

$\rho(2150)$

$$I^G(J^{PC}) = 1^+(1^-)$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See our mini-review under the $\rho(1700)$. **$\rho(2150)$ MASS** **e^+e^- PRODUCED**

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|--------------------|-----------|--|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 2254 ± 22 | ¹ LEES | 12G BABR | $e^+e^- \rightarrow \pi^+\pi^-\gamma$ |
| $2150 \pm 40 \pm 50$ | AUBERT | 07AU BABR | $10.6 e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$ |
| 1990 ± 80 | AUBERT | 07AU BABR | $10.6 e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$ |
| 2153 ± 37 | BIAGINI | 91 RVUE | $e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$ |
| 2110 ± 50 | ² CLEGG | 90 RVUE | $e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$ |

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

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|---------------------|----------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| ~ 2191 | HASAN | 94 RVUE | $\bar{p}p \rightarrow \pi\pi$ |
| ~ 2070 | ³ OAKDEN | 94 RVUE | $0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$ |
| ~ 2170 | ⁴ MARTIN | 80B RVUE | |
| ~ 2100 | ⁴ MARTIN | 80C RVUE | |

S-CHANNEL $\bar{N}N$

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|--------------------------|----------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 2110 ± 35 | ⁵ ANISOVICH | 02 SPEC | $0.6\text{--}1.9 p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$ |
| ~ 2190 | ⁶ CUTTS | 78B CNTR | $0.97\text{--}3 \bar{p}p \rightarrow \bar{N}N$ |
| 2155 ± 15 | ^{6,7} COUPLAND | 77 CNTR | $0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$ |
| 2193 ± 2 | ^{6,8} ALSPECTOR | 73 CNTR | $\bar{p}p$ S channel |
| 2190 ± 10 | ⁹ ABRAMS | 70 CNTR | S channel $\bar{p}N$ |

 $\pi^-p \rightarrow \omega\pi^0n$

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|-------------|----------|---------------------------------------|
| 2155 ± 21 OUR AVERAGE | | | |
| 2140 ± 30 | ALDE | 95 GAM2 | 38 $\pi^-p \rightarrow \omega\pi^0n$ |
| 2170 ± 30 | ALDE | 92C GAM4 | 100 $\pi^-p \rightarrow \omega\pi^0n$ |

¹ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.² Includes ATKINSON 85.³ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.⁴ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.⁶ Isospins 0 and 1 not separated.⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ Seen as bump in $l = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

$\rho(2150)$ WIDTH

e^+e^- PRODUCED

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|---------------------|-----------|--|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 109 ± 76 | ¹⁰ LEES | 12G BABR | $e^+e^- \rightarrow \pi^+\pi^-\gamma$ |
| $350 \pm 40 \pm 50$ | AUBERT | 07AU BABR | $10.6 e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$ |
| 310 ± 140 | AUBERT | 07AU BABR | $10.6 e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$ |
| 389 ± 79 | BIAGINI | 91 RVUE | $e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$ |
| 410 ± 100 | ¹¹ CLEGG | 90 RVUE | $e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$ |

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

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|----------------------|----------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| ~ 296 | HASAN | 94 RVUE | $\bar{p}p \rightarrow \pi\pi$ |
| ~ 40 | ¹² OAKDEN | 94 RVUE | $0.36-1.55 \bar{p}p \rightarrow \pi\pi$ |
| ~ 250 | ¹³ MARTIN | 80B RVUE | |
| ~ 200 | ¹³ MARTIN | 80C RVUE | |

S-CHANNEL $\bar{N}N$

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|---------------------------|---------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 230 ± 50 | ¹⁴ ANISOVICH | 02 SPEC | $0.6-1.9 p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$ |
| 135 ± 75 | ^{15,16} COUPLAND | 77 CNTR | $0.7-2.4 \bar{p}p \rightarrow \bar{p}p$ |
| 98 ± 8 | ¹⁶ ALSPECTOR | 73 CNTR | $\bar{p}p$ S channel |
| ~ 85 | ¹⁷ ABRAMS | 70 CNTR | S channel $\bar{p}N$ |

$\pi^-p \rightarrow \omega\pi^0n$

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|--------------------------------|-------------|---------|--------------------------------------|
| 320 ± 70 | ALDE | 95 GAM2 | $38 \pi^-p \rightarrow \omega\pi^0n$ |

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

~ 300 ALDE 92C GAM4 $100 \pi^-p \rightarrow \omega\pi^0n$

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

¹¹ Includes ATKINSON 85.

¹² See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹³ $J(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁵ From a fit to the total elastic cross section.

¹⁶ Isospins 0 and 1 not separated.

¹⁷ Seen as bump in $l = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

$\rho(2150)$ DECAY MODES

| Mode | Fraction (Γ_i/Γ) |
|------------------------------------|--------------------------------|
| Γ_1 $e^+ e^-$ | |
| Γ_2 $\pi^+ \pi^-$ | seen |
| Γ_3 $K^+ K^-$ | seen |
| Γ_4 $3(\pi^+ \pi^-)$ | seen |
| Γ_5 $2(\pi^+ \pi^- \pi^0)$ | seen |
| Γ_6 $\eta' \pi^+ \pi^-$ | seen |
| Γ_7 $f_1(1285) \pi^+ \pi^-$ | seen |
| Γ_8 $\omega \pi^0$ | seen |
| Γ_9 $\omega \pi^0 \eta$ | seen |
| Γ_{10} $\rho \bar{\rho}$ | |

$\rho(2150) \Gamma(i)\Gamma(e^+ e^-)/\Gamma^2(\text{total})$

$$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \qquad \Gamma_7/\Gamma \times \Gamma_1/\Gamma$$

| VALUE (units 10^{-7}) | DOCUMENT ID | TECN | COMMENT |
|---|----------------------|-----------|---|
| $3.1 \pm 0.6 \pm 0.5$ | ¹⁸ AUBERT | 07AU BABR | $10.6 e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$ |

¹⁸ Calculated by us from the reported value of cross section at the peak.

$$\Gamma(\eta' \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \qquad \Gamma_6/\Gamma \times \Gamma_1/\Gamma$$

| VALUE (units 10^{-8}) | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-------------|------|---------|
|--------------------------|-------------|------|---------|

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

| | | | |
|---------------|----------------------|-----------|---|
| 4.9 ± 1.9 | ¹⁹ AUBERT | 07AU BABR | $10.6 e^+ e^- \rightarrow \eta' \pi^+ \pi^- \gamma$ |
|---------------|----------------------|-----------|---|

¹⁹ Calculated by us from the reported value of cross section at the peak.

$\rho(2150)$ REFERENCES

| | | | |
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