

$\eta'(958)$

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

$\eta'(958)$ MASS

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

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

$\eta'(958)$ WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
0.199 ± 0.009 OUR FIT					
0.230 ± 0.021 OUR AVERAGE					
0.226 ± 0.017 ± 0.014	2300	CZERWINSKI	10	MMS	$pp \rightarrow pp\eta'$
0.40 ± 0.22	4800	WURZINGER	96	SPEC	1.68 $pd \rightarrow {}^3\text{He}\eta'$
0.28 ± 0.10	1000	BINNIE	79	MMS 0	$\pi^- p \rightarrow n\text{MM}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.20 ± 0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

$\eta'(958)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\pi^+\pi^-\eta$	(43.4 \pm 0.7) %	
Γ_2 $\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.3 \pm 0.6) %	
Γ_3 $\pi^0\pi^0\eta$	(21.6 \pm 0.8) %	
Γ_4 $\omega\gamma$	(2.75 \pm 0.22) %	
Γ_5 $\gamma\gamma$	(2.18 \pm 0.08) %	
Γ_6 $3\pi^0$	(1.68 \pm 0.22) $\times 10^{-3}$	
Γ_7 $\mu^+\mu^-\gamma$	(1.07 \pm 0.26) $\times 10^{-4}$	
Γ_8 $\pi^+\pi^-\mu^+\mu^-$	< 2.2 $\times 10^{-4}$	90%
Γ_9 $\pi^+\pi^-\pi^0$	(3.6 $^{+1.1}_{-0.9}$) $\times 10^{-3}$	
Γ_{10} $\pi^0\rho^0$	< 4 %	90%
Γ_{11} $2(\pi^+\pi^-)$	< 2.4 $\times 10^{-4}$	90%
Γ_{12} $\pi^+\pi^-2\pi^0$	< 2.6 $\times 10^{-3}$	90%
Γ_{13} $2(\pi^+\pi^-)$ neutrals	< 1 %	95%
Γ_{14} $2(\pi^+\pi^-)\pi^0$	< 1.9 $\times 10^{-3}$	90%
Γ_{15} $2(\pi^+\pi^-)2\pi^0$	< 1 %	95%
Γ_{16} $3(\pi^+\pi^-)$	< 5 $\times 10^{-4}$	90%
Γ_{17} $\pi^+\pi^-e^+e^-$	(2.4 $^{+1.3}_{-1.0}$) $\times 10^{-3}$	
Γ_{18} γe^+e^-	< 9 $\times 10^{-4}$	90%
Γ_{19} $\pi^0\gamma\gamma$	< 8 $\times 10^{-4}$	90%
Γ_{20} $4\pi^0$	< 5 $\times 10^{-4}$	90%
Γ_{21} e^+e^-	< 2.1 $\times 10^{-7}$	90%
Γ_{22} invisible	< 9 $\times 10^{-4}$	90%

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

Γ_{23} $\pi^+\pi^-$	P, CP	< 6 $\times 10^{-5}$	90%
Γ_{24} $\pi^0\pi^0$	P, CP	< 4 $\times 10^{-4}$	90%
Γ_{25} $\pi^0e^+e^-$	C [a]	< 1.4 $\times 10^{-3}$	90%
Γ_{26} ηe^+e^-	C [a]	< 2.4 $\times 10^{-3}$	90%
Γ_{27} 3γ	C	< 1.0 $\times 10^{-4}$	90%
Γ_{28} $\mu^+\mu^-\pi^0$	C [a]	< 6.0 $\times 10^{-5}$	90%
Γ_{29} $\mu^+\mu^-\eta$	C [a]	< 1.5 $\times 10^{-5}$	90%
Γ_{30} $e\mu$	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 13 branching ratios uses 40 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 31.5$ for 32 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	1							
x_3	-76	-57						
x_4	-20	-24	6					
x_5	-31	-26	35	0				
x_6	-23	-17	28	1	10			
x_9	-1	-5	-7	-3	-4	-2		
x_{17}	-4	-6	-5	-2	-3	-2	-1	
Γ	26	5	-21	4	-72	-6	4	3
	x_1	x_2	x_3	x_4	x_5	x_6	x_9	x_{17}

Mode	Rate (MeV)
Γ_1 $\pi^+ \pi^- \eta$	0.086 \pm 0.004
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	0.0583 \pm 0.0028
Γ_3 $\pi^0 \pi^0 \eta$	0.0430 \pm 0.0022
Γ_4 $\omega \gamma$	0.0055 \pm 0.0005
Γ_5 $\gamma \gamma$	0.00434 \pm 0.00013
Γ_6 $3\pi^0$	(3.3 \pm 0.5) $\times 10^{-4}$
Γ_9 $\pi^+ \pi^- \pi^0$	(7.2 $^{+2.2}_{-1.9}$) $\times 10^{-4}$
Γ_{17} $\pi^+ \pi^- e^+ e^-$	(4.8 $^{+2.6}_{-1.9}$) $\times 10^{-4}$

$\eta'(958)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$					Γ_5
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
4.34 \pm 0.14					
4.28 \pm 0.19					
4.17 \pm 0.10 \pm 0.27	2000	4 ACCIARRI	98Q L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$	
4.53 \pm 0.29 \pm 0.51	266	KARCH	92 CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$	
3.61 \pm 0.13 \pm 0.48		5 BEHREND	91 CELL	$e^+ e^- \rightarrow e^+ e^- \eta'(958)$	
4.6 \pm 1.1 \pm 0.6	23	BARU	90 MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$	

4.57±0.25±0.44		BUTLER	90	MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
5.08±0.24±0.71	547	⁶ ROE	90	ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 ±0.7 ±0.6	34	AIHARA	88C	TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 ±0.5 ±0.5	136	⁷ WILLIAMS	88	CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$

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

4.7 ±0.6 ±0.9	143	⁸ GIDAL	87	MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		⁹ BARTEL	85E	JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

⁴ No non-resonant $\pi^+\pi^-$ contribution found.

⁵ Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.

⁶ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁷ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁸ Superseded by BUTLER 90.

⁹ Systematic error not evaluated.

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

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

$\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}} \quad \Gamma_5\Gamma_2/\Gamma$

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

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

1.85±0.31±0.24	43	BEHREND	83B	CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$
----------------	----	---------	-----	------	---------------------------------------

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}} \quad \Gamma_5\Gamma_3/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

0.94±0.05 OUR FIT

0.92±0.06±0.11 ¹⁰ KARCH 92 CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

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

0.95±0.05±0.08	¹¹ KARCH	90	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	^{11,12} ANTREASYAN	87	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

¹⁰ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.

¹¹ Superseded by KARCH 92.

¹² Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.

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

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

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

Re(α) decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.033 \pm 0.005 \pm 0.003$	44k	¹³ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	¹⁴ AMELIN	05A	VES $28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	¹⁵ BRIERE	00	CLEO $10.6 e^+e^- \rightarrow \eta\pi^+\pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	¹⁶ ALDE	86	GAM2 $38 \pi^- p \rightarrow n\eta\pi^0\pi^0$
-0.08 ± 0.03		^{16,17} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta\pi^+\pi^-$

¹³ See ABLIKIM 11 for the full correlation matrix.

¹⁴ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

¹⁵ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.

¹⁶ Assuming $C = 0$.

¹⁷ 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	¹⁸ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	¹⁹ AMELIN	05A	VES $28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	²⁰ ALDE	86	GAM2 $38 \pi^- p \rightarrow n\eta\pi^0\pi^0$
0.0 ± 0.3		^{20,21} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta\pi^+\pi^-$

¹⁸ See ABLIKIM 11 for the full correlation matrix.

¹⁹ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

²⁰ Assuming $C = 0$.

²¹ 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	²² ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	²³ AMELIN	05A	VES $28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$

²² See ABLIKIM 11 for the full correlation matrix.

²³ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

D decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.059 \pm 0.012 \pm 0.004$	44k	²⁴ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	²⁵ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	²⁶ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{26,27} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

²⁴ See ABLIKIM 11 for the full correlation matrix.²⁵ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.²⁶ Assuming $C = 0$.²⁷ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73. **$\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS**

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

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

a decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.047 \pm 0.011 \pm 0.003$	44k	²⁸ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	²⁹ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	³⁰ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

²⁸ See ABLIKIM 11 for the full correlation matrix.²⁹ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.³⁰ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.**b decay parameter**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.069 \pm 0.019 \pm 0.009$	44k	³¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	³² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	³³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³¹ See ABLIKIM 11 for the full correlation matrix.³² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.³³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

c decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$+0.019 \pm 0.011 \pm 0.003$	44k	34 ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	35 BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	36 DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁴ See ABLIKIM 11 for the full correlation matrix.

³⁵ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³⁶ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

d decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.073 \pm 0.012 \pm 0.003$	44k	37 ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	38 BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	39 DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁷ See ABLIKIM 11 for the full correlation matrix.

³⁸ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.

³⁹ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

$\eta'(958)$ β PARAMETER

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

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

β decay parameter

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.46 ± 0.22 OUR AVERAGE	Error includes scale factor of 1.4.			
-0.59 ± 0.18	235	BLIK	08 GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE	87B GAM2	$38 \pi^- p \rightarrow n 3\pi^0$

$\eta'(958)$ BRANCHING RATIOS

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

Γ_1 / Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.434 ± 0.007 OUR FIT				

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

$0.424 \pm 0.011 \pm 0.004$ 1.2k ⁴⁰ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$

⁴⁰ Not independent of other η' branching fractions and ratios in PEDLAR 09.

$\Gamma(\pi^+ \pi^- \eta(\text{charged decay}))/\Gamma_{\text{total}}$ **0.286 Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1240\pm0.0020				OUR FIT

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

0.123 \pm 0.014	107	RITTENBERG 69	HBC	1.7–2.7 $K^- p$
0.10 \pm 0.04	10	LONDON 66	HBC	2.24 $K^- p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$
0.07 \pm 0.04	7	BADIER 65B	HBC	3 $K^- p$

$\Gamma(\pi^+ \pi^- \eta(\text{neutral decay}))/\Gamma_{\text{total}}$ **0.714 Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.310\pm0.005				OUR FIT

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

0.314 \pm 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
0.293\pm0.006				OUR FIT

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

0.287 \pm 0.007 \pm 0.004	0.2k	⁴¹ PEDLAR 09	CLEO	$J/\psi \rightarrow \gamma \eta'$
0.329 \pm 0.033	298	RITTENBERG 69	HBC	1.7–2.7 $K^- p$
0.2 \pm 0.1	20	LONDON 66	HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
0.34 \pm 0.09	35	BADIER 65B	HBC	3 $K^- p$

⁴¹ 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
0.676\pm0.017			OUR FIT
0.683\pm0.020			OUR AVERAGE

0.677 \pm 0.024 \pm 0.011	PEDLAR 09	CLE3	$J/\psi \rightarrow \eta' \gamma$
0.69 \pm 0.03	ABLIKIM 06E	BES2	$J/\psi \rightarrow \eta' \gamma$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.947\pm0.024				OUR FIT
0.97 \pm 0.09				OUR AVERAGE

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

$\Gamma(\pi^0 \pi^0 \eta)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.216\pm0.008				OUR FIT

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

0.235 \pm 0.013 \pm 0.004	3.2k	⁴² PEDLAR 09	CLEO	$J/\psi \rightarrow \gamma \eta'$
-------------------------------	------	-------------------------	------	-----------------------------------

⁴² 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**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0694±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 $\pi^+ d$
------------	---	-----------	----	-----	---------------

$\Gamma(\pi^0 \pi^0 \eta)/\Gamma(\pi^+ \pi^- \eta)$ **\Gamma_3/\Gamma_1**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.498±0.025 OUR FIT			

0.555±0.043±0.013	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
--------------------------	--------	----	------	-----------------------------------

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.451±0.012 OUR FIT			

0.43 ±0.02 ±0.02	BARBERIS	98C	OMEG	450 $p p \rightarrow p_f \eta' p_s$
-------------------------	----------	-----	------	-------------------------------------

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

0.31 ±0.15	DAVIS	68	HBC	5.5 $K^- p$
------------	-------	----	-----	-------------

$\Gamma(\omega \gamma)/\Gamma_{\text{total}}$ **\Gamma_4/\Gamma**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0275±0.0022 OUR FIT				

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

0.0234±0.0030±0.0004	70	⁴³ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
----------------------	----	----------------------	----	------	-----------------------------------

⁴³ Not independent of other η' branching fractions and ratios in PEDLAR 09.

$\Gamma(\omega \gamma)/\Gamma(\pi^+ \pi^- \eta)$ **\Gamma_4/\Gamma_1**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.063±0.005 OUR FIT				

0.055±0.007±0.001	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
--------------------------	--------	----	------	-----------------------------------

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

0.068±0.013	68	ZANFINO	77	ASPK	8.4 $\pi^- p$
-------------	----	---------	----	------	---------------

$\Gamma(\omega \gamma)/\Gamma(\pi^0 \pi^0 \eta)$ **\Gamma_4/\Gamma_3**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.127±0.011 OUR FIT			

0.147±0.016	ALDE	87B	GAM2	38 $\pi^- p \rightarrow n 4\gamma$
--------------------	------	-----	------	------------------------------------

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.433±0.012 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**

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0863±0.0032 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
-------	------	-------------	------	---------

0.396±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 $K^- p \rightarrow \Lambda \pi^+ \pi^-$ neutrals
0.35 ±0.06	33	BADIER	65B	HBC	3 $K^- p$

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

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

2.18±0.08 OUR FIT

2.00±0.15 OUR AVERAGE

1.98 ^{+0.31} _{-0.27} ±0.07	114	44 WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$
2.00±0.18		45 STANTON	80	SPEC	8.45 $\pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$

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

2.25±0.16±0.03	0.3k	46 PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
1.8 ±0.2	6000	47 APEL	79	NICE	15-40 $\pi^- p \rightarrow n 2\gamma$
2.5 ±0.7		DUANE	74	MMS	$\pi^- p \rightarrow n \text{MM}$
1.71±0.33	68	DALPIAZ	72	CNTR	1.6 $\pi^- p \rightarrow n X^0$
2.0 ^{+0.8} _{-0.6}	31	HARVEY	71	OSPK	3.65 $\pi^- p \rightarrow n X^0$

⁴⁴WICHT 08 reports $[\Gamma(\eta'(958) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta' K^+) = (7.06 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴⁵Includes APEL 79 result.

⁴⁶Not independent of other η' branching fractions and ratios in PEDLAR 09.

⁴⁷Data is included in STANTON 80 evaluation.

$\Gamma(\gamma\gamma)/\Gamma(\pi^+\pi^-\eta)$ Γ_5/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.0503±0.0022 OUR FIT

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

$\Gamma(\gamma\gamma)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.0744±0.0033 OUR FIT

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

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_5/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.101±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 $\pi^- p \rightarrow n 2\gamma$

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_5/0.714\Gamma_3$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

0.141±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 $\pi^- p \rightarrow n X^0$
-------------	----	------	----	------	---------------------------------

$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_3+0.09\Gamma_4+\Gamma_5)/\Gamma$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	-------------	--------------------	-------------	----------------

0.179±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 $\pi^- p \rightarrow nX^0$
0.189±0.026	123	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

$\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_6/Γ_3

<u>VALUE (units 10⁻⁴)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------------------------	-------------	--------------------	-------------	----------------

78±10 OUR FIT

78±10 OUR AVERAGE

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

$\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_7/Γ_5

<u>VALUE (units 10⁻³)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------------------------	-------------	--------------------	-------------	----------------

4.9±1.2 33 VIKTOROV 80 CNTR 25,33 $\pi^- p \rightarrow 2\mu\gamma$

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_8/Γ

<u>VALUE (units 10⁻⁴)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------------------------	------------	--------------------	-------------	----------------

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

<2.4 90 ⁴⁸ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁴⁸ Not independent of measured value of Γ_8/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_8/Γ_1

<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------------------------	------------	--------------------	-------------	----------------

<0.5 90 ⁴⁹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁴⁹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

<u>VALUE (units 10⁻²)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------------------------	------------	--------------------	-------------	----------------

0.36^{+0.11}_{-0.09} OUR FIT

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

0.37^{+0.11}_{-0.09}±0.04 ⁵⁰ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

<9 95 DANBURG 73 HBC 2.2 $K^- p \rightarrow \Lambda X^0$

<5 90 RITTENBERG 69 HBC 1.7–2.7 $K^- p$

⁵⁰ Not independent of measured value of Γ_9/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$					Γ_9/Γ_1
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	

8.3 $\begin{smallmatrix} +2.5 \\ -2.1 \end{smallmatrix}$ OUR FIT

$8.26 \begin{smallmatrix} +2.49 \\ -2.12 \end{smallmatrix} \pm 0.04$	20	51 NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
--	----	---------	----	------	----------------------------------

⁵¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21 \begin{smallmatrix} +6 \\ -5 \end{smallmatrix} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. 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_{10}/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_{11}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	

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

< 2.4	90	⁵² NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
<100	90	RITTENBERG 69	HBC	$1.7\text{--}2.7 K^- p$	

⁵² Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.

$\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$					Γ_{11}/Γ_1
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.6	90	⁵³ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

⁵³ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$					Γ_{12}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	

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

<27	90	⁵⁴ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
-----	----	--------------------	----	------	----------------------------------

⁵⁴ Not independent of measured value of Γ_{12}/Γ_1 from NAIK 09.

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$					Γ_{12}/Γ_1
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<6	90	⁵⁵ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

⁵⁵ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

$\Gamma(2(\pi^+\pi^-) \text{ neutrals})/\Gamma_{\text{total}}$					Γ_{13}/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	$1.7\text{--}2.7 K^- p$	
-------	----	---------------	-----	-------------------------	--

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ **Γ_{14}/Γ**

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	------------	--------------------	-------------	----------------

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

<0.002	90	⁵⁶ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
<0.01	90	RITTENBERG	69	HBC $1.7-2.7 K^- p$

⁵⁶ Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma(\pi^+\pi^-\eta)$ **Γ_{14}/Γ_1**

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	------------	--------------------	-------------	----------------

<4	90	⁵⁷ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
----	----	--------------------	----	---------------------------------------

⁵⁷ 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 $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

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

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	------------	--------------------	-------------	----------------

<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_{16}/Γ**

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	------------	--------------------	-------------	----------------

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

<0.53	90	⁵⁸ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
<5	95	KALBFLEISCH	64B	HBC $K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$

⁵⁸ Not independent of measured value of Γ_{16}/Γ_1 from NAIK 09.

$\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ **Γ_{16}/Γ_1**

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	------------	--------------------	-------------	----------------

<1.2	90	⁵⁹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
------	----	--------------------	----	---------------------------------------

⁵⁹ 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 $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ **Γ_{17}/Γ**

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	------------	--------------------	-------------	----------------

$2.4^{+1.3}_{-1.0}$ OUR FIT

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

$2.5^{+1.2}_{-0.9} \pm 0.5$		⁶⁰ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
<6	90	RITTENBERG	65	HBC $2.7 K^- p$

⁶⁰ Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

5.6 $^{+3.0}_{-2.2}$ OUR FIT

5.50 $^{+2.99}_{-2.29} \pm 0.03$ 8 61 NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<0.9 90 BRIERE 00 CLEO $10.6 e^+e^-$

$\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{19}/Γ_3

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

<37 90 ALDE 87B GAM2 $38 \pi^- p \rightarrow n4\gamma$

$\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{20}/Γ_3

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

<23 90 ALDE 87B GAM2 $38 \pi^- p \rightarrow n8\gamma$

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

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<2.1 90 VOROBYEV 88 ND $e^+e^- \rightarrow \pi^+\pi^-\eta$

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{22}/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 62 NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶² Not independent of measured value of Γ_{22}/Γ_1 from NAIK 09.

$\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{22}/Γ_5

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

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

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

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<2.1 90 63 NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶³ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.6	90	⁶⁴ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
••• We do not use the following data for averages, fits, limits, etc. •••				
< 29	90	⁶⁵ MORI 07A	BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$
< 3.3	90	⁶⁶ MORI 07A	BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$
< 800	95	DANBURG 73	HBC	$2.2 K^- p \rightarrow \Lambda X^0$
< 200	90	RITTENBERG 69	HBC	$1.7\text{--}2.7 K^- p$

⁶⁴ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.16 \times 10^{-3}$.

⁶⁵ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

⁶⁶ Without interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 4×10^{-4}	90	⁶⁷ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

⁶⁷ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.16 \times 10^{-3}$.

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{24}/Γ_3

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

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{25}/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	$2.7 K^- p$

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{26}/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_{27}/Γ_3

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

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

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

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

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

$\Gamma(e\mu)/\Gamma_{\text{total}}$					Γ_{30}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<4.7	90	BRIERE	00	CLEO	$10.6 e^+ e^-$

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

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

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

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

$\eta'(958)$ REFERENCES

ABLIKIM 11	PR D83 012003	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM 11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BES-III Collab.)
CZERWINSKI 10	PRL 105 122001	E. Czerwinski <i>et al.</i>	(COSY-11 Collab.)
BLIK 09	PAN 72 231	A.M. Blik <i>et al.</i>	(IHEP (Protvino))
	Translated from YAF 72 258.		
NAIK 09	PRL 102 061801	P. Naik <i>et al.</i>	(CLEO Collab.)
PEDLAR 09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)
BLIK 08	PAN 71 2124	A. Blik <i>et al.</i>	(GAMS-4 π Collab.)
	Translated from YAF 71 2161.		
LIBBY 08	PRL 101 182002	J. Libby <i>et al.</i>	(CLEO Collab.)
WICHT 08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)
DOROFEEV 07	PL B651 22	V. Dorofeev <i>et al.</i>	(VES Collab.)
MORI 07A	JPSJ 76 074102	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM 06Q	PRL 97 202002	M. Ablikim <i>et al.</i>	(BES Collab.)
AMELIN 05A	PAN 68 372	D.V. Amelin <i>et al.</i>	(VES Collab.)
	Translated from YAF 68 401.		
AMSLER 04B	EPJ C33 23	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)
BAI 04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRIERE 00	PRL 84 26	R. Briere <i>et al.</i>	(CLEO Collab.)
ACCIARRI 98Q	PL B418 399	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARBERIS 98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
WURZINGER 96	PL B374 283	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)
PDG 94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)
AMSLER 93	ZPHY C58 175	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitjukov, G.V. Borisov	(SERP+)
	Translated from YAF 55 2748.		
KARCH 92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)
ARMSTRONG 91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BEHREND 91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
AUGUSTIN 90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BARU 90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)
BUTLER 90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)
KARCH 90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)
ROE 90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)
AIHARA 88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
VOROBYEV 88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
	Translated from YAF 48 436.		

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