$(7.1 \pm 0.5) \times 10^{-4}$
Γ_{22}	$\pi^+\pi^-e^+e^-$	$(4.6\ ^{+2.5}_{-1.9}) \times 10^{-4}$

$\eta'(958)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_7

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.36±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
1.26±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	$e^+e^- \to e^+e^-\rho\gamma$

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

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
1.00±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)%.

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

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

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

[1] AKHMETSHIN 15 reports [$\Gamma(\eta'(958) \to \pi^+\pi^-\eta) \times \Gamma(\eta'(958) \to e^+e^-)/\Gamma_{\text{total}}$] × [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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.426±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.

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{\text{total}}$ $0.2810\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1196±0.0019 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

$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$ $0.7212\Gamma_1/\Gamma$

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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.289±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.

$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ 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
0.679±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
0.951±0.024 OUR FIT					
0.97 ±0.09 OUR AVERAGE					
0.70 ±0.22		AMSLER	04B	CBAR	0 $\bar{p}p \to \pi^+\pi^-\eta$
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_4/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.228±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.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0733±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_4/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.536±0.026 OUR FIT				
0.555±0.043±0.013	PEDLAR	09	CLE3	$J/\psi \to \eta'\gamma$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.442±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_5/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_5/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0615±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_5/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
0.115±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_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 ± 0.16) × 10^{-3} and B($\omega \to \pi^+\pi^-\pi^0$) = (89.2 ± 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
0.425±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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0886±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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.3926±0.0035 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_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.22±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_7/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.0522±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_7/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
0.0768±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_7/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
0.097±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 $\overline{p}p$
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
0.136±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 $\pi^- p \to nX^0$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.188±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 $K^- p$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.54 ±0.18 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
111± 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 $\pi^- p \to n6\gamma$
75±18		BINON	84	GAM2	30–40 $\pi^- p \to n6\gamma$

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

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

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/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_{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 $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma$(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.

$\Gamma((\pi^+\pi^-\pi^0)$ 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 .

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
8.5 ±0.4 OUR FIT					
$\mathbf{8.28^{+2.49}_{-2.12}\pm0.04}$	20	[1] NAIK	09	CLEO	$J/\psi \to \gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958) \to \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)] = (21^{+6}_{-5} \pm 2)\times10^{-3}$ 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_{14}/Γ

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

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
8.4±0.9±0.3		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 $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

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

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

[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_{16}/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 $[\Gamma(\eta'(958) \to \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] = (9.38\pm1.79\pm0.89)\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] Not independent of measured value of Γ_{16}/Γ_1 from NAIK 09.

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

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

[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_{17}/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_{18}/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_{18}/Γ_1 from NAIK 09.

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

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

[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 $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

$\Gamma(2(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.01	95	KALBFLEISCH	64B	HBC	$K^- p \to \Lambda 2(\pi^+\pi^-)$+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_{20}/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_{20}/Γ_1 from NAIK 09.

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

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

[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 $B(\eta \to 2\gamma) = 39.41 \times 10^{-2}$.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.3\times10^{-4}$	90	ABLIKIM	16M	BES3	$e^+e^-\to J/\psi\to$ hadrons

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{22}/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. • • •						
$2.11\pm0.12\pm0.14$		429	[1] ABLIKIM	13O	BES3	$J/\psi\to\gamma\eta'$
$2.5\ ^{+1.2}_{-0.9}\ \pm0.5$			[2] NAIK	09	CLEO	$J/\psi\to\gamma\eta'$
<6	90		RITTENBERG	65	HBC	2.7 K^-p

[1] Using $\Gamma_2/\Gamma = (29.3\pm0.6)\%$ from PDG 12.

[2] Not independent of measured value of Γ_{22}/Γ_1 from NAIK 09.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$5.5\ ^{+3.0}_{-2.2}$ OUR FIT					
$5.52^{+3.00}_{-2.30}\pm0.03$	8	[1] NAIK	09	CLEO	$J/\psi\to\gamma\eta'$

[1] NAIK 09 reports $[\Gamma(\eta'(958)\to\pi^+\pi^-e^+e^-)/\Gamma(\eta'(958)\to\pi^+\pi^-\eta)]$ / $[B(\eta\to2\gamma)] = (14^{+7}_{-5}\pm3)\times10^{-3}$ which we multiply by our best value $B(\eta\to2\gamma) = (39.41\pm0.20)\times10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{22}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$7.2\pm0.4\pm0.5$	429	ABLIKIM	13O	BES3	$J/\psi\to\gamma\eta'$

$\Gamma(\pi^+e^-\nu_e+\text{c.c.})/\Gamma(\pi^+\pi^-\eta)$ Γ_{23}/Γ_1

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

$\Gamma(\gamma e^+e^-)/\Gamma_{\text{total}}$ Γ_{24}/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_{24}/Γ_7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$2.13\pm0.09\pm0.07$	864	ABLIKIM	15O	BES3	$J/\psi\to\gamma e^+e^-$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$3.20\pm0.07\pm0.23$	3.4k	ABLIKIM	17T	BES3	$J/\psi\to\gamma\eta'$

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

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

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

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

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.2\times10^{-4}$	90	DONSKOV	14	GAM4	32.5 $\pi^- p \to \eta' n$

$\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ 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
$< 5.6\times10^{-9}$	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 $e^+e^- \to \pi^+\pi^-\eta$
$< 2.1\times10^{-7}$	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 $B(\eta \to \gamma\gamma) = (39.41 \pm 0.20)\%$.

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{29}/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_{29}/Γ_1 from NAIK 09.

$\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{29}/Γ_7

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_{29}/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 $[\Gamma(\eta'(958) \to \text{invisible})/\Gamma(\eta'(958) \to \pi^+\pi^-\eta)]$ / $[B(\eta \to 2\gamma)]$ $< 5.4\times10^{-3}$ which we multiply by our best value $B(\eta \to 2\gamma) = 39.41\times10^{-2}$.

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ Γ_{30}/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 $[\Gamma(\eta'(958) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta'(958))] < 2.84\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.21\times10^{-3}$.

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

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

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ Γ_{31}/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 $B(J/\psi(1S) \to \gamma\eta'(958)) = 5.21\times10^{-3}$.

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{31}/Γ_4

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

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$ Γ_{32}/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_{33}/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_{34}/Γ_4

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

$\Gamma(\mu^+\mu^-\pi^0)/\Gamma_{total}$ Γ_{35}/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_{36}/Γ

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

$\Gamma(e\mu)/\Gamma_{total}$ Γ_{37}/Γ

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

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

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

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

$Re(\alpha)$ decay parameter

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

[1] See ABLIKIM 11 for the full correlation matrix.
[2] Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.
[3] Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.
[4] Assuming $C = 0$.
[5] From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

$Im(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.000 \pm 0.019 \pm 0.001$	351k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta\pi^+\pi^-$
$0.000 \pm 0.038 \pm 0.002$	56k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta\pi^0\pi^0$
$0.000 \pm 0.049 \pm 0.001$	44k	[1] ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

0.0	±0.1	±0.0	7k	[2] AMELIN	05A	VES	28	$\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$
−0.00	±0.13	±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±0.0024±0.0015	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
0.018 ±0.009 ±0.003	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
0.020 ±0.018 ±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±0.004±0.004	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
−0.061±0.009±0.005	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
−0.059±0.012±0.004	44k	[1] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
−0.066±0.030±0.015	7k	[2] AMELIN	05A	VES	28 $\pi^- A \to \eta\pi^+\pi^-\pi^- A^*$
0.00 ±0.03 ±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. • • •				

$-0.056 \pm 0.004 \pm 0.002$	351k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.087 \pm 0.009 \pm 0.006$	56k		ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.074 \pm 0.008 \pm 0.006$	124k		ADLARSON	18A	A2MM	$\eta' \to \eta\pi^0\pi^0$
$-0.072 \pm 0.007 \pm 0.008$		[1]	GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	[2]	ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	[3]	BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	[4]	DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[1] Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.
[2] See ABLIKIM 11 for the full correlation matrix.
[3] From $\eta' \to \eta\pi^0\pi^0$ decay.
[4] 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. • • •					
$-0.049 \pm 0.006 \pm 0.006$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$-0.073 \pm 0.014 \pm 0.005$	56k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^0\pi^0$
$-0.063 \pm 0.014 \pm 0.005$	124k	ADLARSON	18A	A2MM	$\eta' \to \eta\pi^0\pi^0$
$-0.052 \pm 0.001 \pm 0.002$		[1] GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	[2] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	[3] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	[4] DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

[1] Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.
[2] See ABLIKIM 11 for the full correlation matrix.
[3] From $\eta' \to \eta\pi^0\pi^0$ decay.
[4] 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. • • •					
$0.0027 \pm 0.0024 \pm 0.0018$	351k	ABLIKIM	18	BES3	$\eta' \to \eta\pi^+\pi^-$
$0.019 \pm 0.011 \pm 0.003$	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. • • •					
$-0.063 \pm 0.004 \pm 0.003$	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	$\eta' \to \eta\pi^0\pi^0$
$-0.051 \pm 0.008 \pm 0.006$		[1] GONZALEZ-S..	18A	RVUE	$\eta' \to \eta\pi^0\pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	[2] ABLIKIM	11	BES3	$J/\psi \to \gamma\eta\pi^+\pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	[3] BLIK	09	GAM4	32.5 $\pi^- p \to \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	[4] DOROFEEV	07	VES	27 $\pi^- p \to \eta' n$, $\pi^- A \to \eta'\pi^- A^*$

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

ABLIKIM	18	PR D97 012003	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	18C	PRL 120 242003	M. Ablikim *et al.*	(BES III 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.*	(BES III Collab.)
ABLIKIM	17T	PR D96 012005	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	16M	PR D93 072008	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15AD	PR D92 051101	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15G	PR D92 012014	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15O	PR D92 012001	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15P	PR D92 012007	M. Ablikim *et al.*	(BES III Collab.)
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.*	(BES III Collab.)
DONSKOV	14	MPL A29 1450213	S. Donskov *et al.*	(GAMS-4π Collab.)
PDG	14	CP C38 070001	K. Olive *et al.*	(PDG Collab.)
ABLIKIM	13	PR D87 012009	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	13G	PR D87 032006	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	13O	PR D87 092011	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	13U	PR D88 091502	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	12E	PRL 108 182001	M. Ablikim *et al.*	(BES III Collab.)
PDG	12	PR D86 010001	J. Beringer *et al.*	(PDG Collab.)
ABLIKIM	11	PR D83 012003	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	11G	PR D84 032006	M. Ablikim *et al.*	(BES III Collab.)
CZERWINSKI	10	PRL 105 122001	E. Czerwinski *et al.*	(COSY-11 Collab.)
BLIK	09	PAN 72 231 Translated from YAF 72 258.	A.M. Blik *et al.*	(IHEP (Protvino))
NAIK	09	PRL 102 061801	P. Naik *et al.*	(CLEO Collab.)
PEDLAR	09	PR D79 111101	T.K. Pedlar *et al.*	(CLEO Collab.)
BLIK	08	PAN 71 2124 Translated from YAF 71 2161.	A. Blik *et al.*	(GAMS-4π Collab.)
LIBBY	08	PRL 101 182002	J. Libby *et al.*	(CLEO Collab.)
WICHT	08	PL B662 323	J. Wicht *et al.*	(BELLE Collab.)
DOROFEEV	07	PL B651 22	V. Dorofeev *et al.*	(VES Collab.)
MORI	07A	JPSJ 76 074102	T. Mori *et al.*	(BELLE Collab.)
ABLIKIM	06E	PR D73 052008	M. Ablikim *et al.*	(BES Collab.)
ABLIKIM	06Q	PRL 97 202002	M. Ablikim *et al.*	(BES Collab.)
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.)
BARBERIS	98C	PL B440 225	D. Barberis *et al.*	(WA 102 Collab.)
WURZINGER	96	PL B374 283	R. Wurzinger *et al.*	(BONN, ORSAY, SACL+)
PDG	94	PR D50 1173	L. Montanet *et al.*	(CERN, LBL, BOST+)
AMSLER	93	ZPHY C58 175	C. Amsler *et al.*	(Crystal Barrel Collab.)
BELADIDZE	92C	SJNP 55 1535 Translated from YAF 55 2748.	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)

KARCH	92	ZPHY C54 33	K. Karch *et al.*	(Crystal Ball Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)
BEHREND	91	ZPHY C49 401	H.J. Behrend *et al.*	(CELLO Collab.)
AUGUSTIN	90	PR D42 10	J.E. Augustin *et al.*	(DM2 Collab.)
BARU	90	ZPHY C48 581	S.E. Baru *et al.*	(MD-1 Collab.)
BUTLER	90	PR D42 1368	F. Butler *et al.*	(Mark II Collab.)
KARCH	90	PL B249 353	K. Karch *et al.*	(Crystal Ball Collab.)
ROE	90	PR D41 17	N.A. Roe *et al.*	(ASP Collab.)
AIHARA	88C	PR D38 1	H. Aihara *et al.*	(TPC-2γ Collab.)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev *et al.*	(NOVO)
		Translated from YAF 48 436.		
WILLIAMS	88	PR D38 1365	D.A. Williams *et al.*	(Crystal Ball Collab.)
AIHARA	87	PR D35 2650	H. Aihara *et al.*	(TPC-2γ Collab.) JP
ALBRECHT	87B	PL B199 457	H. Albrecht *et al.*	(ARGUS Collab.)
ALDE	87B	ZPHY C36 603	D.M. Alde *et al.*	(LANL, BELG, SERP, LAPP)
ANTREASYAN	87	PR D36 2633	D. Antreasyan *et al.*	(Crystal Ball Collab.)
GIDAL	87	PRL 59 2012	G. Gidal *et al.*	(LBL, SLAC, HARV)
ALDE	86	PL B177 115	D.M. Alde *et al.*	(SERP, BELG, LANL, LAPP)
BARTEL	85E	PL 160B 421	W. Bartel *et al.*	(JADE Collab.)
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)
ALTHOFF	84E	PL 147B 487	M. Althoff *et al.*	(TASSO Collab.)
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)
BINON	84	PL 140B 264	F.G. Binon *et al.*	(SERP, BELG, LAPP+)
JENNI	83	PR D27 1031	P. Jenni *et al.*	(SLAC, LBL)
BARTEL	82B	PL 113B 190	W. Bartel *et al.*	(JADE Collab.)
BEHREND	82C	PL 114B 378	H.J. Behrend *et al.*	(CELLO Collab.)
Also		PL 125B 518 (erratum)	H.J. Behrend *et al.*	(CELLO Collab.)
DZHELYADIN	81	PL 105B 239	R.I. Dzhelyadin *et al.*	(SERP)
STANTON	80	PL B92 353	N.R. Stanton *et al.*	(OSU, CARL, MCGI+)
VIKTOROV	80	SJNP 32 520	V.A. Viktorov *et al.*	(SERP)
		Translated from YAF 32 1005.		
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)
BINNIE	79	PL 83B 141	D.M. Binnie *et al.*	(LOIC)
ZANFINO	77	PRL 38 930	C. Zanfino *et al.*	(CARL, MCGI, OHIO+)
GRIGORIAN	75	NP B91 232	A. Grigorian *et al.*	(+)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
DUANE	74	PRL 32 425	A. Duane *et al.*	(LOIC, SHMP)
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)
DANBURG	73	PR D8 3744	J.S. Danburg *et al.*	(BNL, MICH) JP
JACOBS	73	PR D8 18	S.M. Jacobs *et al.*	(BRAN, UMD, SYRA+) JP
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez *et al.*	(BNL)
APEL	72	PL 40B 680	W.D. Apel *et al.*	(KARLK, KARLE, PISA)
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz *et al.*	(CERN)
BASILE	71	NC 3A 371	M. Basile *et al.*	(CERN, BGNA, STRB)
HARVEY	71	PRL 27 885	E.H. Harvey *et al.*	(MINN, MICH)
BENSINGER	70	PL 33B 505	J.R. Bensinger *et al.*	(WISC)
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I
DAVIS	68	PL 27B 532	R. Davis *et al.*	(NWES, ANL)
LONDON	66	PR 143 1034	G.W. London *et al.*	(BNL, SYRA) IJP
BADIER	65B	PL 17 337	J. Badier *et al.*	(EPOL, SACL, AMST)
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)
DAUBER	64	PRL 13 449	P.M. Dauber *et al.*	(UCLA) JP
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP