

$f_2(1270)$ 

$$I^G(J^{PC}) = 0^+(2^{++})$$

 **$f_2(1270)$  MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1275.1 ± 1.2</b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.1.		
1262 $\pm \frac{1}{2}$ ±8		ABLIKIM 06V	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1275 ±15		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
1283 ± 5		ALDE 98	GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0n$
1278 ± 5		<sup>1</sup> BERTIN 97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1272 ± 8	200k	PROKOSHKIN 94	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$
1269.7 ± 5.2	5730	AUGUSTIN 89	DM2	$e^+e^- \rightarrow 5\pi$
1283 ± 8	400	<sup>2</sup> ALDE 87	GAM4	100 $\pi^-p \rightarrow 4\pi^0n$
1274 ± 5		<sup>2</sup> AUGUSTIN 87	DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		<sup>3</sup> LONGACRE 86	MPS	22 $\pi^-p \rightarrow n2K_S^0$
1276 ± 7		COURAU 84	DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ± 2.3		<sup>4</sup> CHABAUD 83	ASPK	17 $\pi^-p$ polarized
1280 ± 4		<sup>5</sup> CASON 82	STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL 81	MRK2	$J/\psi$ decay
1282 ± 5		<sup>6</sup> CORDEN 79	OMEG	12–15 $\pi^-p \rightarrow n2\pi$
1269 ± 4	10k	APEL 75	NICE	40 $\pi^-p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER 74	DBC	6 $\pi^+n \rightarrow \pi^+\pi^-p$
1277 ± 4	5300	FLATTE 71	HBC	7.0 $\pi^+p$
1273 ± 8		<sup>2</sup> STUNTEBECK 70	HBC	8 $\pi^-p$ , 5.4 $\pi^+d$
1265 ± 8		BOESEBECK 68	HBC	8 $\pi^+p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1270 ± 8		<sup>7</sup> ANISOVICH 09	RVUE	0.0 $\bar{p}p$ , $\pi N$
1277 ± 6	870	<sup>8</sup> SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ±10		TIKHOMIROV 03	SPEC	40.0 $\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ±10		<sup>9</sup> ALDE 97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		<sup>9</sup> GRYGOREV 96	SPEC	40 $\pi^-N \rightarrow K_S^0 K_S^0 X$
1262 ±11		AGUILAR-... 91	EHS	400 $pp$
1275 ±10		AKER 91	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1220 ±10		BREAKSTONE 90	SFM	$pp \rightarrow pp\pi^+\pi^-$
1288 ±12		ABACHI 86B	HRS	$e^+e^- \rightarrow \pi^+\pi^-X$
1284 ±30	3k	BINON 83	GAM2	38 $\pi^-p \rightarrow n2\eta$
1280 ±20	3k	APEL 82	CNTR	25 $\pi^-p \rightarrow n2\pi^0$
1284 ±10	16000	DEUTSCH... 76	HBC	16 $\pi^+p$
1258 ±10	600	TAKAHASHI 72	HBC	8 $\pi^-p \rightarrow n2\pi$
1275 ±13		ARMENISE 70	HBC	9 $\pi^+n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	<sup>2</sup> ARMENISE 68	DBC	5.1 $\pi^+n \rightarrow p\pi^+MM^-$
1270 ±10	360	<sup>2</sup> ARMENISE 68	DBC	5.1 $\pi^+n \rightarrow p\pi^0MM$
1268 ± 6		<sup>10</sup> JOHNSON 68	HBC	3.7–4.2 $\pi^-p$

- <sup>1</sup> T-matrix pole.
- <sup>2</sup> Mass errors enlarged by us to  $\Gamma/\sqrt{N}$ ; see the note with the  $K^*(892)$  mass.
- <sup>3</sup> From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- <sup>4</sup> From an energy-independent partial-wave analysis.
- <sup>5</sup> From an amplitude analysis of the reaction  $\pi^+\pi^- \rightarrow 2\pi^0$ .
- <sup>6</sup> From an amplitude analysis of  $\pi^+\pi^- \rightarrow \pi^+\pi^-$  scattering data.
- <sup>7</sup> 4-poles, 5-channel K matrix fit.
- <sup>8</sup> From analysis of L3 data at 91 and 183–209 GeV.
- <sup>9</sup> Systematic uncertainties not estimated.
- <sup>10</sup> JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

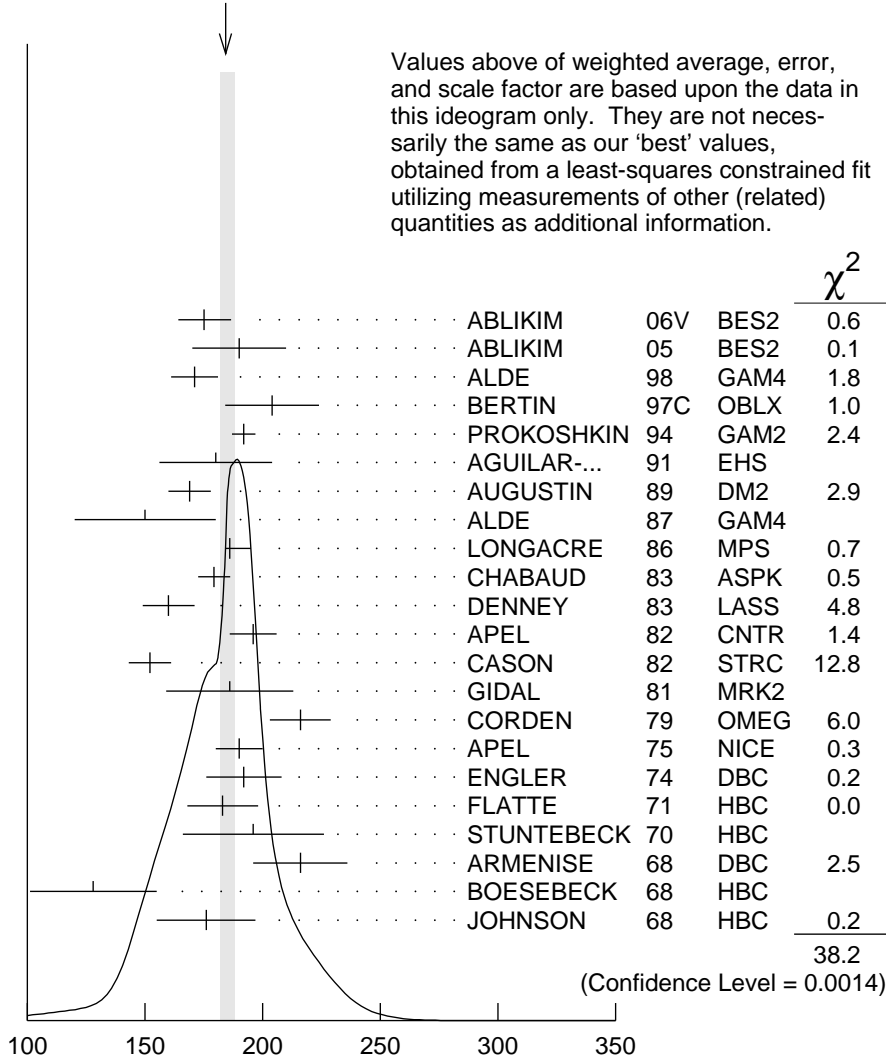
## $f_2(1270)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>185.1<sup>+</sup><sub>-</sub> 2.9 2.4</b>		<b>OUR FIT</b>		Error includes scale factor of 1.5.
<b>184.2<sup>+</sup><sub>-</sub> 4.0 2.4</b>		<b>OUR AVERAGE</b>		Error includes scale factor of 1.5. See the ideogram below.
175 <sup>+6</sup> <sub>-4</sub> ±10		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
190 ±20		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
171 ±10		ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0\pi^0 n$
204 ±20		<sup>11</sup> BERTIN	97C OBLX	$0.0 \bar{p} p \rightarrow \pi^+\pi^-\pi^0$
192 ± 5	200k	PROKOSHKIN	94 GAM2	$38 \pi^- p \rightarrow \pi^0\pi^0 n$
180 ±24		AGUILAR-...	91 EHS	400 $pp$
169 ± 9	5730	<sup>12</sup> AUGUSTIN	89 DM2	$e^+e^- \rightarrow 5\pi$
150 ±30	400	<sup>12</sup> ALDE	87 GAM4	$100 \pi^- p \rightarrow 4\pi^0 n$
186 <sup>+9</sup> <sub>-2</sub>		<sup>13</sup> LONGACRE	86 MPS	$22 \pi^- p \rightarrow n2K_S^0$
179.2 <sup>+6.9</sup> <sub>-6.6</sub>		<sup>14</sup> CHABAUD	83 ASPK	17 $\pi^- p$ polarized
160 ±11		DENNEY	83 LASS	10 $\pi^+ N$
196 ±10	3k	APEL	82 CNTR	$25 \pi^- p \rightarrow n2\pi^0$
152 ± 9		<sup>15</sup> CASON	82 STRC	$8 \pi^+ p \rightarrow \Delta^{++}\pi^0\pi^0$
186 ±27	11600	GIDAL	81 MRK2	$J/\psi$ decay
216 ±13		<sup>16</sup> CORDEN	79 OMEG	$12-15 \pi^- p \rightarrow n2\pi$
190 ±10	10k	APEL	75 NICE	$40 \pi^- p \rightarrow n2\pi^0$
192 ±16	4600	ENGLER	74 DBC	$6 \pi^+ n \rightarrow \pi^+\pi^- p$
183 ±15	5300	FLATTE	71 HBC	$7 \pi^+ p \rightarrow \Delta^{++}f_2$
196 ±30		<sup>12</sup> STUNTEBECK	70 HBC	$8 \pi^- p, 5.4 \pi^+ d$
216 ±20	1960	<sup>12</sup> ARMENISE	68 DBC	$5.1 \pi^+ n \rightarrow p\pi^+MM^-$
128 ±27		<sup>12</sup> BOESEBECK	68 HBC	$8 \pi^+ p$
176 ±21		<sup>12,17</sup> JOHNSON	68 HBC	$3.7-4.2 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
194 ±36		<sup>18</sup> ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
195 ±15	870	<sup>19</sup> SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ±26		TIKHOMIROV	03 SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
187 ±20		<sup>20</sup> ALDE	97 GAM2	$450 pp \rightarrow pp\pi^0\pi^0$
184 ±10		<sup>20</sup> GRYGOREV	96 SPEC	$40 \pi^- N \rightarrow K_S^0 K_S^0 X$
200 ±10		AKER	91 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$

240 ± 40	3k	BINON	83	GAM2	38	$\pi^- p \rightarrow n2\eta$
187 ± 30	650	12 ANTIPOV	77	CIBS	25	$\pi^- p \rightarrow p3\pi$
225 ± 38	16000	DEUTSCH...	76	HBC	16	$\pi^+ p$
166 ± 28	600	12 TAKAHASHI	72	HBC	8	$\pi^- p \rightarrow n2\pi$
173 ± 53		12 ARMENISE	70	HBC	9	$\pi^+ n \rightarrow p\pi^+\pi^-$

WEIGHTED AVERAGE

184.2+4.0-2.4 (Error scaled by 1.5)



$f_2(1270)$  width (MeV)

- 11 T-matrix pole.
- 12 Width errors enlarged by us to  $4\Gamma/\sqrt{N}$ ; see the note with the  $K^*(892)$  mass.
- 13 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- 14 From an energy-independent partial-wave analysis.
- 15 From an amplitude analysis of the reaction  $\pi^+\pi^- \rightarrow 2\pi^0$ .
- 16 From an amplitude analysis of  $\pi^+\pi^- \rightarrow \pi^+\pi^-$  scattering data.
- 17 JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
- 18 4-poles, 5-channel K matrix fit.

<sup>19</sup> From analysis of L3 data at 91 and 183–209 GeV.

<sup>20</sup> Systematic uncertainties not estimated.

## $f_2(1270)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	(84.8 $\begin{smallmatrix} +2.4 \\ -1.2 \end{smallmatrix}$ ) %	S=1.2
$\Gamma_2 \quad \pi^+\pi^-2\pi^0$	( 7.1 $\begin{smallmatrix} +1.4 \\ -2.7 \end{smallmatrix}$ ) %	S=1.3
$\Gamma_3 \quad K\bar{K}$	( 4.6 $\pm 0.4$ ) %	S=2.8
$\Gamma_4 \quad 2\pi^+2\pi^-$	( 2.8 $\pm 0.4$ ) %	S=1.2
$\Gamma_5 \quad \eta\eta$	( 4.0 $\pm 0.8$ ) $\times 10^{-3}$	S=2.1
$\Gamma_6 \quad 4\pi^0$	( 3.0 $\pm 1.0$ ) $\times 10^{-3}$	
$\Gamma_7 \quad \gamma\gamma$	( 1.64 $\pm 0.19$ ) $\times 10^{-5}$	S=1.9
$\Gamma_8 \quad \eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%
$\Gamma_9 \quad K^0K^-\pi^+ + \text{c.c.}$	$< 3.4 \times 10^{-3}$	CL=95%
$\Gamma_{10} \quad e^+e^-$	$< 6 \times 10^{-10}$	CL=90%

## CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 44 measurements and one constraint to determine 8 parameters. The overall fit has a  $\chi^2 = 81.8$  for 37 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$ , 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.

$x_2$	-91						
$x_3$	11	-39					
$x_4$	10	-37	1				
$x_5$	1	-6	0	0			
$x_6$	0	-7	0	0	0		
$x_7$	8	-5	-6	1	0	0	
$\Gamma$	-78	71	-11	-8	-1	0	-11
	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$

Mode	Rate (MeV)	Scale factor
$\Gamma_1 \quad \pi\pi$	156.9 $\begin{smallmatrix} +4.0 \\ -1.2 \end{smallmatrix}$	
$\Gamma_2 \quad \pi^+\pi^-2\pi^0$	13.2 $\begin{smallmatrix} +2.8 \\ -5.0 \end{smallmatrix}$	1.3

$\Gamma_3$	$K\bar{K}$	8.5	$\pm 0.8$	2.9
$\Gamma_4$	$2\pi^+ 2\pi^-$	5.2	$\pm 0.7$	1.2
$\Gamma_5$	$\eta\eta$	0.74	$\pm 0.14$	2.1
$\Gamma_6$	$4\pi^0$	0.55	$\pm 0.18$	
$\Gamma_7$	$\gamma\gamma$	$0.00303 \pm 0.00035$		1.9

## $f_2(1270)$ PARTIAL WIDTHS

$\Gamma(\pi\pi)$					$\Gamma_1$
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

**$156.9^{+4.0}_{-1.2}$  OUR FIT**

**$157.0^{+6.0}_{-1.0}$**       <sup>21</sup> LONGACRE    86    MPS    22  $\pi^- p \rightarrow n 2K_S^0$

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

$152 \pm 8$       870      <sup>22</sup> SCHEGELSKY 06A    RVUE     $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(K\bar{K})$					$\Gamma_3$
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

**$8.5 \pm 0.8$  OUR FIT**    Error includes scale factor of 2.9.

**$9.0^{+0.7}_{-0.3}$**       <sup>21</sup> LONGACRE    86    MPS    22  $\pi^- p \rightarrow n 2K_S^0$

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

$7.5 \pm 2.0$       870      <sup>22</sup> SCHEGELSKY 06A    RVUE     $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\eta\eta)$					$\Gamma_5$
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

**$0.74 \pm 0.14$  OUR FIT**    Error includes scale factor of 2.1.

**$1.0 \pm 0.1$**       <sup>21</sup> LONGACRE    86    MPS    22  $\pi^- p \rightarrow n 2K_S^0$

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

$1.8 \pm 0.4$       870      <sup>22</sup> SCHEGELSKY 06A    RVUE     $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$					$\Gamma_7$
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The value of this width depends on the theoretical model used. Unitary approaches with scalars typically (with exception of PENNINGTON 08) give values clustering around 2.6 keV; without an S-wave contribution, values are systematically higher (typically around 3 keV).

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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**$3.03 \pm 0.35$  OUR FIT**    Error includes scale factor of 1.9.

**$3.14 \pm 0.20$**       <sup>23,24</sup> PENNINGTON 08    RVUE    Compilation

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

$3.82 \pm 0.30$       <sup>24,25</sup> PENNINGTON 08    RVUE    Compilation

$2.55 \pm 0.15$       870      <sup>22</sup> SCHEGELSKY 06A    RVUE     $\gamma\gamma \rightarrow K_S^0 K_S^0$

$2.84 \pm 0.35$       BOGLIONE    99    RVUE     $\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$

$2.93 \pm 0.23 \pm 0.32$       <sup>26</sup> YABUKI    95    VNS

$2.58 \pm 0.13^{+0.36}_{-0.27}$       <sup>27</sup> BEHREND    92    CELL     $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$

$3.10 \pm 0.35 \pm 0.35$       <sup>28</sup> BLINOV    92    MD1     $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$

$2.27 \pm 0.47 \pm 0.11$       ADACHI    90D    TOPZ     $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$

$3.15 \pm 0.04 \pm 0.39$		BOYER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$3.19 \pm 0.16^{+0.29}_{-0.28}$		MARSISKE	90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
$2.35 \pm 0.65$		<sup>29</sup> MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
$3.19 \pm 0.09^{+0.22}_{-0.38}$	2177	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
$3.2 \pm 0.1 \pm 0.4$		<sup>30</sup> AIHARA	86B	TPC	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.5 \pm 0.1 \pm 0.5$		BEHREND	84B	CELL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.85 \pm 0.25 \pm 0.5$		<sup>31</sup> BERGER	84	PLUT	$e^+e^- \rightarrow e^+e^-2\pi$
$2.70 \pm 0.05 \pm 0.20$		COURAU	84	DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.52 \pm 0.13 \pm 0.38$		<sup>32</sup> SMITH	84C	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.7 \pm 0.2 \pm 0.6$		EDWARDS	82F	CBAL	$e^+e^- \rightarrow e^+e^-2\pi^0$
$2.9^{+0.6}_{-0.4} \pm 0.6$		<sup>33</sup> EDWARDS	82F	CBAL	$e^+e^- \rightarrow e^+e^-2\pi^0$
$3.2 \pm 0.2 \pm 0.6$		BRANDELIK	81B	TASS	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$3.6 \pm 0.3 \pm 0.5$		ROUSSARIE	81	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.3 \pm 0.8$		<sup>34</sup> BERGER	80B	PLUT	$e^+e^-$

### $\Gamma(e^+e^-)$

$\Gamma_{10}$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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**<0.11** 90 ACHASOV 00K SND  $e^+e^- \rightarrow \pi^0\pi^0$

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

<1.7 90 VOROBYEV 88 ND  $e^+e^- \rightarrow \pi^0\pi^0$

<sup>21</sup> From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

<sup>22</sup> From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

<sup>23</sup> Solution A (preferred solution based on  $\chi^2$ -analysis).

<sup>24</sup> Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

<sup>25</sup> Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

<sup>26</sup> With a narrow scalar state around 1220 MeV.

<sup>27</sup> Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.

<sup>28</sup> Using the unitarized model of LYTH 85.

<sup>29</sup> Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with  $\gamma\gamma$  width of  $f_0(1370)$ :  $\Gamma(f_2) + 1/4 \Gamma(f^0) = 3.6 \pm 0.3$  KeV.

<sup>30</sup> Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes  $2.66 \pm 0.21$  in the calculation of LANDRO 86.

<sup>31</sup> Using the MENNESSIER 83 model.

<sup>32</sup> Superseded by BOYER 90.

<sup>33</sup> If helicity = 2 assumption is not made.

<sup>34</sup> Using mass, width and  $B(f_2(1270) \rightarrow 2\pi)$  from PDG 78.

### $f_2(1270) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

### $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_3\Gamma_7/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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**0.139 ± 0.019 OUR FIT** Error includes scale factor of 1.9.

**0.091 ± 0.007 ± 0.027** <sup>35</sup> ALBRECHT 90G ARG  $e^+e^- \rightarrow e^+e^-K^+K^-$

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

$0.104 \pm 0.007 \pm 0.072$  <sup>36</sup> ALBRECHT 90G ARG  $e^+e^- \rightarrow e^+e^-K^+K^-$

<sup>35</sup> Using an incoherent background.

<sup>36</sup> Using a coherent background.

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_7/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
$11.5^{+1.8+4.5}_{-2.0-3.7}$	37 UEHARA	10A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$	

<sup>37</sup> Including interference with the  $f'_2(1525)$  (parameters fixed to the values from the 2008 edition of this review, PDG 08) and  $f_0(Y)$ .

### Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
$3.7 \pm 0.3^{+15.9}_{-2.9}$	UEHARA	08A	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$

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

13	38,39 PENNINGTON 08	RVUE	Compilation
26	39,40 PENNINGTON 08	RVUE	Compilation

<sup>38</sup> Solution A (preferred solution based on  $\chi^2$ -analysis).

<sup>39</sup> Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

<sup>40</sup> Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

### $f_2(1270)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.848^{+0.024}_{-0.012}$ OUR FIT				Error includes scale factor of 1.2.	
<b>0.837 ± 0.020 OUR AVERAGE</b>					
0.849 ± 0.025		CHABAUD	83	ASPK 17 $\pi^- p$ polarized	
0.85 ± 0.05	250	BEAUPRE	71	HBC 8 $\pi^+ p \rightarrow \Delta^{++} f_2$	
0.8 ± 0.04	600	OH	70	HBC 1.26 $\pi^- p \rightarrow \pi^+ \pi^- n$	

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi\pi)$					$\Gamma_2/\Gamma_1$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

Should be twice  $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$  if decay is  $\rho\rho$ . (See ASCOLI 68D.)

$0.084^{+0.018}_{-0.033}$ OUR FIT				Error includes scale factor of 1.3.	
<b>0.15 ± 0.06</b>	600	EISENBERG	74	HBC 4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$	
0.07		EMMS	75D	DBC 4 $\pi^+ n \rightarrow p f_2$	

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

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$   $\Gamma_3/\Gamma_1$

We average only experiments which either take into account  $f_2(1270)$ - $a_2(1320)$  interference explicitly or demonstrate that  $a_2(1320)$  production is negligible.

VALUE      EVTS      DOCUMENT ID      TECN      COMMENT

**0.054<sup>+0.005</sup><sub>-0.006</sub>** **OUR FIT**    Error includes scale factor of 2.8.

**0.041<sup>+0.004</sup><sub>-0.005</sub>** **OUR AVERAGE**

0.045±0.01		41 BARGIOTTI	03	OBLX	$\bar{p}p$
0.037 <sup>+0.008</sup> <sub>-0.021</sub>		ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2K_S^0$
0.045±0.009		CHABAUD	81	ASPK	$17 \pi^- p$ polarized
0.039±0.008		LOVERRE	80	HBC	$4 \pi^- p \rightarrow K\bar{K}N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.052±0.025		ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
0.036±0.005		42 COSTA...	80	OMEG	$1-2.2 \pi^- p \rightarrow K^+ K^- n$
0.030±0.005		43 MARTIN	79	RVUE	
0.027±0.009		44 POLYCHRO...	79	STRC	$7 \pi^- p \rightarrow n 2K_S^0$
0.025±0.015		EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.031±0.012	20	ADERHOLZ	69	HBC	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$   $\Gamma_4/\Gamma_1$

VALUE      EVTS      DOCUMENT ID      TECN      COMMENT

**0.033±0.005** **OUR FIT**    Error includes scale factor of 1.2.

**0.033±0.004** **OUR AVERAGE**    Error includes scale factor of 1.1.

0.024±0.006	160	EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.051±0.025	70	EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$
0.043 <sup>+0.007</sup> <sub>-0.011</sub>	285	LOUIE	74	HBC	$3.9 \pi^- p \rightarrow n f_2$
0.037±0.007	154	ANDERSON	73	DBC	$6 \pi^+ n \rightarrow p f_2$
0.047±0.013		OH	70	HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$

VALUE (units 10<sup>-3</sup>)      DOCUMENT ID      TECN      COMMENT

**4.0±0.8** **OUR FIT**    Error includes scale factor of 2.1.

**2.9±0.5** **OUR AVERAGE**

2.7±0.7		BINON	05	GAMS	$33 \pi^- p \rightarrow \eta\eta n$
2.8±0.7		ALDE	86D	GAM4	$100 \pi^- p \rightarrow 2\eta n$
5.2±1.7		BINON	83	GAM2	$38 \pi^- p \rightarrow 2\eta n$

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$   $\Gamma_5/\Gamma_1$

VALUE      CL%      DOCUMENT ID      TECN      COMMENT

**0.003±0.001**      BARBERIS      00E      450  $pp \rightarrow p_f \eta \eta p_S$

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

<0.05	95	EDWARDS	82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\eta$
<0.016	95	EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
<0.09	95	EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$



$\Gamma(4\pi^0)/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.0030 ± 0.0010 OUR FIT</b>				
<b>0.003 ± 0.001</b>	400 ± 50	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

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

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.57 \pm 0.01^{+1.39}_{-0.14}$	UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
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$\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$   $\Gamma_8/\Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 0.010</b>	95	EMMS	75D	DBC 4 $\pi^+ n \rightarrow p f_2$

$\Gamma(K^0 K^- \pi^+ + \text{c.c.})/\Gamma(\pi\pi)$   $\Gamma_9/\Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 0.004</b>	95	EMMS	75D	DBC 4 $\pi^+ n \rightarrow p f_2$

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$

VALUE (units $10^{-10}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 6</b>	90	ACHASOV	00K	SND $e^+ e^- \rightarrow \pi^0 \pi^0$

<sup>41</sup> Coupled channel analysis of  $\pi^+ \pi^- \pi^0$ ,  $K^+ K^- \pi^0$ , and  $K^\pm K_S^0 \pi^\mp$ .

<sup>42</sup> Re-evaluated by CHABAUD 83.

<sup>43</sup> Includes PAWLICKI 77 data.

<sup>44</sup> Takes into account the  $f_2(1270)$ - $f'_2(1525)$  interference.

## $f_2(1270)$ REFERENCES

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BOGLIONE	99	EPJ C9 11	M. Boggione, M.R. Pennington	
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)
		Translated from YAF 59 2187.		
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)
PROKOSHKIN	94	SPD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)
		Translated from DANS 336 613.		

BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
		Translated from YAF 48 436.		
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 $\gamma$ Collab.)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
LYTH	85	JP G11 459	D.H. Lyth	
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
		Translated from YAF 38 934.		
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>	
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)
DEUTSCH...	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)
EISENBERG	74	PL 52B 239	Y. Eisenberg <i>et al.</i>	(REHO)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)
LOUIE	74	PL 48B 385	J. Louie <i>et al.</i>	(SACL, CERN)
ANDERSON	73	PRL 31 562	J.C. Anderson <i>et al.</i>	(CMU, CASE)
TAKAHASHI	72	PR D6 1266	K. Takahashi <i>et al.</i>	(TOHOK, PENN, NDAM+)
BEAUPRE	71	NP B28 77	J.V. Beaupre <i>et al.</i>	(AACH, BERL, CERN)
FLATTE	71	PL 34B 551	S.M. Flatte <i>et al.</i>	(LBL)
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
OH	70	PR D1 2494	B.Y. Oh <i>et al.</i>	(WISC, TNTO) JP
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)

LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)

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