

$\rho(2150)$

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

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

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

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

$\rho(2150)$ REFERENCES

LEES	12G PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUBERT	07AU PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
ANISOVICH	02 PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J PL B491 47	A.V. Anisovich <i>et al.</i>	
KLOET	96 PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ALDE	95 ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94 PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN	94 NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ALDE	92C ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
BIAGINI	91 NC 104A 363	M.E. Biagini <i>et al.</i>	(FRAS, PRAG)
CLEGG	90 ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ATKINSON	85 ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
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)
COUPLAND	77 PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
PEASLEE	75 PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)
ALSPECTOR	73 PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70 PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
COOPER	68 PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)
GOUNARIS	68 PRL 21 244	G.J. Gounaris, J.J. Sakurai	