# $f_0(2020)$

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

Needs confirmation.

## $f_0(2020)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma \approx 2\ \mathrm{Im}(\sqrt{s})$.

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **(1870–2080) − *i* (120–240) OUR ESTIMATE** | | | | |
| $(2038 \pm 48) - i\ (156 \pm 41)$ | [1] RODAS | 22 | RVUE | $J/\psi(1S) \to \gamma\ (\pi\pi,\ K\overline{K})$ |
| $(1925 \pm 25) - i\ (160 \pm 18)$ | SARANTSEV | 21 | RVUE | $J/\psi(1S) \to \gamma\ (\pi\pi,\ K\overline{K},\ \eta\eta,\ \omega\phi)$ |
| $(1910 \pm 50) - i\ (199 \pm 40)$ | [2] ROPERTZ | 18 | RVUE | $\overline{B}{}^0_s \to J/\psi(\pi^+\pi^-/K^+K^-)$ |
| $(1992 \pm 16) - i\ (221 \pm 30)$ | [3] BARBERIS | 00C | | 450 $pp \to p_f 4\pi p_s$ |
| $(2020 \pm 35) - i(205 \pm 25)$ | BARBERIS | 97B | OMEG | 450 $pp \to pp2(\pi^+\pi^-)$ |

[1] T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \to \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \to \gamma K^0_S K^0_S$ (ABLIKIM 18AA).

[2] T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.

[3] Average between $\pi^+\pi^- 2\pi^0$ and $2(\pi^+\pi^-)$.

## $f_0(2020)$ MASS

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| **$1982 \pm 3^{+54}_{-0}$** | | [1] ABLIKIM | 22C | BES3 | $J/\psi \to \gamma\eta'\eta' \to 4/5\gamma 2(\pi^+\pi^-)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $2010 \pm 6^{+6}_{-4}$ | | [2] ABLIKIM | 22AS | BES3 | $J/\psi(1S) \to \gamma\eta\eta'$ |
| $2037 \pm 8$ | 80k | [3] UMAN | 06 | E835 | $5.2\ \overline{p}p \to \eta\eta\pi^0$ |
| $2040 \pm 38$ | | ANISOVICH | 00J | SPEC | |
| $2010 \pm 60$ | | ALDE | 98 | GAM4 | 100 $\pi^- p \to \pi^0\pi^0 n$ |

[1] From a partial wave analysis of the systems $(\gamma X)$, with $X \to \eta'\eta'$, and $(\eta' X)$, with $X \to \gamma\eta'$ in the decay $J/\psi \to \gamma\eta'\eta'$. The intermediate resonance $X$ is parametrized by a constant-width, relativistic Breit-Wigner.

[2] From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \to \eta\eta'$ $P$-wave.

[3] Statistical error only.

## $f_0(2020)$ WIDTH

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| **$436 \pm 4^{+46}_{-49}$** | | [1] ABLIKIM | 22C | BES3 | $J/\psi \to \gamma\eta'\eta' \to 4/5\gamma 2(\pi^+\pi^-)$ |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $203 \pm 9^{+13}_{-11}$ | | [2] ABLIKIM | 22AS | BES3 | $J/\psi(1S) \to \gamma\eta\eta'$ | |
| $296 \pm 17$ | 80k | [3] UMAN | 06 | E835 | $5.2\ \overline{p}p \to \eta\eta\pi^0$ | |
| $405 \pm 40$ | | ANISOVICH | 00J | SPEC | | |
| $240 \pm 100$ | | ALDE | 98 | GAM4 | $100\ \pi^- p \to \pi^0\pi^0 n$ | |

[1] From a partial wave analysis of the systems $(\gamma X)$, with $X \to \eta'\eta'$, and $(\eta' X)$, with $X \to \gamma\eta'$ in the decay $J/\psi \to \gamma\eta'\eta'$. The intermediate resonance $X$ is parametrized by a constant-width, relativistic Breit-Wigner.

[2] From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \to \eta\eta'$ $P$-wave.

[3] Statistical error only.

## $f_0(2020)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $\rho\pi\pi$ | seen |
| $\Gamma_2$ | $\pi^0\pi^0$ | seen |
| $\Gamma_3$ | $\rho\rho$ | seen |
| $\Gamma_4$ | $\omega\omega$ | seen |
| $\Gamma_5$ | $\eta\eta$ | seen |
| $\Gamma_6$ | $\eta'\eta'$ | seen |

## $f_0(2020)$ BRANCHING RATIOS

### $\Gamma(\rho\rho)/\Gamma(\omega\omega)$ $\Gamma_3/\Gamma_4$

| VALUE | DOCUMENT ID | | COMMENT |
|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| $\sim 3$ | BARBERIS | 00F | $450\ pp \to p_f\omega\omega p_s$ |

### $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | UMAN | 06 | E835 | $5.2\ \overline{p}p \to \eta\eta\pi^0$ |

### $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | [1] ABLIKIM | 22C | BES3 | $J/\psi \to \gamma\eta'\eta' \to 4/5\gamma 2(\pi^+\pi^-)$ |

[1] From a partial wave analysis of the systems $(\gamma X)$, with $X \to \eta'\eta'$, and $(\eta' X)$, with $X \to \gamma\eta'$ in the decay $J/\psi \to \gamma\eta'\eta'$. The intermediate resonance $X$ is parametrized by a constant-width, relativistic Breit-Wigner.

## $f_0(2020)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| ABLIKIM | 22AS | PR D106 072012 | M. Ablikim *et al.* | (BESIII Collab.) |
| Also | | PR D107 079901 (errat.) | M. Ablikim *et al.* | (BESIII Collab.) |
| ABLIKIM | 22C | PR D105 072002 | M. Ablikim *et al.* | (BESIII Collab.) |
| RODAS | 22 | EPJ C82 80 | A. Rodas *et al.* | (JPAC Collab.) |
| SARANTSEV | 21 | PL B816 136227 | A.V. Sarantsev *et al.* | (BONN, PNPI) |
| ABLIKIM | 18AA | PR D98 072003 | M. Ablikim *et al.* | (BESIII Collab.) |
| ROPERTZ | 18 | EPJ C78 1000 | S. Ropertz, C. Hanhart, B. Kubis | (BONN, JULI) |

| | | | | |
|---|---|---|---|---|
| AAIJ | 17V | JHEP 1708 037 | R. Aaij *et al.* | (LHCb Collab.) |
| ABLIKIM | 15AE | PR D92 052003 | M. Ablikim *et al.* | (BESIII Collab.) |
| AAIJ | 14BR | PR D89 092006 | R. Aaij *et al.* | (LHCb Collab.) |
| UMAN | 06 | PR D73 052009 | I. Uman *et al.* | (FNAL E835) |
| ANISOVICH | 00J | PL B491 47 | A.V. Anisovich *et al.* | (RAL, LOQM, PNPI+) |
| BARBERIS | 00C | PL B471 440 | D. Barberis *et al.* | (WA 102 Collab.) |
| BARBERIS | 00F | PL B484 198 | D. Barberis *et al.* | (WA 102 Collab.) |
| ALDE | 98 | EPJ A3 361 | D. Alde *et al.* | (GAM4 Collab.) |
| Also | | PAN 62 405 | D. Alde *et al.* | (GAMS Collab.) |
| | | Translated from YAF 62 446. | | |
| BARBERIS | 97B | PL B413 217 | D. Barberis *et al.* | (WA 102 Collab.) |