

# $f_0(1500)$

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

See also the mini-reviews on scalar mesons under  $f_0(600)$  (see the index for the page number) and on non- $q\bar{q}$  candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

## $f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1505 ± 6 OUR AVERAGE</b>		Error includes scale factor of 1.3. See the ideogram below.		
1466 ± 6 ± 20		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1515 ± 12		<sup>1</sup> BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta p_S$
1511 ± 9		<sup>1,2</sup> BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_S$
1510 ± 8		<sup>1</sup> BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_S$
1522 ± 25		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
1449 ± 20		<sup>1</sup> BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1515 ± 20		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
1500 ± 15		<sup>3</sup> AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1505 ± 15		<sup>4</sup> AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1486 ± 10		<sup>1</sup> ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
1470 ± 60	568	<sup>5</sup> KLEMP	08 E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
1470 <sup>+</sup> <sub>−</sub> $\frac{6+72}{7-255}$		<sup>6</sup> UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1495 ± 4		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1539 ± 20	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
1473 ± 5	80k	<sup>7,8</sup> UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
1478 ± 6		VLADIMIRSK...	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
1493 ± 7		<sup>7</sup> BINON	05 GAMS	33 $\pi^-p \rightarrow \eta \eta n$
1524 ± 14	1400	<sup>9</sup> GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
1489 <sup>+</sup> <sub>−</sub> $\frac{8}{4}$		<sup>10</sup> ANISOVICH	03 RVUE	
1490 ± 30		<sup>7</sup> ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
1497 ± 10		<sup>7</sup> BARBERIS	99 OMEG	450 $pp \rightarrow p_S p_f K^+K^-$
1502 ± 10		<sup>7</sup> BARBERIS	99B OMEG	450 $pp \rightarrow p_S p_f \pi^+\pi^-$
1502 ± 12 ± 10		<sup>11</sup> BARBERIS	99D OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
1530 ± 45		<sup>7</sup> BELLAZZINI	99 GAM4	450 $pp \rightarrow p p \pi^0 \pi^0$
1505 ± 18		<sup>7</sup> FRENCH	99	300 $pp \rightarrow p_f (K^+K^-) p_S$
1447 ± 27		<sup>12</sup> KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
1580 ± 80		<sup>7</sup> ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0 n$
1499 ± 8		<sup>1</sup> ANISOVICH	98B RVUE	Compilation
~ 1520		REYES	98 SPEC	800 $pp \rightarrow p_S p_f K_S^0 K_S^0$
1510 ± 20		<sup>1</sup> BARBERIS	97B OMEG	450 $pp \rightarrow p p 2(\pi^+\pi^-)$
~ 1475		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 1505		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
1500 ± 8		<sup>1</sup> ABELE	96C RVUE	Compilation
1460 ± 20	120	<sup>7</sup> AMELIN	96B VES	37 $\pi^-A \rightarrow \eta \eta \pi^- A$

1500 ± 8		BUGG	96	RVUE	
1500 ± 10		<sup>13</sup> AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta,$ $\pi^0\pi^0\eta$
1445 ± 5		<sup>14</sup> ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
1497 ± 30		<sup>7</sup> ANTINORI	95	OMEG	300,450 $pp \rightarrow pp\pi^+\pi^-$
~ 1505		BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1446 ± 5		<sup>7</sup> ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
1545 ± 25		<sup>7</sup> AMSLER	94E	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta'$
1520 ± 25		<sup>1,15</sup> ANISOVICH	94	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
1505 ± 20		<sup>1,16</sup> BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
1560 ± 25		<sup>7</sup> AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta$
1550 ± 45 ± 30		<sup>7</sup> BELADIDZE	92C	VES	36 $\pi^-Be \rightarrow \pi^-\eta'\eta Be$
1449 ± 4		<sup>7</sup> ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
1610 ± 20		<sup>7</sup> ALDE	88	GAM4	300 $\pi^-N \rightarrow \pi^-N2\eta$
~ 1525		ASTON	88D	LASS	11 $K^-p \rightarrow K_S^0K_S^0\Lambda$
1570 ± 20	600	<sup>7</sup> ALDE	87	GAM4	100 $\pi^-p \rightarrow 4\pi^0n$
1575 ± 45		<sup>17</sup> ALDE	86D	GAM4	100 $\pi^-p \rightarrow 2\eta n$
1568 ± 33		<sup>7</sup> BINON	84C	GAM2	38 $\pi^-p \rightarrow \eta\eta'n$
1592 ± 25		<sup>7</sup> BINON	83	GAM2	38 $\pi^-p \rightarrow 2\eta n$
1525 ± 5		<sup>7</sup> GRAY	83	DBC	0.0 $\bar{p}N \rightarrow 3\pi$

<sup>1</sup> T-matrix pole.

<sup>2</sup> Average between  $\pi^+\pi^-2\pi^0$  and  $2(\pi^+\pi^-)$ .

<sup>3</sup> T-matrix pole, supersedes ANISOVICH 94.

<sup>4</sup> T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

<sup>5</sup> Reanalysis of AITALA 01A data. This state could also be  $f_0(1370)$ .

<sup>6</sup> Breit-Wigner mass. May also be the  $f_0(1370)$ .

<sup>7</sup> Breit-Wigner mass.

<sup>8</sup> Statistical error only.

<sup>9</sup> Breit-Wigner, solution 1, PWA ambiguous.

<sup>10</sup> K-matrix pole from combined analysis of  $\pi^-p \rightarrow \pi^0\pi^0n, \pi^-p \rightarrow K\bar{K}n,$   
 $\pi^+\pi^- \rightarrow \pi^+\pi^-, \bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta, \pi^+\pi^-\pi^0, K^+K^-\pi^0, K_S^0K_S^0\pi^0,$   
 $K^+K_S^0\pi^-$  at rest,  $\bar{p}n \rightarrow \pi^-\pi^-\pi^+, K_S^0K^-\pi^0, K_S^0K_S^0\pi^-$  at rest.

<sup>11</sup> Supersedes BARBERIS 99 and BARBERIS 99B.

<sup>12</sup> T-matrix pole on sheet  $--+$ .

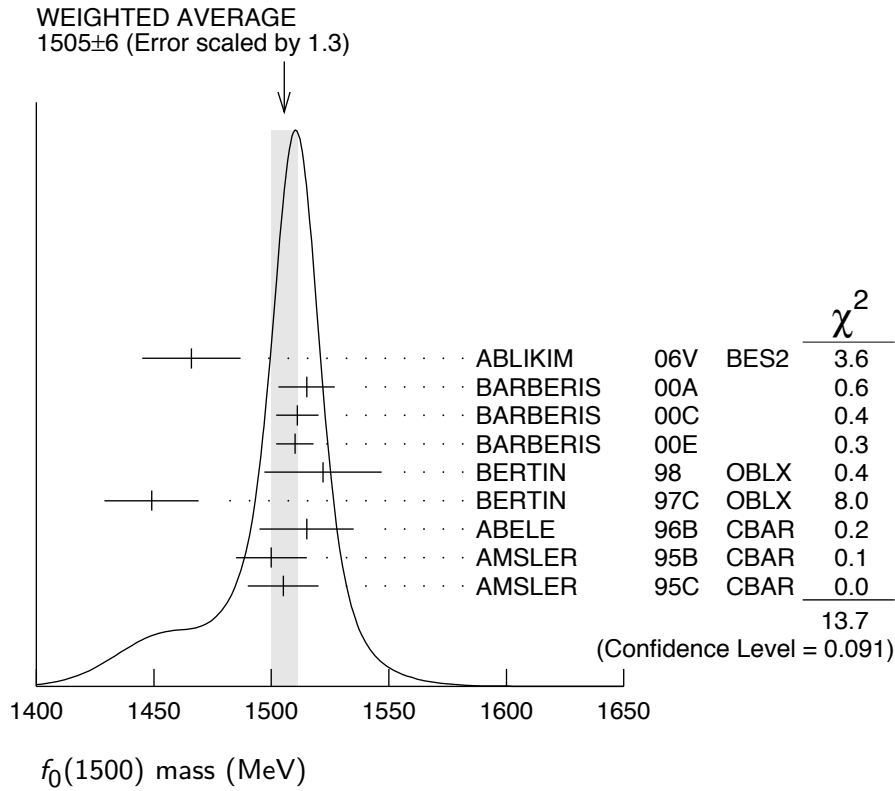
<sup>13</sup> T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

<sup>14</sup> Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

<sup>15</sup> From a simultaneous analysis of the annihilations  $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$ .

<sup>16</sup> Reanalysis of ANISOVICH 94 data.

<sup>17</sup> From central value and spread of two solutions. Breit-Wigner mass.



### $f_0(1500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>109± 7</b>	<b>OUR AVERAGE</b>			
108 <sup>+</sup> <sub>11</sub> ± 25		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
110± 24	18	BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
102± 18	18,19	BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
110± 16	18	BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
108± 33		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
114± 30	18	BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
105± 15		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
120± 25	20	AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
120± 30	21	AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
114± 10	18	ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
90 <sup>+</sup> <sub>1</sub> <sup>2+50</sup> <sub>1-22</sub>	22	UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
121± 8		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
257± 33	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
108± 9	80k	23,24 UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
119± 10		VLADIMIRSK...	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
90± 15	23	BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
136± 23	1400	25 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
102± 10	26	ANISOVICH	03 RVUE	
140± 40	23	ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$

104 ± 25		23 BARBERIS	99 OMEG 450	$pp \rightarrow p_S p_f K^+ K^-$
131 ± 15		23 BARBERIS	99B OMEG 450	$pp \rightarrow p_S p_f \pi^+ \pi^-$
98 ± 18 ± 16		27 BARBERIS	99D OMEG 450	$pp \rightarrow K^+ K^-, \pi^+ \pi^-$
160 ± 50		23 BELLAZZINI	99 GAM4 450	$pp \rightarrow pp\pi^0\pi^0$
100 ± 33		23 FRENCH	99	300 $pp \rightarrow p_f(K^+ K^-)p_S$
108 ± 46		28 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
280 ± 100		23 ALDE	98 GAM4 100	$\pi^- p \rightarrow \pi^0\pi^0 n$
130 ± 20		18 ANISOVICH	98B RVUE	Compilation
120 ± 35		18 BARBERIS	97B OMEG 450	$pp \rightarrow pp2(\pi^+ \pi^-)$
~ 100		FRABETTI	97D E687	$D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 169		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
100 ± 30	120	23 AMELIN	96B VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
132 ± 15		BUGG	96 RVUE	
154 ± 30		29 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta,$ $\pi^0\pi^0\eta$
65 ± 10		30 ANTINORI	95 OMEG 300,450	$pp \rightarrow pp2(\pi^+ \pi^-)$
199 ± 30		23 ANTINORI	95 OMEG 300,450	$pp \rightarrow pp\pi^+ \pi^-$
56 ± 12		23 ABATZIS	94 OMEG 450	$pp \rightarrow pp2(\pi^+ \pi^-)$
100 ± 40		23 AMSLER	94E CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta'$
148 <sup>+</sup> <sub>-</sub> 20 25		18,31 ANISOVICH	94 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
150 ± 20		18,32 BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
245 ± 50		23 AMSLER	92 CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta$
153 ± 67 ± 50		23 BELADIDZE	92C VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
78 ± 18		23 ARMSTRONG	89E OMEG 300	$pp \rightarrow pp2(\pi^+ \pi^-)$
170 ± 40		23 ALDE	88 GAM4 300	$\pi^- N \rightarrow \pi^- N 2\eta$
150 ± 20	600	23 ALDE	87 GAM4 100	$\pi^- p \rightarrow 4\pi^0 n$
265 ± 65		33 ALDE	86D GAM4 100	$\pi^- p \rightarrow 2\eta n$
260 ± 60		23 BINON	84C GAM2 38	$\pi^- p \rightarrow \eta\eta' n$
210 ± 40		23 BINON	83 GAM2 38	$\pi^- p \rightarrow 2\eta n$
101 ± 13		23 GRAY	83 DBC	0.0 $\bar{p}N \rightarrow 3\pi$

18 T-matrix pole.

19 Average between  $\pi^+ \pi^- 2\pi^0$  and  $2(\pi^+ \pi^-)$ .

20 T-matrix pole, supersedes ANISOVICH 94.

21 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

22 Breit-Wigner width. May also be the  $f_0(1370)$ .

23 Breit-Wigner width.

24 Statistical error only.

25 Breit-Wigner, solution 1, PWA ambiguous.

26 K-matrix pole from combined analysis of  $\pi^- p \rightarrow \pi^0\pi^0 n$ ,  $\pi^- p \rightarrow K\bar{K}n$ ,  $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$ ,  $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta, \pi^+ \pi^- \pi^0, K^+ K^- \pi^0, K_S^0 K_S^0 \pi^0$ ,  $K^+ K_S^0 \pi^-$  at rest,  $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$ ,  $K_S^0 K^- \pi^0, K_S^0 K_S^0 \pi^-$  at rest.

27 Supersedes BARBERIS 99 and BARBERIS 99B.

28 T-matrix pole on sheet -- +.

29 T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

30 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

31 From a simultaneous analysis of the annihilations  $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$ .

32 Reanalysis of ANISOVICH 94 data.

33 From central value and spread of two solutions. Breit-Wigner mass.

## $f_0(1500)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor
$\Gamma_1$ $\pi\pi$	(34.9 ± 2.3) %	1.2
$\Gamma_2$ $\pi^+\pi^-$	seen	
$\Gamma_3$ $2\pi^0$	seen	
$\Gamma_4$ $4\pi$	(49.5 ± 3.3) %	1.2
$\Gamma_5$ $4\pi^0$	seen	
$\Gamma_6$ $2\pi^+2\pi^-$	seen	
$\Gamma_7$ $2(\pi\pi)_{S\text{-wave}}$	seen	
$\Gamma_8$ $\rho\rho$	seen	
$\Gamma_9$ $\pi(1300)\pi$	seen	
$\Gamma_{10}$ $a_1(1260)\pi$	seen	
$\Gamma_{11}$ $\eta\eta$	( 5.1 ± 0.9) %	1.4
$\Gamma_{12}$ $\eta\eta'(958)$	( 1.9 ± 0.8) %	1.7
$\Gamma_{13}$ $K\bar{K}$	( 8.6 ± 1.0) %	1.1
$\Gamma_{14}$ $\gamma\gamma$	not seen	

### CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a  $\chi^2 = 11.4$  for 6 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$ , in percent, from the fit to 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.

$x_4$	-83			
$x_{11}$	11	-52		
$x_{12}$	-5	-31	29	
$x_{13}$	39	-67	33	6
	$x_1$	$x_4$	$x_{11}$	$x_{12}$

### $f_0(1500)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_{14}/\Gamma$
VALUE (eV)    CL%	DOCUMENT ID    TECN    COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
$33^{+12+1809}_{-6-21}$	<sup>34</sup> UEHARA    08A BELL    10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
not seen	ACCIARRI    01H L3 $\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{ee} = 91, 183\text{--}209 \text{ GeV}$
<460	95    BARATE    00E ALEP $\gamma\gamma \rightarrow \pi^+\pi^-$
<sup>34</sup> May also be the $f_0(1370)$ . Multiplied by us by 3 to obtain the $\pi\pi$ value.	

## $f_0(1500)$ BRANCHING RATIOS

### $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma$

VALUE DOCUMENT ID TECN

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

0.454 ± 0.104      BUGG      96      RVUE

### $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma$

VALUE DOCUMENT ID TECN COMMENT

**seen**      BERTIN      98      OBLX      0.05–0.405  $\bar{p}p \rightarrow \pi^+\pi^+\pi^-$

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

possibly seen      FRABETTI      97D      E687       $D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

### $\Gamma(4\pi)/\Gamma(\pi\pi)$ $\Gamma_4/\Gamma_1$

VALUE DOCUMENT ID TECN COMMENT

**1.42 ± 0.18 OUR FIT**      Error includes scale factor of 1.2.

**1.42 ± 0.18 OUR AVERAGE**      Error includes scale factor of 1.2.

1.37 ± 0.16      BARBERIS      00D      450  $pp \rightarrow p_f 4\pi p_S$

2.1 ± 0.6      35 AMSLER      98      RVUE

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

2.1 ± 0.2      36 ANISOVICH      02D      SPEC      Combined fit

3.4 ± 0.8      35 ABELE      96      CBAR      0.0  $\bar{p}p \rightarrow 5\pi^0$

### $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(\pi\pi)$ $\Gamma_7/\Gamma_1$

VALUE DOCUMENT ID TECN COMMENT

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

0.42 ± 0.26      37 ABELE      01      CBAR      0.0  $\bar{p}d \rightarrow \pi^- 4\pi^0 p$

### $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ $\Gamma_7/\Gamma_4$

VALUE DOCUMENT ID TECN COMMENT

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

0.26 ± 0.07      ABELE      01B      CBAR      0.0  $\bar{p}d \rightarrow 5\pi p$

### $\Gamma(\rho\rho)/\Gamma(4\pi)$ $\Gamma_8/\Gamma_4$

VALUE DOCUMENT ID TECN COMMENT

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

0.13 ± 0.08      ABELE      01B      CBAR      0.0  $\bar{p}d \rightarrow 5\pi p$

### $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{S\text{-wave}})$ $\Gamma_8/\Gamma_7$

VALUE DOCUMENT ID COMMENT

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

3.3 ± 0.5      BARBERIS      00C      450  $pp \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_S$

2.6 ± 0.4      BARBERIS      00C      450  $pp \rightarrow p_f 2(\pi^+ \pi^-) p_S$

### $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ $\Gamma_9/\Gamma_4$

VALUE DOCUMENT ID TECN COMMENT

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

0.50 ± 0.25      ABELE      01B      CBAR      0.0  $\bar{p}d \rightarrow 5\pi p$

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$

$\Gamma_{10}/\Gamma_4$

VALUE	DOCUMENT ID	TECN	COMMENT
0.12 ± 0.05	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

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

$\Gamma_{11}/\Gamma$

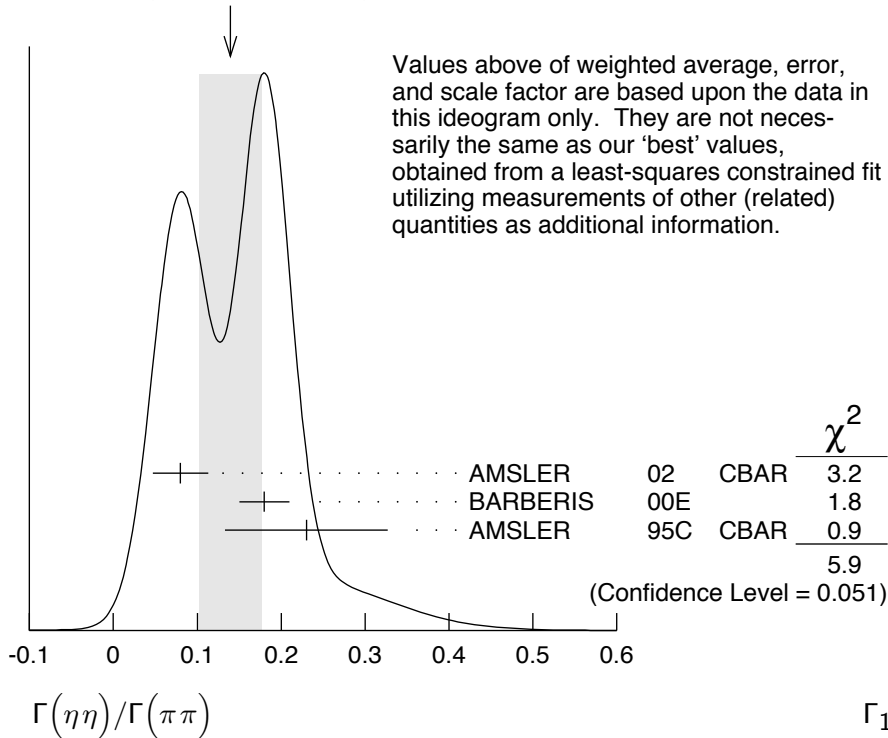
VALUE	DOCUMENT ID	TECN	COMMENT
large	ALDE	88	GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

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

$\Gamma_{11}/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.145 ± 0.027 OUR FIT</b>	Error includes scale factor of 1.5.		
<b>0.14 ± 0.04 OUR AVERAGE</b>	Error includes scale factor of 1.7. See the ideogram below.		
0.080 ± 0.033	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
0.18 ± 0.03	BARBERIS	00E	450 $p p \rightarrow p_f \eta\eta p_s$
0.230 ± 0.097	38 AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.11 ± 0.03	36 ANISOVICH	02D	SPEC Combined fit
0.078 ± 0.013	39 ABELE	96C	RVUE Compilation
0.157 ± 0.060	40 AMSLER	95D	CBAR 0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$

WEIGHTED AVERAGE  
0.14 ± 0.04 (Error scaled by 1.7)



$\Gamma(4\pi^0)/\Gamma(\eta\eta)$   $\Gamma_5/\Gamma_{11}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.8 \pm 0.3$	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$   $\Gamma_{12}/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.055 \pm 0.024</math> OUR FIT</b>	Error includes scale factor of 1.8.		
<b><math>0.095 \pm 0.026</math></b>	BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.005 \pm 0.003$	<sup>36</sup> ANISOVICH	02D	SPEC Combined fit

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$   $\Gamma_{12}/\Gamma_{11}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.38 \pm 0.16</math> OUR FIT</b>	Error includes scale factor of 1.9.		
<b><math>0.29 \pm 0.10</math></b>	<sup>41</sup> AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.05 \pm 0.03$	<sup>36</sup> ANISOVICH	02D	SPEC Combined fit
$0.84 \pm 0.23$	ABELE	96C	RVUE Compilation
$2.7 \pm 0.8$	BINON	84C	GAM2 38 $\pi^- p \rightarrow \eta\eta' n$

$\Gamma(K\bar{K})/\Gamma_{total}$   $\Gamma_{13}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.044 \pm 0.021$	BUGG	96	RVUE

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$   $\Gamma_{13}/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.246 \pm 0.026</math> OUR FIT</b>			
<b><math>0.241 \pm 0.028</math> OUR AVERAGE</b>			
$0.25 \pm 0.03$	<sup>42</sup> BARGIOTTI	03	OBLX $\bar{p}p$
$0.19 \pm 0.07$	<sup>43</sup> ABELE	98	CBAR 0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.16 \pm 0.05$	<sup>36</sup> ANISOVICH	02D	SPEC Combined fit
$0.33 \pm 0.03 \pm 0.07$	BARBERIS	99D	OMEG 450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$
$0.20 \pm 0.08$	<sup>44</sup> ABELE	96B	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$

$\Gamma(K\bar{K})/\Gamma(\eta\eta)$   $\Gamma_{13}/\Gamma_{11}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>1.69 \pm 0.33</math> OUR FIT</b>	Error includes scale factor of 1.4.			
<b><math>1.85 \pm 0.41</math></b>		BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.5 \pm 0.6$		<sup>36</sup> ANISOVICH	02D	SPEC Combined fit
$< 0.4$	90	<sup>45</sup> PROKOSHKIN	91	GAM4 300 $\pi^- p \rightarrow \pi^- p \eta \eta$
$< 0.6$		<sup>46</sup> BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$



- 35 Excluding  $\rho\rho$  contribution to  $4\pi$ .  
 36 From a combined K-matrix analysis of Crystal Barrel ( $0^- \rho\bar{\rho} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$ ), GAMS ( $\pi\rho \rightarrow \pi^0\pi^0n, \eta\eta n, \eta\eta'n$ ), and BNL ( $\pi\rho \rightarrow K\bar{K}n$ ) data.  
 37 From the combined data of ABELE 96 and ABELE 96C.  
 38 Using AMSLER 95B ( $3\pi^0$ ).  
 39  $2\pi$  width determined to be  $60 \pm 12$  MeV.  
 40 Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.  
 41 Using AMSLER 94E ( $\eta\eta'\pi^0$ ).  
 42 Coupled channel analysis of  $\pi^+\pi^-\pi^0, K^+K^-\pi^0$ , and  $K^\pm K_S^0\pi^\mp$ .  
 43 Using  $\pi^0\pi^0$  from AMSLER 95B.  
 44 Using AMSLER 95B ( $3\pi^0$ ), AMSLER 94C ( $2\pi^0\eta$ ) and SU(3).  
 45 Combining results of GAM4 with those of WA76 on  $K\bar{K}$  central production.  
 46 Using ETKIN 82B and COHEN 80.

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ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
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