# $f_2(1565)$

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

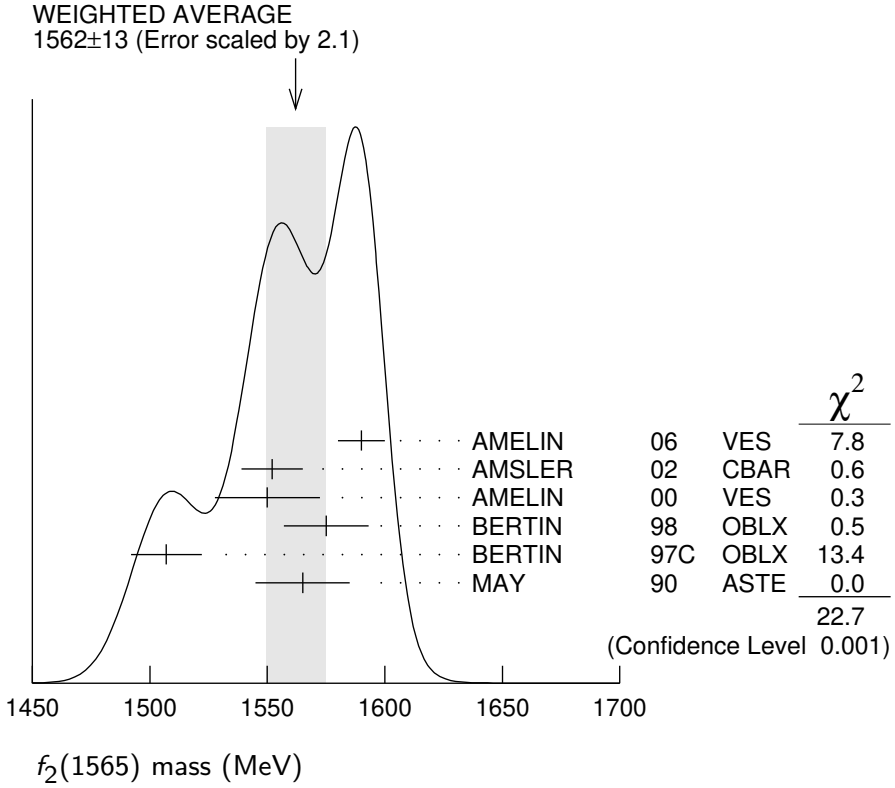
OMITTED FROM SUMMARY TABLE

Seen in antinucleon-nucleon annihilation at rest. Needs confirmation.

## $f_2(1565)$ MASS

| VALUE (MeV) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **1562 ±13 OUR AVERAGE** Error includes scale factor of 2.1. See the ideogram below. | | | | | |
| 1590 ±10 | | [1] AMELIN | 06 | VES | 36 $\pi^- p \to \omega\omega n$ |
| 1552 ±13 | | [2] AMSLER | 02 | CBAR | 0.9 $\overline{p}p \to \pi^0\eta\eta$, $\pi^0\pi^0\pi^0$ |
| 1550 ±10 | ±20 | AMELIN | 00 | VES | 37 $\pi^- p \to \eta\pi^+\pi^- n$ |
| 1575 ±18 | | BERTIN | 98 | OBLX | 0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 1507 ±15 | | [2] BERTIN | 97C | OBLX | 0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$ |
| 1565 ±20 | | MAY | 90 | ASTE | 0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 1544.7 ± 3.0 | | VLADIMIRSKII | 00 | SPEC | 40 $\pi^- p \to K^0_S K^0_S X$ |
| 1598 ±11 | ± 9 | BAKER | 99B | SPEC | 0 $\overline{p}p \to \omega\omega\pi^0$ |
| 1534 ±20 | | [3] ABELE | 96C | RVUE | Compilation |
| ∼ 1552 | | [4] AMSLER | 95D | CBAR | 0.0 $\overline{p}p \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$ |
| 1598 ±72 | | BALOSHIN | 95 | SPEC | 40 $\pi^- C \to K^0_S K^0_S X$ |
| 1566 $^{+80}_{-50}$ | | [5] ANISOVICH | 94 | CBAR | 0.0 $\overline{p}p \to 3\pi^0, \eta\eta\pi^0$ |
| 1502 ± 9 | | ADAMO | 93 | OBLX | $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 1488 ±10 | | [6] ARMSTRONG | 93C | E760 | $\overline{p}p \to \pi^0\eta\eta \to 6\gamma$ |
| 1508 ±10 | | [6] ARMSTRONG | 93D | E760 | $\overline{p}p \to 3\pi^0 \to 6\gamma$ |
| 1525 ±10 | | [6] ARMSTRONG | 93D | E760 | $\overline{p}p \to \eta\pi^0\pi^0 \to 6\gamma$ |
| ∼ 1504 | | [7] WEIDENAUER | 93 | ASTE | 0.0 $\overline{p}N \to 3\pi^- 2\pi^+$ |
| 1540 ±15 | | [6] ADAMO | 92 | OBLX | $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 1515 ±10 | | [8] AKER | 91 | CBAR | 0.0 $\overline{p}p \to 3\pi^0$ |
| 1477 ± 5 | | BRIDGES | 86C | DBC | 0.0 $\overline{p}N \to 3\pi^- 2\pi^+$ |

[1] Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.
[2] T-matrix pole.
[3] T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.
[4] Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[5] From a simultaneous analysis of the annihilations $\overline{p}p \to 3\pi^0, \pi^0\eta\eta$ including AKER 91 data.
[6] $J^P$ not determined, could be partly $f_0(1500)$.
[7] $J^P$ not determined.
[8] Superseded by AMSLER 95B.




## $f_2(1565)$ WIDTH

| VALUE (MeV) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **134 ± 8** | **OUR AVERAGE** | | | | |
| 140 ± 11 | | [9] AMELIN | 06 | VES | 36 $\pi^- p \to \omega\omega n$ |
| 113 ± 23 | | [10] AMSLER | 02 | CBAR | 0.9 $\overline{p}p \to \pi^0\eta\eta$, $\pi^0\pi^0\pi^0$ |
| 130 ± 20 | ±40 | AMELIN | 00 | VES | 37 $\pi^- p \to \eta\pi^+\pi^- n$ |
| 119 ± 24 | | BERTIN | 98 | OBLX | 0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 130 ± 20 | | [10] BERTIN | 97C | OBLX | 0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$ |
| 170 ± 40 | | MAY | 90 | ASTE | 0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 10.3 ± 3.0 | | VLADIMIRSKII | 00 | SPEC | 40 $\pi^- p \to K^0_S K^0_S X$ |
| 180 ± 60 | | [11] ABELE | 96C | RVUE | Compilation |
| ∼ 142 | | [12] AMSLER | 95D | CBAR | 0.0 $\overline{p}p \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$ |
| 263 ±101 | | BALOSHIN | 95 | SPEC | 40 $\pi^- C \to K^0_S K^0_S X$ |
| 166 $^{+80}_{-20}$ | | [13] ANISOVICH | 94 | CBAR | 0.0 $\overline{p}p \to 3\pi^0, \eta\eta\pi^0$ |
| 130 ± 10 | | [14] ADAMO | 93 | OBLX | $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 148 ± 27 | | [15] ARMSTRONG | 93C | E760 | $\overline{p}p \to \pi^0\eta\eta \to 6\gamma$ |
| 103 ± 15 | | [15] ARMSTRONG | 93D | E760 | $\overline{p}p \to 3\pi^0 \to 6\gamma$ |
| 111 ± 10 | | [15] ARMSTRONG | 93D | E760 | $\overline{p}p \to \eta\pi^0\pi^0 \to 6\gamma$ |
| ∼ 206 | | [16] WEIDENAUER | 93 | ASTE | 0.0 $\overline{p}N \to 3\pi^- 2\pi^+$ |
| 132 ± 37 | | [15] ADAMO | 92 | OBLX | $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 120 ± 10 | | [17] AKER | 91 | CBAR | 0.0 $\overline{p}p \to 3\pi^0$ |
| 116 ± 9 | | BRIDGES | 86C | DBC | 0.0 $\overline{p}N \to 3\pi^- 2\pi^+$ |

[9] Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.
[10] T-matrix pole.
[11] T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.
[12] Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[13] From a simultaneous analysis of the annihilations $\overline{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$ including AKER 91 data.
[14] Supersedes ADAMO 92.
[15] $J^P$ not determined, could be partly $f_0(1500)$.
[16] $J^P$ not determined.
[17] Superseded by AMSLER 95B.

## $f_2(1565)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $\pi\pi$ | seen |
| $\Gamma_2$ | $\pi^+\pi^-$ | seen |
| $\Gamma_3$ | $\pi^0\pi^0$ | seen |
| $\Gamma_4$ | $\rho^0\rho^0$ | seen |
| $\Gamma_5$ | $2\pi^+2\pi^-$ | seen |
| $\Gamma_6$ | $\eta\eta$ | seen |
| $\Gamma_7$ | $a_2(1320)\pi$ | |
| $\Gamma_8$ | $\omega\omega$ | seen |
| $\Gamma_9$ | $K\overline{K}$ | |
| $\Gamma_{10}$ | $\gamma\gamma$ | |

## $f_2(1565)$ PARTIAL WIDTHS

### $\Gamma(\eta\eta)$ — $\Gamma_6$

| VALUE (MeV) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $1.2\pm0.3$ | 870 | [18] SCHEGELSKY 06A | RVUE | $\gamma\gamma \rightarrow K^0_S K^0_S$ |

### $\Gamma(K\overline{K})$ — $\Gamma_9$

| VALUE (MeV) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $2.0\pm1.0$ | 870 | [18] SCHEGELSKY 06A | RVUE | $\gamma\gamma \rightarrow K^0_S K^0_S$ |

### $\Gamma(\gamma\gamma)$ — $\Gamma_{10}$

| VALUE (keV) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $0.70\pm0.14$ | 870 | [18] SCHEGELSKY 06A | RVUE | $\gamma\gamma \rightarrow K^0_S K^0_S$ |

[18] From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

# $f_2(1565)$ BRANCHING RATIOS

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

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | BAKER | 99B | SPEC | $0\ \overline{p}p \rightarrow \omega\omega\pi^0$ |

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

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | BERTIN | 98 | OBLX | 0.05–0.405 $\overline{n}p \rightarrow \pi^+\pi^+\pi^-$ |
| not seen | [19] ANISOVICH | 94B | RVUE | $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$ |
| seen | MAY | 89 | ASTE | $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$ |

[19] ANISOVICH 94B is from a reanalysis of MAY 90.

## $\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — $\Gamma_3/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| seen | AMSLER | 95B | CBAR | $0.0\ \overline{p}p \rightarrow 3\pi^0$ |

## $\Gamma(\pi^+\pi^-)/\Gamma(\rho^0\rho^0)$ — $\Gamma_2/\Gamma_4$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $0.042\pm0.013$ | BRIDGES | 86B | DBC | $\overline{p}N \rightarrow 3\pi^-2\pi^+$ |

## $\Gamma(\eta\eta)/\Gamma(\pi^0\pi^0)$ — $\Gamma_6/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $0.024\pm0.005\pm0.012$ | [20] ARMSTRONG | 93C | E760 | $\overline{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$ |

[20] $J^P$ not determined, could be partly $f_0(1500)$.

## $\Gamma(\omega\omega)/\Gamma_{total}$ — $\Gamma_8/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | BAKER | 99B | SPEC | $0\ \overline{p}p \rightarrow \omega\omega\pi^0$ |

# $f_2(1565)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| AMELIN | 06 | PAN 69 690 | D.V. Amelin et al. | (VES Collab.) |
| | | Translated from YAF 69 715. | | |
| SCHEGELSKY | 06A | EPJ A27 207 | V.A. Schegelsky et al. | |
| AMSLER | 02 | EPJ C23 29 | C. Amsler et al. | |
| AMELIN | 00 | NP A668 83 | D. Amelin et al. | (VES Collab.) |
| VLADIMIRSKII | 00 | JETPL 26 486 | V.V. Vladimirskii et al. | |
| | | Translated from ZETFP 72 698. | | |
| BAKER | 99B | PL B467 147 | C.A. Baker et al. | |
| BERTIN | 98 | PR D57 55 | A. Bertin et al. | (OBELIX Collab.) |
| BERTIN | 97C | PL B408 476 | A. Bertin et al. | (OBELIX Collab.) |
| ABELE | 96C | NP A609 562 | A. Abele et al. | (Crystal Barrel Collab.) |
| AMSLER | 95B | PL B342 433 | C. Amsler et al. | (Crystal Barrel Collab.) |
| AMSLER | 95C | PL B353 571 | C. Amsler et al. | (Crystal Barrel Collab.) |
| AMSLER | 95D | PL B355 425 | C. Amsler et al. | (Crystal Barrel Collab.) |
| BALOSHIN | 95 | PAN 58 46 | O.N. Baloshin et al. | (ITEP) |
| | | Translated from YAF 58 50. | | |

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|---|---|---|---|---|
| AMSLER | 94D | PL B333 277 | C. Amsler *et al.* | (Crystal Barrel Collab.) |
| ANISOVICH | 94 | PL B323 233 | V.V. Anisovich *et al.* | (Crystal Barrel Collab.) |
| ANISOVICH | 94B | PR D50 1972 | V.V. Anisovich *et al.* | (LOQM) |
| ADAMO | 93 | NP A558 13C | A. Adamo *et al.* | (OBELIX Collab.) |
| ARMSTRONG | 93C | PL B307 394 | T.A. Armstrong *et al.* | (FNAL, FERR, GENO+) |
| ARMSTRONG | 93D | PL B307 399 | T.A. Armstrong *et al.* | (FNAL, FERR, GENO+) |
| WEIDENAUER | 93 | ZPHY C59 387 | P. Weidenauer *et al.* | (ASTERIX Collab.) |
| ADAMO | 92 | PL B287 368 | A. Adamo *et al.* | (OBELIX Collab.) |
| BELADIDZE | 92B | ZPHY C54 367 | G.M. Beladidze *et al.* | (VES Collab.) |
| AKER | 91 | PL B260 249 | E. Aker *et al.* | (Crystal Barrel Collab.) |
| MAY | 90 | ZPHY C46 203 | B. May *et al.* | (ASTERIX Collab.) |
| MAY | 89 | PL B225 450 | B. May *et al.* | (ASTERIX Collab.) IJP |
| BRIDGES | 86B | PRL 56 215 | D.L. Bridges *et al.* | (SYRA, CASE) |
| BRIDGES | 86C | PRL 57 1534 | D.L. Bridges *et al.* | (SYRA) |


## OTHER RELATED PAPERS


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|---|---|---|---|
| ANISOVICH | 05 | JETPL 80 715<br>Translated from ZETFP 80 845. | V.V. Anisovich |