# $f_2(2150)$

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

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* |
|---|---|
| **2156±11 OUR AVERAGE** | Includes data from the 2 datablocks that follow this one. |

### $\eta\eta$ MODE

The data in this block is included in the average printed for a previous datablock.

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **2157±12 OUR AVERAGE** | | | | |
| 2151±16 | BARBERIS | 00E | | 450 $pp \to p_f \eta\eta p_s$ |
| 2175±20 | PROKOSHKIN | 95D | GAM4 | 300 $\pi^- N \to \pi^- N 2\eta$, 450 $pp \to pp2\eta$ |
| 2130±35 | SINGOVSKI | 94 | GAM4 | 450 $pp \to pp2\eta$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 2140±30 | [1] ABELE | 99B | CBAR | |
| seen | [2] ANISOVICH | 99B | SPEC | 1.35–1.94 $\overline{p}p \to \eta\eta\pi^0$ |
| 2105±10 | [2] ANISOVICH | 99K | RVUE | 0.6–1.94 $\overline{p}p \to \eta\eta, \eta\eta'$ |
| 2104±20 | [3] ARMSTRONG | 93C | E760 | $\overline{p}p \to \pi^0\eta\eta \to 6\gamma$ |

[1] Spin not determined.
[2] $J^{PC} = 0^{++}$.
[3] No $J^{PC}$ determination.

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

The data in this block is included in the average printed for a previous datablock.

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| **2135±20±45** | ADOMEIT | 96 | CBAR | 0 | 1.94 $\overline{p}p \to \eta 3\pi^0$ |

### $\overline{p}p \to \pi\pi$

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| ~ 2226 | HASAN | 94 | RVUE | $\overline{p}p \to \pi\pi$ |
| ~ 2090 | [4] OAKDEN | 94 | RVUE | 0.36–1.55 $\overline{p}p \to \pi\pi$ |
| ~ 2120 | [5] OAKDEN | 94 | RVUE | 0.36–1.55 $\overline{p}p \to \pi\pi$ |
| ~ 2170 | [6] MARTIN | 80B | RVUE | |
| ~ 2150 | [6] MARTIN | 80C | RVUE | |
| ~ 2150 | [7] DULUDE | 78B | OSPK | 1–2 $\overline{p}p \to \pi^0\pi^0$ |

[4] OAKDEN 94 makes an amplitude analysis of LEAR data on $\overline{p}p \to \pi\pi$ 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.
[5] From solution B of amplitude analysis of data on $\overline{p}p \to \pi\pi$.
[6] $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\overline{p} \to \pi^-\pi^+$ and $\pi^0\pi^0$.
[7] $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.

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

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

[8] Isospins 0 and 1 not separated.
[9] From a fit to the total elastic cross section.
[10] Referred to as *T* or *T* region by ALSPECTOR 73.

## $K\overline{K}$ MODE

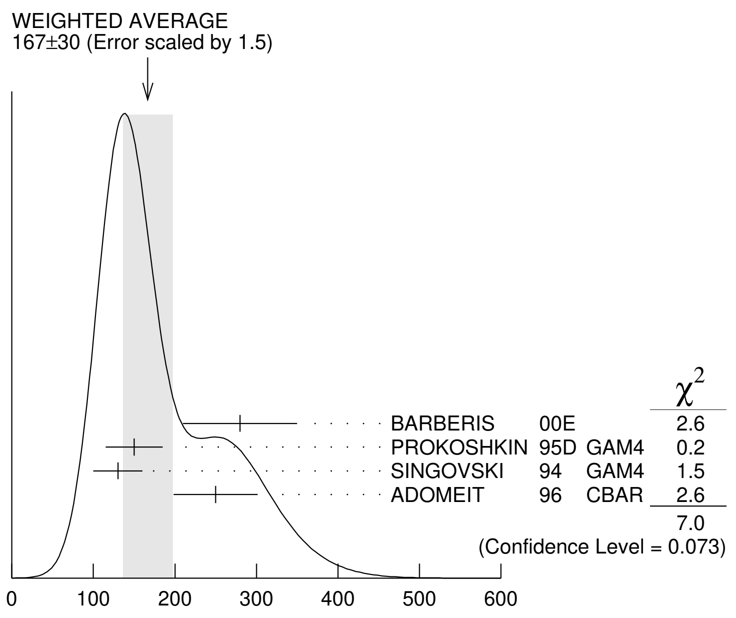
| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **2130±35** | BARBERIS | 99 | OMEG | 450 $pp \rightarrow p_s p_f K^+ K^-$ |

# $f_2$(2150) WIDTH

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

| *VALUE* (MeV) | *DOCUMENT ID* |
|---|---|

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

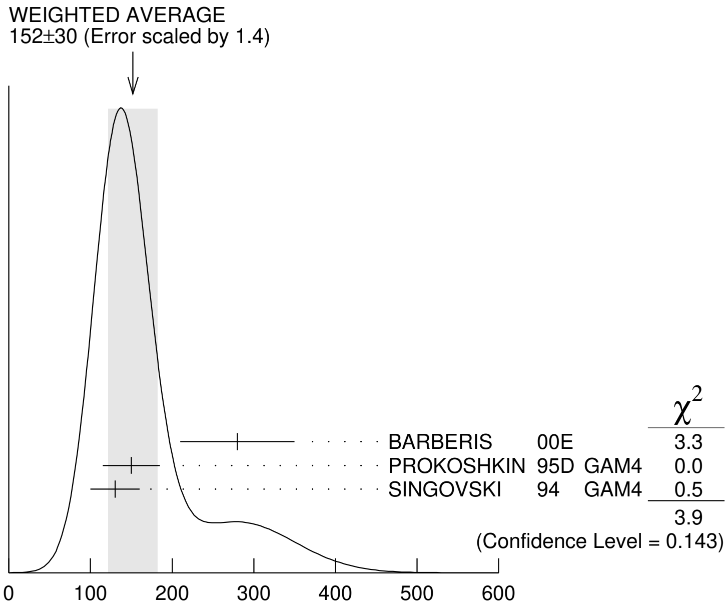



$f_2$(2150) WIDTH, COMBINED MODES (MeV)

### $\eta\eta$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| 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 | [11] ABELE | 99B | CBAR | |
| seen | [12] ANISOVICH | 99B | SPEC | 1.35–1.94 $\overline{p} p \rightarrow \eta\eta\pi^0$ |
| 200±25 | [13] ANISOVICH | 99K | RVUE | 0.6–1.94 $\overline{p} p \rightarrow \eta\eta$, $\eta\eta'$ |
| 203±10 | [14] ARMSTRONG | 93C | E760 | $\overline{p} p \rightarrow \pi^0 \eta\eta \rightarrow 6\gamma$ |

[11] Spin not determined.
[12] $J^{PC} = 0^{++}$
[13] PWA gives $J^{PC} = 0^{++}$.
[14] No $J^{PC}$ determination.




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

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

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | | |
| **250±25±45** | ADOMEIT | 96 | CBAR | 0 | 1.94 $\overline{p} p \rightarrow \eta 3\pi^0$ |

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

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **250 OUR ESTIMATE** | | | | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $\sim 226$ | HASAN | 94 | RVUE | $\overline{p}p \rightarrow \pi\pi$ |
| $\sim 70$ | [15] OAKDEN | 94 | RVUE | 0.36–1.55 $\overline{p}p \rightarrow \pi\pi$ |
| $\sim 250$ | [16] MARTIN | 80B | RVUE | |
| $\sim 250$ | [16] MARTIN | 80C | RVUE | |
| $\sim 250$ | [17] DULUDE | 78B | OSPK | 1–2 $\overline{p}p \rightarrow \pi^0\pi^0$ |

[15] See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
[16] $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\overline{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.
[17] $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.

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

| VALUE (MeV) | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $56^{+31}_{-16}$ | [18] EVANGELISTA | 97 | SPEC | | 0.6-2.4 $\overline{p}p \rightarrow K^0_S K^0_S$ |
| $135\pm75$ | [19,20] COUPLAND | 77 | CNTR | 0 | 0.7–2.4 $\overline{p}p \rightarrow \overline{p}p$ |
| $98\pm 8$ | [20] ALSPECTOR | 73 | CNTR | | $\overline{p}p$ S channel |

[18] Isospin 0 and 2 not separated.
[19] From a fit to the total elastic cross section.
[20] Isospins 0 and 1 not separated.

### $K\overline{K}$ MODE

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **$270\pm50$** | BARBERIS | 99 | OMEG | 450 $pp \rightarrow p_s p_f K^+ K^-$ |

## $f_2(2150)$ DECAY MODES

| | Mode |
|---|---|
| $\Gamma_1$ | $\pi\pi$ |
| $\Gamma_2$ | $\eta\eta$ |
| $\Gamma_3$ | $K\overline{K}$ |
| $\Gamma_4$ | $f_2(1270)\eta$ |
| $\Gamma_5$ | $a_2(1320)\pi$ |

## $f_2(2150)$ BRANCHING RATIOS

### $\Gamma(K\overline{K})/\Gamma(\eta\eta)$ — $\Gamma_3/\Gamma_2$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$1.28\pm0.23$** | | 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 | [21] PROKOSHKIN | 95D | GAM4 | 300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp2\eta$ |

[21] 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 | [22] PROKOSHKIN 95D | GAM4 | 300 $\pi^- N \to \pi^- N 2\eta$, 450 $pp \to pp2\eta$ |

[22] 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 |
|---|---|---|---|
| **0.79±0.11** | [23] ADOMEIT 96 | CBAR | 1.94 $\overline{p}p \to \eta 3\pi^0$ |

[23] Using B($a_2(1320) \to \eta\pi$) = 0.145

## $f_2(2150)$ REFERENCES


| | | | | |
|---|---|---|---|---|
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| ABELE | 99B | EPJ C8 67 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| ANISOVICH | 99B | PL B449 154 | A.V. Anisovich *et al.* | |
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| EVANGELISTA | 97 | PR D56 3803 | C. Evangelista *et al.* | (LEAR Collab.) |
| MARTIN | 97 | PR C56 1114 | B.R. Martin, G.C. Oades | (LOUC, AARH) |
| ADOMEIT | 96 | ZPHY C71 227 | J. Adomeit *et al.* | (Crystal Barrel Collab.) |
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| 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 *et al.* | (FNAL, FERR, GENO+) |
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| MARTIN | 80C | NP B169 216 | A.D. Martin, M.R. Pennington | (DURH) JP |
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| COUPLAND | 77 | PL 71B 460 | M. Coupland *et al.* | (LOQM, RHEL) |
| ALSPECTOR | 73 | PRL 30 511 | J. Alspector *et al.* | (RUTG, UPNJ) |


## OTHER RELATED PAPERS


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