$\rho(2150)$

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

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	$e^+e^- \to \pi^+\pi^-\gamma$
$2150\pm40\pm50$	AUBERT	07AU	BABR	10.6 $e^+e^- \to f_1(1285)\pi^+\pi^-\gamma$
1990 ± 80	AUBERT	07AU	BABR	10.6 $e^+e^- \to \eta'\pi^+\pi^-\gamma$
2153 ± 37	BIAGINI	91	RVUE	$e^+e^- \to \pi^+\pi^-$, K^+K^-
2110 ± 50	[2] CLEGG	90	RVUE	$e^+e^- \to 3(\pi^+\pi^-)$, $2(\pi^+\pi^-\pi^0)$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2191	HASAN	94	RVUE	$\overline{p}p \to \pi\pi$
~ 2070	[3] OAKDEN	94	RVUE	0.36–1.55 $\overline{p}p \to \pi\pi$
~ 2170	[4] MARTIN	80B	RVUE	
~ 2100	[4] MARTIN	80C	RVUE	

S-CHANNEL $\overline{N}N$

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

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

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

[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 $p\overline{p} \to \pi^-\pi^+$ 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 $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\overline{p}p$ 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	$e^+e^- \to \pi^+\pi^-\gamma$
350± 40±50	AUBERT	07AU	BABR	10.6 $e^+e^- \to f_1(1285)\pi^+\pi^-\gamma$
310±140	AUBERT	07AU	BABR	10.6 $e^+e^- \to \eta'\pi^+\pi^-\gamma$
389± 79	BIAGINI	91	RVUE	$e^+e^- \to \pi^+\pi^-$, K^+K^-
410±100	[11] CLEGG	90	RVUE	$e^+e^- \to 3(\pi^+\pi^-)$, $2(\pi^+\pi^-\pi^0)$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
∼ 296	HASAN	94	RVUE	$\overline{p}p \to \pi\pi$
∼ 40	[12] OAKDEN	94	RVUE	0.36–1.55 $\overline{p}p \to \pi\pi$
∼ 250	[13] MARTIN	80B	RVUE	
∼ 200	[13] MARTIN	80C	RVUE	

S-CHANNEL $\overline{N}N$

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 $p\overline{p} \to \omega\pi^0$, $\omega\eta\pi^0$, $\pi^+\pi^-$
135±75	[15,16] COUPLAND	77	CNTR	0.7–2.4 $\overline{p}p \to \overline{p}p$
98± 8	[16] ALSPECTOR	73	CNTR	$\overline{p}p$ S channel
∼ 85	[17] ABRAMS	70	CNTR	S channel $\overline{p}N$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
320±70	ALDE	95	GAM2	38 $\pi^-p \to \omega\pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
∼ 300	ALDE	92C	GAM4	100 $\pi^-p \to \omega\pi^0 n$

[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] $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\overline{p} \to \pi^-\pi^+$ 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 $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\overline{p}p$ 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}	$p\overline{p}$	

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

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

VALUE (units 10^{-7})	*DOCUMENT ID*		*TECN*	*COMMENT*
3.1±0.6±0.5	[18] AUBERT	07AU	BABR	10.6 $e^+e^- \to f_1(1285)\pi^+\pi^-\gamma$

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

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

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 $e^+e^- \to \eta'\pi^+\pi^-\gamma$

[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 *et al.*	(BABAR Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert *et al.*	(BABAR Collab.)
ANISOVICH	02	PL B542 8	A.V. Anisovich *et al.*	
ANISOVICH	01D	PL B508 6	A.V. Anisovich *et al.*	
ANISOVICH	01E	PL B513 281	A.V. Anisovich *et al.*	
ANISOVICH	00J	PL B491 47	A.V. Anisovich *et al.*	
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ALDE	95	ZPHY C66 379	D.M. Alde *et al.*	(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 *et al.*	(BELG, SERP, KEK, LANL+)
BIAGINI	91	NC 104A 363	M.E. Biagini *et al.*	(FRAS, PRAG)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ATKINSON	85	ZPHY C29 333	M. Atkinson *et al.*	(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 *et al.*	(STON, WISC)
COUPLAND	77	PL 71B 460	M. Coupland *et al.*	(LOQM, RHEL)
PEASLEE	75	PL 57B 189	D.C. Peaslee *et al.*	(CANB, BARI, BROW+)
ALSPECTOR	73	PRL 30 511	J. Alspector *et al.*	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams *et al.*	(BNL)
COOPER	68	PRL 20 1059	W.A. Cooper *et al.*	(ANL)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	