

# $f_2(2150)$

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

OMITTED FROM SUMMARY TABLE

This entry was previously called  $T_0$ .

## $f_2(2150)$ MASS

### $f_2(2150)$ MASS, COMBINED MODES (MeV)

VALUE (MeV)	DOCUMENT ID
<b>2156 ± 11 OUR AVERAGE</b>	Includes data from the 2 datablocks that follow this one.

### $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			

### 2157 ± 12 OUR AVERAGE

2151 ± 16	BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_S$
2175 ± 20	PROKOSHKIN	95D GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $p\bar{p} \rightarrow p p 2\eta$
2130 ± 35	SINGOVSKI	94 GAM4	450 $p\bar{p} \rightarrow p p 2\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2140 ± 30	<sup>1</sup> ABELE	99B CBAR	
seen	<sup>2</sup> ANISOVICH	99B SPEC	1.35–1.94 $\bar{p}p \rightarrow \eta \eta \pi^0$
2105 ± 10	<sup>2</sup> ANISOVICH	99K RVUE	0.6–1.94 $\bar{p}p \rightarrow \eta \eta, \eta \eta'$
2104 ± 20	<sup>3</sup> ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$

- <sup>1</sup> Spin not determined.  
<sup>2</sup>  $J^{PC} = 0^{++}$ .  
<sup>3</sup> No  $J^{PC}$  determination.

### $\eta\pi\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
The data in this block is included in the average printed for a previous datablock.				

2135 ± 20 ± 45	ADOMEIT	96 CBAR	0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
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### $\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			

~ 2226	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2090	<sup>4</sup> OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2120	<sup>5</sup> OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170	<sup>6</sup> MARTIN	80B RVUE	
~ 2150	<sup>6</sup> MARTIN	80C RVUE	
~ 2150	<sup>7</sup> DULUDE	78B OSPK	1–2 $\bar{p}p \rightarrow \pi^0 \pi^0$

<sup>4</sup> OAKDEN 94 makes an amplitude analysis of LEAR data on  $\bar{p}p \rightarrow \pi\pi$  using a method based on Barrelet zeros. This is solution A. The amplitude analysis of HASAN 94 includes earlier data as well, and assume that the data can be parametrized in terms of towers of nearly degenerate resonances on the leading Regge trajectory. See also KLOET 96 and MARTIN 97 who make related analyses.

<sup>5</sup> From solution B of amplitude analysis of data on  $\bar{p}p \rightarrow \pi\pi$ .

<sup>6</sup>  $I(J^P) = 0(2^+)$  from simultaneous analysis of  $p\bar{p} \rightarrow \pi^- \pi^+$  and  $\pi^0 \pi^0$ .

<sup>7</sup>  $I^G(J^P) = 0^+(2^+)$  from partial-wave amplitude analysis.

### S-CHANNEL $\bar{p}p$ , $\bar{N}N$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2139^{+8}_{-9}$	<sup>8</sup> EVANGELISTA 97	SPEC		0.6-2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
~ 2190	<sup>8</sup> CUTTS	78B	CNTR	0.97-3 $\bar{p}p \rightarrow \bar{N}N$
$2155 \pm 15$	<sup>8,9</sup> COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
$2193 \pm 2$	<sup>8,10</sup> ALSPECTOR	73	CNTR	$\bar{p}p$ S channel

<sup>8</sup> Isospins 0 and 1 not separated.

<sup>9</sup> From a fit to the total elastic cross section.

<sup>10</sup> Referred to as  $T$  or  $\bar{T}$  region by ALSPECTOR 73.

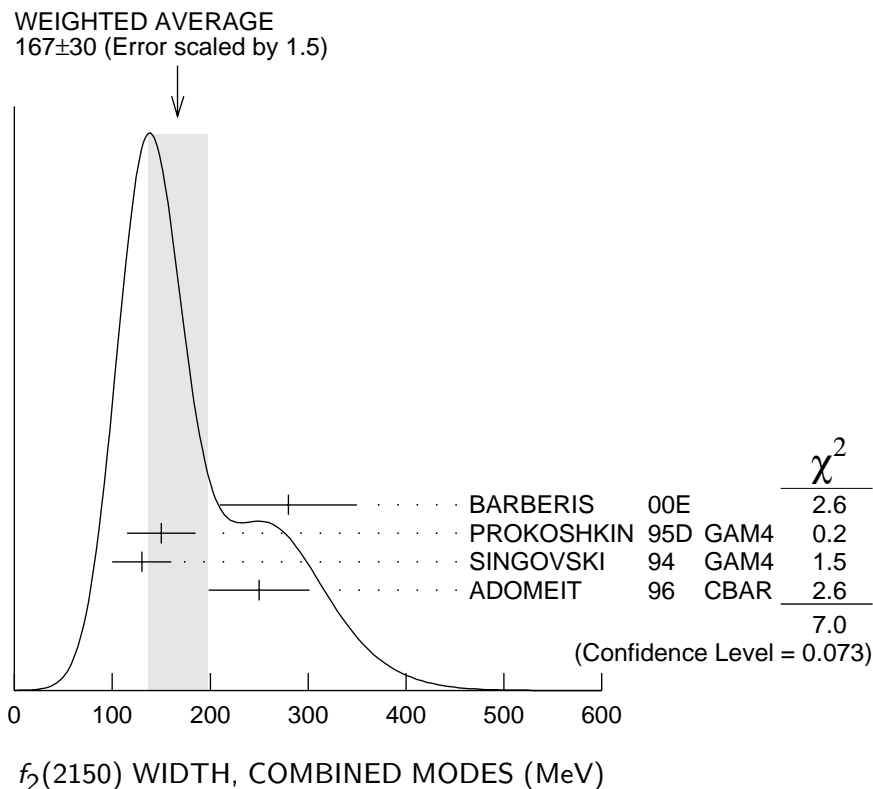
### K $\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2150 \pm 20$	ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
$2130 \pm 35$	BARBERIS	99	OMEG 450 $pp \rightarrow p_S p_f K^+ K^-$

### $f_2(2150)$ WIDTH

### $f_2(2150)$ WIDTH, COMBINED MODES (MeV)

**$167 \pm 30$  OUR AVERAGE** Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.



### $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

**152±30 OUR AVERAGE** Error includes scale factor of 1.4. See the ideogram below.

280±70	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$
150±35	PROKOSHKIN	95D GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow pp 2\eta$
130±30	SINGOVSKI	94 GAM4	450 $pp \rightarrow pp 2\eta$

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

310±50	<sup>11</sup> ABELE	99B CBAR	
seen	<sup>12</sup> ANISOVICH	99B SPEC	1.35–1.94 $\bar{p}p \rightarrow \eta\eta\pi^0$
200±25	<sup>13</sup> ANISOVICH	99K RVUE	0.6–1.94 $\bar{p}p \rightarrow \eta\eta, \eta\eta'$
203±10	<sup>14</sup> ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0 \eta\eta \rightarrow 6\gamma$

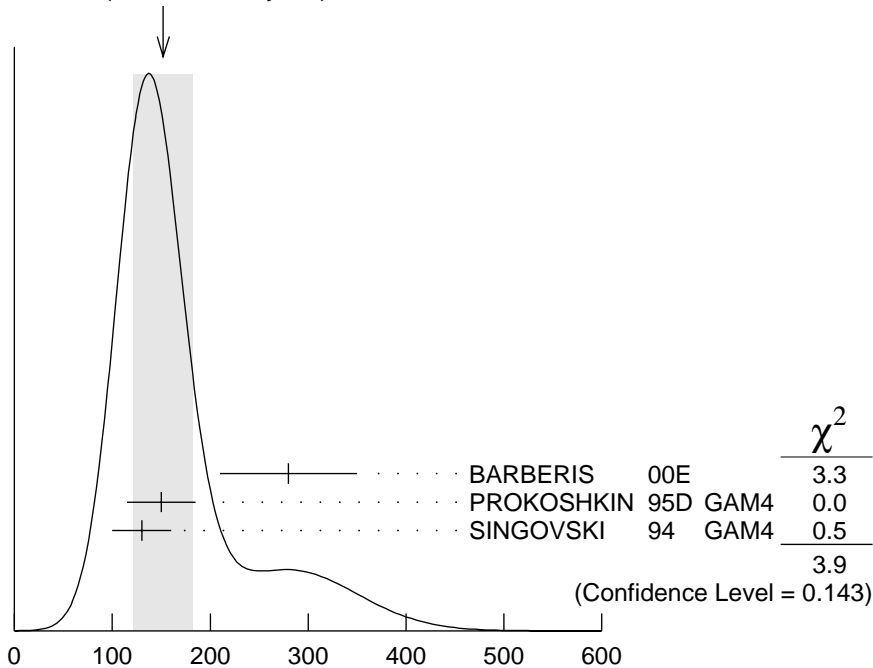
<sup>11</sup> Spin not determined.

<sup>12</sup>  $J^{PC} = 0^{++}$

<sup>13</sup> PWA gives  $J^{PC} = 0^{++}$ .

<sup>14</sup> No  $J^{PC}$  determination.

WEIGHTED AVERAGE  
152±30 (Error scaled by 1.4)



$f_2(2150)$  WIDTH,  $\eta\eta$  MODE (MeV)

### $\eta\pi\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

<b>250±25±45</b>	ADOMEIT	96 CBAR	0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
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### $\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>250 OUR ESTIMATE</b>			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 226	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 70	<sup>15</sup> OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	<sup>16</sup> MARTIN	80B RVUE	
~ 250	<sup>16</sup> MARTIN	80C RVUE	
~ 250	<sup>17</sup> DULUDE	78B OSPK	1–2 $\bar{p}p \rightarrow \pi^0\pi^0$
<sup>15</sup> See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.			
<sup>16</sup> $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$ .			
<sup>17</sup> $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.			

### S-CHANNEL $\bar{p}p, \bar{N}N$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$56^{+31}_{-16}$	<sup>18</sup> EVANGELISTA 97	SPEC		0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
$135 \pm 75$	<sup>19,20</sup> COUPLAND	77 CNTR	0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
$98 \pm 8$	<sup>20</sup> ALSPECTOR	73 CNTR		$\bar{p}p$ S channel
<sup>18</sup> Isospin 0 and 2 not separated.				
<sup>19</sup> From a fit to the total elastic cross section.				
<sup>20</sup> Isospins 0 and 1 not separated.				

### $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$150 \pm 30$	ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
$270 \pm 50$	BARBERIS	99 OMEG 450	$pp \rightarrow p_S p_f K^+ K^-$

## $f_2(2150)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $\pi\pi$	
$\Gamma_2$ $\eta\eta$	seen
$\Gamma_3$ $K\bar{K}$	seen
$\Gamma_4$ $f_2(1270)\eta$	seen
$\Gamma_5$ $a_2(1320)\pi$	seen

## $f_2(2150)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma(\eta\eta)$			$\Gamma_3/\Gamma_2$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>1.28 ± 0.23</b>		BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_S$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<0.1	95	<sup>21</sup> PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow pp 2\eta$

<sup>21</sup>Using data from ARMSTRONG 89D.

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

$\Gamma_1/\Gamma_2$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.33	95	<sup>22</sup> PROKOSHKIN 95D GAM4	300	$\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow pp 2\eta$
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<sup>22</sup> Derived from a  $\pi^0\pi^0/\eta\eta$  limit.

## $\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$

$\Gamma_4/\Gamma_5$

VALUE	DOCUMENT ID	TECN	COMMENT
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<b>0.79 ± 0.11</b>	<sup>23</sup> ADOMEIT	96	CBAR 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
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<sup>23</sup> Using  $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

## $f_2(2150)$ REFERENCES

ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELISTA	97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
PROKOSHKIN	95D	SPD 40 495	Y.D. Prokoshkin	(SERP) IGJPC
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
SINGOVSKI	94	NC 107A 1911	A.V. Singovsky	(SERP)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG	89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE	78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)

## OTHER RELATED PAPERS

EISENHAND...	75	NP B96 109	E. Eisenhandler <i>et al.</i>	(LOQM, LIVP, DARE+)
FIELDS	71	PRL 27 1749	T. Fields <i>et al.</i>	(ANL, OXF)
YOH	71	PRL 26 922	J.K. Yoh <i>et al.</i>	(CIT, BNL, ROCH)