

**$f_2(2150)$** 

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

OMITTED FROM SUMMARY TABLE

This entry was previously called  $T_0$ . **$f_2(2150)$  MASS** **$f_2(2150)$  MASS, COMBINED MODES (MeV)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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**2157±12 OUR AVERAGE** Includes data from the 2 datablocks that follow this one.

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

2170±6	80k	<sup>1</sup> UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
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<sup>1</sup>Statistical error only. **$\eta\eta$  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.

**2157±12 OUR AVERAGE**

2151±16	BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
2175±20	PROKOSHKIN	95D	GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow pp2\eta$
2130±35	SINGOVSKI	94	GAM4 450 $pp \rightarrow pp2\eta$

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

2140±30	<sup>2</sup> ABELE	99B	CBAR
2104±20	<sup>3</sup> ARMSTRONG	93C	E760 $\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$

<sup>2</sup>Spin not determined.<sup>3</sup>No  $J^{PC}$  determination. **$\eta\pi\pi$  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.

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

2135±20±45	<sup>4</sup> ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta3\pi^0$
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<sup>4</sup>ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single  $J^P = 2^+$  resonance. **$\bar{p}p \rightarrow \pi\pi$** 

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

~ 2090	<sup>5</sup> OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2120	<sup>6</sup> OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170	<sup>7</sup> MARTIN	80B	RVUE	
~ 2150	<sup>7</sup> MARTIN	80C	RVUE	
~ 2150	<sup>8</sup> DULUDE	78B	OSPK	1–2 $\bar{p}p \rightarrow \pi^0\pi^0$

<sup>5</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>6</sup> From solution B of amplitude analysis of data on  $\bar{p}p \rightarrow \pi\pi$ .

<sup>7</sup>  $I(J^P) = 0(2^+)$  from simultaneous analysis of  $p\bar{p} \rightarrow \pi^-\pi^+$  and  $\pi^0\pi^0$ .

<sup>8</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>9</sup> EVANGELIS...	97	SPEC	0.6-2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
$\sim 2190$	<sup>9</sup> CUTTS	78B	CNTR	0.97-3 $\bar{p}p \rightarrow \bar{N}N$
$2155 \pm 15$	<sup>9,10</sup> COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
$2193 \pm 2$	<sup>9,11</sup> ALSPECTOR	73	CNTR	$\bar{p}p$ S channel

<sup>9</sup> Isospins 0 and 1 not separated.

<sup>10</sup> From a fit to the total elastic cross section.

<sup>11</sup> Referred to as  $T$  or  $T$  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. ● ● ●			
$2200 \pm 13$	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
$2150 \pm 20$	ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
$2130 \pm 35$	BARBERIS	99	OMEG 450 $p\bar{p} \rightarrow p_S p_f K^+ K^-$

## $f_2(2150)$ WIDTH

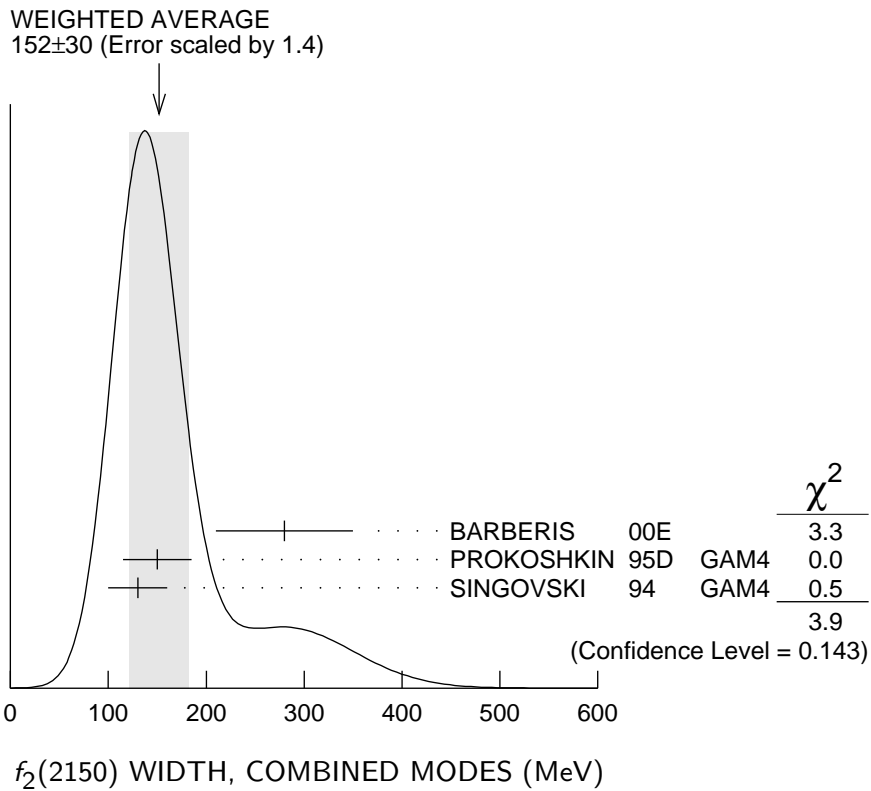
### $f_2(2150)$ WIDTH, COMBINED MODES (MeV)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>152 ± 30 OUR AVERAGE</b>	Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.4. See the ideogram below.			

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

$182 \pm 11$	80k	<sup>12</sup> UMAN	06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
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<sup>12</sup> Statistical error only.



### $\eta\eta$ MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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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.

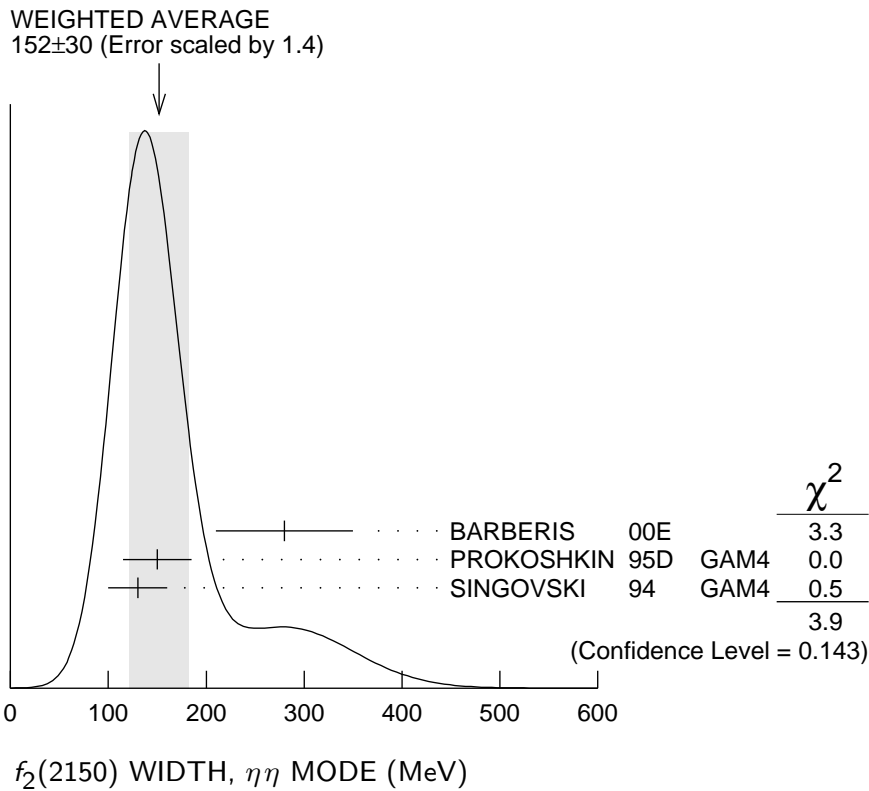
280 ± 70	BARBERIS	00E	450 $p p \rightarrow p_f \eta \eta p_s$
150 ± 35	PROKOSHKIN	95D	GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $p p \rightarrow p p 2\eta$
130 ± 30	SINGOVSKI	94	GAM4 450 $p p \rightarrow p p 2\eta$

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

310 ± 50	<sup>13</sup> ABELE	99B	CBAR
203 ± 10	<sup>14</sup> ARMSTRONG	93C	E760 $\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$

<sup>13</sup> Spin not determined.

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



### $\eta\pi\pi$ 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.

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

250±25±45                      <sup>15</sup> ADOMEIT    96    CBAR   0    1.94  $\bar{p}p \rightarrow \eta 3\pi^0$   
<sup>15</sup> ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single  $J^P = 2^+$  resonance.

### $\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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#### 250 OUR ESTIMATE

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

~ 70                      <sup>16</sup> OAKDEN    94    RVUE   0.36–1.55  $\bar{p}p \rightarrow \pi\pi$   
 ~ 250                     <sup>17</sup> MARTIN    80B   RVUE  
 ~ 250                     <sup>17</sup> MARTIN    80C   RVUE  
 ~ 250                     <sup>18</sup> DULUDE    78B   OSPK   1–2  $\bar{p}p \rightarrow \pi^0\pi^0$

<sup>16</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>17</sup>  $I(J^P) = 0(2^+)$  from simultaneous analysis of  $p\bar{p} \rightarrow \pi^-\pi^+$  and  $\pi^0\pi^0$ .

<sup>18</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>19</sup> EVANGELIS...	97	SPEC	0.6-2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
$135 \pm 75$	<sup>20,21</sup> COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
$98 \pm 8$	<sup>21</sup> ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
<sup>19</sup> Isospin 0 and 2 not separated.				
<sup>20</sup> From a fit to the total elastic cross section.				
<sup>21</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. ● ● ●			
$91 \pm 62$	VLADIMIRSK..06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
$150 \pm 30$	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
$\Gamma_6$ $\rho\bar{\rho}$	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>22</sup> PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow p\rho 2\eta$
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<sup>22</sup> Using data from ARMSTRONG 89D.

$\Gamma(\pi\pi)/\Gamma(\eta\eta)$				$\Gamma_1/\Gamma_2$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.33	95	<sup>23</sup> PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$ , 450 $pp \rightarrow p\rho 2\eta$
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<sup>23</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
<b>0.79±0.11</b>	<sup>24</sup> ADOMEIT 96	CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

<sup>24</sup> Using  $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

$\Gamma(p\bar{p})/\Gamma_{total}$   $\Gamma_6/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$

**$f_2(2150)$  REFERENCES**

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
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.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELIS... 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
	Translated from DANS 344 469.		
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)