$\rho(1700)$

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

THE $\rho(1450)$ AND THE $\rho(1700)$

Updated March 2002 by S. Eidelman (Novosibirsk) and J.J. Hernández-Rey (IFIC, Valencia).

In our 1988 edition, we replaced the $\rho(1600)$ entry with two new ones, the $\rho(1450)$ and the $\rho(1700)$, because there was emerging evidence that the 1600-MeV region actually contains two ρ-like resonances. ERKAL 86 had pointed out this possibility with a theoretical analysis on the consistency of 2π and 4π electromagnetic form factors and the $\pi\pi$ scattering length. DONNACHIE 87, with a full analysis of data on the 2π and 4π final states in e^+e^- annihilation and photoproduction reactions, had also argued that in order to obtain a consistent picture, two resonances were necessary. The existence of $\rho(1450)$ was supported by the analysis of $\eta\rho^0$ mass spectra obtained in photoproduction and e^+e^- annihilation (DONNACHIE 87B), as well as that of $e^+e^- \to \omega\pi$ (DONNACHIE 91).

The analysis of DONNACHIE 87 was further extended by CLEGG 88,94 to include new data on 4π systems produced in e^+e^- annihilation, and in τ decays (τ decays to 4π and e^+e^- annihilation to 4π can be related by the Conserved Vector Current assumption). These systems were successfully analyzed using interfering contributions from two ρ-like states, and from the tail of the $\rho(770)$ decaying into two-body states. While specific conclusions on $\rho(1450) \to 4\pi$ were obtained, little could be said about the $\rho(1700)$.

An analysis by CLEGG 90 of 6π mass spectra from e^+e^- annihilation and diffractive photoproduction provides evidence for two ρ mesons at about 2.1 and 1.8 GeV that decay strongly into 6π states. While the former is a candidate for a new resonance ($\rho(2150)$), the latter could be a manifestation of the $\rho(1700)$ distorted by threshold effects.

Independent evidence for two 1^- states is provided by KILLIAN 80 in 4π electroproduction at $\langle Q^2 \rangle = 1$ (GeV/c)^2, and by FUKUI 88 in a high-statistics sample of the $\eta\pi\pi$ system in $\pi^- p$ charge exchange.

This scenario with two overlapping resonances is supported by other data. BISELLO 89 measured the pion form factor in the interval 1.35–2.4 GeV and observed a deep minimum around 1.6 GeV. The best fit was obtained with the hypothesis of ρ-like resonances at 1420 and 1770 MeV, with widths of about 250 MeV. ANTONELLI 88 found that the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section is better fitted with two fully interfering Breit-Wigners, with parameters in fair agreement with those of DONNACHIE 87 and BISELLO 89. These results can be considered as a confirmation of the $\rho(1450)$.

Decisive evidence for the $\pi\pi$ decay mode of both $\rho(1450)$ and $\rho(1700)$ came from recent results in $\overline{p}p$ annihilation at rest (ABELE 97). It was shown that these resonances also possess a $K\overline{K}$ decay mode (ABELE 98, BERTIN 98B, ABELE 99D). High statistics studies of the decays $\tau \rightarrow \pi\pi\nu_\tau$ (BARATE 97M, URHEIM 97), and $\tau \rightarrow 4\pi\nu_\tau$ (EDWARDS 00), also require the $\rho(1450)$, but are not sensitive to the $\rho(1700)$, because it is too close to the τ mass.

The structure of these ρ states is not yet completely clear. BARNES 97 and CLOSE 97C claim that $\rho(1450)$ has a mass consistent with radial $2S$, but its decays show characteristics of hybrids, and suggest that this state may be a $2S$-hybrid mixture. DONNACHIE 99 argues that hybrid states could have a 4π decay mode dominated by the $a_1\pi$. Such behavior has recently been observed by AKHMETSHIN 99E in $e^+e^- \rightarrow 4\pi$ in the energy range 1.05–1.38 GeV, and by EDWARDS 00 in $\tau \rightarrow 4\pi$

decays. More data should be collected to clarify the nature of the ρ states, particularly in the energy range above 1.6 GeV.

We also list the $\phi\pi$ state with $J^{PC} = 1^{--}$ or $C(1480)$ observed by BITYUKOV 87 under the $\rho(1450)$. While ACHASOV 96B shows that it may be a threshold effect, CLEGG 88 and LANDSBERG 92 suggest two independent vector states with this decay mode. Note, however, that $C(1480)$ in its $\phi\pi$ decay mode was not confirmed by e^+e^- (DOLINSKY 91, BISELLO 91C) and $\overline{p}p$ (ABELE 97H) experiments.

Several observations on the $\omega\pi$ system in the 1200-MeV region (FRENKIEL 72, COSME 76, BARBER 80C, ASTON 80C, ATKINSON 84C, BRAU 88, AMSLER 93B) may be interpreted in terms of either $J^P = 1^-$ $\rho(770) \to \omega\pi$ production (LAYSSAC 71), or $J^P = 1^+$ $b_1(1235)$ production (BRAU 88, AMSLER 93B). We argue that no special entry for a $\rho(1250)$ is needed. The LASS amplitude analysis (ASTON 91B) showing evidence for $\rho(1270)$ is preliminary and needs confirmation. For completeness, the relevant observations are listed under the $\rho(1450)$.

References

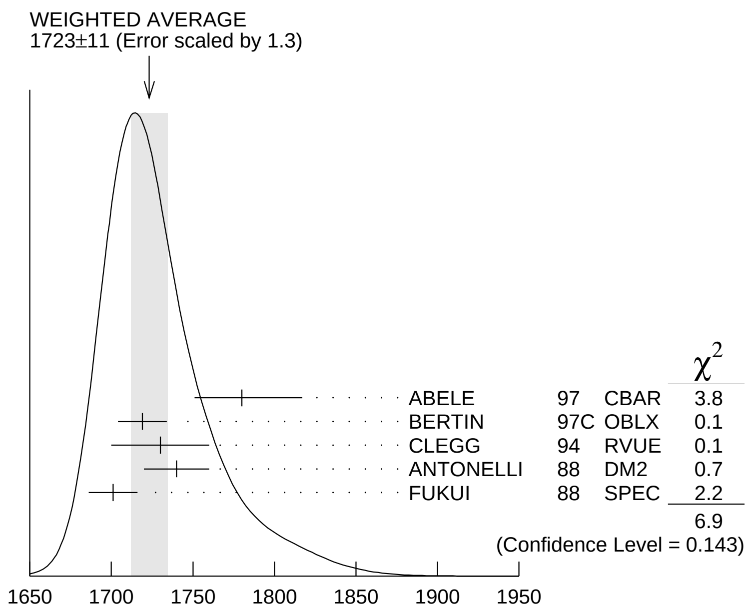
References may be found at the end of the $\rho(1770)$ Listing.

$\rho(1700)$ MASS

$\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)	*DOCUMENT ID*
1700±20 OUR ESTIMATE	

1723±11 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.3. See the ideogram below.



$\rho(1700)$ mass, $\eta\rho^0$ and $\pi^+\pi^-$ modes (MeV)

$\eta\rho^0$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
1740±20	ANTONELLI	88	DM2	$e^+e^- \to \eta\pi^+\pi^-$
1701±15	[2] FUKUI	88	SPEC	8.95 $\pi^- p \to \eta\pi^+\pi^- n$

$\pi\pi$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
$1780\ ^{+37}_{-29}$	[3] ABELE	97	CBAR	$\overline{p}n \to \pi^-\pi^0\pi^0$
1719 ±15	[3] BERTIN	97C	OBLX	0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$
1730 ±30	CLEGG	94	RVUE	$e^+e^- \to \pi^+\pi^-$

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

1768 ±21	BISELLO	89	DM2	$e^+e^- \to \pi^+\pi^-$
1745.7±91.9	DUBNICKA	89	RVUE	$e^+e^- \to \pi^+\pi^-$
1546 ±26	GESHKEN...	89	RVUE	
1650	[4] ERKAL	85	RVUE	20–70 $\gamma p \to \gamma\pi$
1550 ±70	ABE	84B	HYBR	20 $\gamma p \to \pi^+\pi^- p$
1590 ±20	[5] ASTON	80	OMEG	20–70 $\gamma p \to p 2\pi$
1600 ±10	[6] ATIYA	79B	SPEC	50 γC $\to$ C2π
1598 $^{+24}_{-22}$	BECKER	79	ASPK	17 $\pi^- p$ polarized
1659 ±25	[4] LANG	79	RVUE	
1575	[4] MARTIN	78C	RVUE	17 $\pi^- p \to \pi^+\pi^- n$
1610 ±30	[4] FROGGATT	77	RVUE	17 $\pi^- p \to \pi^+\pi^- n$
1590 ±20	[7] HYAMS	73	ASPK	17 $\pi^- p \to \pi^+\pi^- n$

$\pi\omega$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1550 to 1620	[8] ACHASOV	00I	SND	$e^+e^- \to \pi^0\pi^0\gamma$
1580 to 1710	[9] ACHASOV	00I	SND	$e^+e^- \to \pi^0\pi^0\gamma$
1710±90	ACHASOV	97	RVUE	$e^+e^- \to \omega\pi^0$

$K\overline{K}$ MODE

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1740.8±22.2	27k	[1] ABELE	99D	CBAR	±	0.0 $\overline{p}p \to K^+K^-\pi^0$
1582 ±36	1600	CLELAND	82B	SPEC	±	50 $\pi p \to K^0_S K^\pm p$

[1] K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

$2(\pi^+\pi^-)$ MODE

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1851^{+27}_{-24}		ACHASOV	97	RVUE	$e^+e^- \to 2(\pi^+\pi^-)$
1570± 20		[10] CORDIER	82	DM1	$e^+e^- \to 2(\pi^+\pi^-)$
1520± 30		[5] ASTON	81E	OMEG	20–70 $\gamma p \to p 4\pi$
1654± 25		[11] DIBIANCA	81	DBC	$\pi^+ d \to pp 2(\pi^+\pi^-)$
1666± 39		[10] BACCI	80	FRAG	$e^+e^- \to 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^- p \to 2(\pi^+\pi^-)$
1500		[12] ATIYA	79B	SPEC	50 γC $\to$ C$4\pi^\pm$
1570± 60	65	[13] ALEXANDER	75	HBC	7.5 $\gamma p \to p 4\pi$
1550± 60		[5] CONVERSI	74	OSPK	$e^+e^- \to 2(\pi^+\pi^-)$
1550± 50	160	SCHACHT	74	STRC	5.5–9 $\gamma p \to p 4\pi$
1450±100	340	SCHACHT	74	STRC	9–18 $\gamma p \to p 4\pi$
1430± 50	400	BINGHAM	72B	HBC	9.3 $\gamma p \to p 4\pi$

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1660±30	ATKINSON	85B	OMEG	20–70 γp

3($\pi^+\pi^-$) AND 2($\pi^+\pi^-\pi^0$) MODES

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1783±15	CLEGG	90	RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

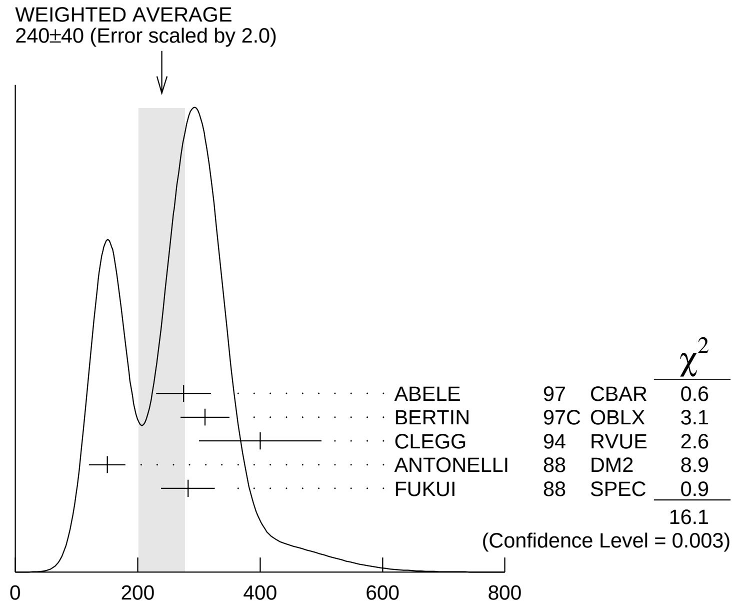
[2] Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.
[3] T-matrix pole.
[4] From phase shift analysis of HYAMS 73 data.
[5] Simple relativistic Breit-Wigner fit with constant width.
[6] An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
[7] Included in BECKER 79 analysis.
[8] Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.
[9] Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.
[10] Simple relativistic Breit-Wigner fit with model dependent width.
[11] One peak fit result.
[12] Parameters roughly estimated, not from a fit.
[13] Skew mass distribution compensated by Ross-Stodolsky factor.

$\rho(1700)$ WIDTH

$\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)	*DOCUMENT ID*
240±60 OUR ESTIMATE	

240±40 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 2.0. See the ideogram below.



$\rho(1700)$ width, $\eta\rho^0$ and $\pi^+\pi^-$ modes (MeV)

$\eta\rho^0$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
150±30	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282±44	[15] FUKUI	88	SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$\pi\pi$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
275 ± 45	[16] ABELE	97	CBAR	$\overline{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40	[16] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
400 ±100	CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

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

224 ± 22	BISELLO	89	DM2	$e^+e^- \to \pi^+\pi^-$
242.5±163.0	DUBNICKA	89	RVUE	$e^+e^- \to \pi^+\pi^-$
620 ± 60	GESHKEN...	89	RVUE	
<315	[17] ERKAL	85	RVUE	20–70 $\gamma p \to \gamma\pi$
280^{+30}_{-80}	ABE	84B	HYBR	20 $\gamma p \to \pi^+\pi^- p$
230 ± 80	[18] ASTON	80	OMEG	20–70 $\gamma p \to p2\pi$
283 ± 14	[19] ATIYA	79B	SPEC	50 γC $\to$ C2π
175^{+98}_{-53}	BECKER	79	ASPK	17 $\pi^- p$ polarized
232 ± 34	[17] LANG	79	RVUE	
340	[17] MARTIN	78C	RVUE	17 $\pi^- p \to \pi^+\pi^- n$
300 ±100	[17] FROGGATT	77	RVUE	17 $\pi^- p \to \pi^+\pi^- n$
180 ± 50	[20] HYAMS	73	ASPK	17 $\pi^- p \to \pi^+\pi^- n$

$K\overline{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
187.2± 26.7	27k	[14] ABELE	99D	CBAR	±	0.0 $\overline{p}p \to K^+K^-\pi^0$
265 ±120	1600	CLELAND	82B	SPEC	±	50 $\pi p \to K^0_S K^\pm p$

[14] K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

$2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
510± 40		[21] CORDIER	82	DM1	$e^+e^- \to 2(\pi^+\pi^-)$
400± 50		[18] ASTON	81E	OMEG	20–70 $\gamma p \to p4\pi$
400±146		[22] DIBIANCA	81	DBC	$\pi^+ d \to pp2(\pi^+\pi^-)$
700±160		[21] BACCI	80	FRAG	$e^+e^- \to 2(\pi^+\pi^-)$
100	34	KILLIAN	80	SPEC	11 $e^- p \to 2(\pi^+\pi^-)$
600		[23] ATIYA	79B	SPEC	50 γC $\to$ C$4\pi^\pm$
340±160	65	[24] ALEXANDER	75	HBC	7.5 $\gamma p \to p4\pi$
360±100		[18] CONVERSI	74	OSPK	$e^+e^- \to 2(\pi^+\pi^-)$
400±120	160	[25] SCHACHT	74	STRC	5.5–9 $\gamma p \to p4\pi$
850±200	340	[25] SCHACHT	74	STRC	9–18 $\gamma p \to p4\pi$
650±100	400	BINGHAM	72B	HBC	9.3 $\gamma p \to p4\pi$

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
300±50	ATKINSON	85B	OMEG	20–70 γp

$\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
350 to 580	[26] ACHASOV	00I	SND	$e^+e^- \to \pi^0\pi^0\gamma$
490 to 1040	[27] ACHASOV	00I	SND	$e^+e^- \to \pi^0\pi^0\gamma$

$3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
285±20	CLEGG	90	RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

[15] Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.
[16] T-matrix pole.
[17] From phase shift analysis of HYAMS 73 data.
[18] Simple relativistic Breit-Wigner fit with constant width.
[19] An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
[20] Included in BECKER 79 analysis.
[21] Simple relativistic Breit-Wigner fit with model-dependent width.
[22] One peak fit result.
[23] Parameters roughly estimated, not from a fit.
[24] Skew mass distribution compensated by Ross-Stodolsky factor.
[25] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[26] Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.
[27] Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

$\rho(1700)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	4π	
Γ_2	$2(\pi^+\pi^-)$	large
Γ_3	$\rho\pi\pi$	dominant
Γ_4	$\rho^0\pi^+\pi^-$	large
Γ_5	$\rho^0\pi^0\pi^0$	
Γ_6	$\rho^\pm\pi^\mp\pi^0$	large
Γ_7	$a_1(1260)\pi$	
Γ_8	$h_1(1170)\pi$	
Γ_9	$\pi(1300)\pi$	
Γ_{10}	$\rho\rho$	
Γ_{11}	$\pi^+\pi^-$	seen
Γ_{12}	$\pi\pi$	seen
Γ_{13}	$K\overline{K}^*(892)+$ c.c.	seen
Γ_{14}	$\eta\rho$	seen
Γ_{15}	$a_2(1320)\pi$	not seen
Γ_{16}	$K\overline{K}$	seen
Γ_{17}	e^+e^-	seen
Γ_{18}	$\pi^0\omega$	seen

$\rho(1700)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the cross-section into channel$_I$ in e^+e^- annihilation.

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
2.83±0.42	BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.6 ±0.2	DELCOURT	81B	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$

$\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{11}\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13	[28] DIEKMAN	88	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
$0.029^{+0.016}_{-0.012}$	KURDADZE	83	OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

[28] Using total width = 220 MeV.

$\Gamma(K\overline{K}^*(892)+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{13}\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.305±0.071	[29] BIZOT	80	DM1	e^+e^-

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{14}\Gamma_{17}/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
7 ±3	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

$\Gamma(K\overline{K}) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.035±0.029	[29] BIZOT	80	DM1	e^+e^-

$\Gamma(\rho\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_3\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.510±0.090	[29] BIZOT	80	DM1	e^+e^-

[29] Model dependent.

$\rho(1700)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.287^{+0.043}_{-0.042}$	BECKER	79	ASPK	17 $\pi^- p$ polarized
0.15 to 0.30	[30] MARTIN	78C	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
<0.20	[31] COSTA...	77B	RVUE	$e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	[30] FROGGATT	77	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
<0.15	[32] EISENBERG	73	HBC	5 $\pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	[33] HYAMS	73	ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

[30] From phase shift analysis of HYAMS 73 data.
[31] Estimate using unitarity, time reversal invariance, Breit-Wigner.
[32] Estimated using one-pion-exchange model.
[33] Included in BECKER 79 analysis.

$\Gamma(\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ — Γ_{11}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13 ± 0.05	ASTON	80	OMEG	20–70 $\gamma p \rightarrow p 2\pi$
<0.14	[34] DAVIER	73	STRC	6–18 $\gamma p \rightarrow p 4\pi$
<0.2	[35] BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p 2\pi$

[34] Upper limit is estimate.
[35] 2σ upper limit.

$\Gamma(\pi\pi)/\Gamma(4\pi)$ — Γ_{12}/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.16 ± 0.04	[40,41] ABELE	01B	CBAR	0.0 $\overline{p} n \rightarrow 5\pi$

$\Gamma(K\overline{K}^*(892)+c.c.)/\Gamma(2(\pi^+\pi^-))$ — Γ_{13}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15 ± 0.03	[36] DELCOURT	81B	DM1	$e^+e^- \rightarrow \overline{K} K \pi$

[36] Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

$\Gamma(\eta\rho)/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.04		DONNACHIE	87B	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
possibly seen		AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
<0.02	58	ATKINSON	86B	OMEG	20–70 γp

$\Gamma(a_2(1320)\pi)/\Gamma_{total}$ — Γ_{15}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$\Gamma(\eta\rho)/\Gamma(2(\pi^+\pi^-))$ — Γ_{14}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.123±0.027	DELCOURT	82	DM1	$e^+e^- \to \pi^+\pi^-$ MM
~ 0.1	ASTON	80	OMEG	20–70 γp

$\Gamma(\pi^+\pi^-$ neutrals$)/\Gamma(2(\pi^+\pi^-))$ — $(\Gamma_5+\Gamma_6+0.714\Gamma_{14})/\Gamma_2$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.6±0.4	[37] BALLAM	74	HBC	9.3 γp

[37] Upper limit. Background not subtracted.

$\Gamma(\pi^0\omega)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	ACHASOV	97	RVUE	$e^+e^- \to \omega\pi^0$

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ — Γ_7/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.16±0.05	[40] ABELE	01B	CBAR	0.0 $\overline{p}n \to 5\pi$

$\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ — Γ_8/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17±0.06	[40] ABELE	01B	CBAR	0.0 $\overline{p}n \to 5\pi$

$\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ — Γ_9/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.30±0.10	[40] ABELE	01B	CBAR	0.0 $\overline{p}n \to 5\pi$

$\Gamma(\rho\rho)/\Gamma(4\pi)$ — Γ_{10}/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.09±0.03	[40] ABELE	01B	CBAR	0.0 $\overline{p}n \to 5\pi$

$\Gamma(\rho\pi\pi)/\Gamma(4\pi)$ — Γ_3/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.28±0.06	[40] ABELE	01B	CBAR	0.0 $\overline{p}n \to 5\pi$

$\Gamma(K\overline{K})/\Gamma(2(\pi^+\pi^-))$ — Γ_{16}/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.015±0.010		[38] DELCOURT	81B	DM1		$e^+e^- \to \overline{K}K$
<0.04	95	BINGHAM	72B	HBC	0	9.3 γp

[38] Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

$\Gamma(K\overline{K})/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_{16}/Γ_{13}

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.052 ± 0.026	BUON	82	DM1	$e^+e^- \to$ hadrons

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ — Γ_4/Γ_2

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1.0		DELCOURT	81B	DM1	$e^+e^- \to 2(\pi^+\pi^-)$
0.7 ± 0.1	500	SCHACHT	74	STRC	5.5–18 $\gamma p \to p4\pi$
0.80		[39] BINGHAM	72B	HBC	9.3 $\gamma p \to p4\pi$

[39] The $\pi\pi$ system is in *S*-wave.

$\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0)$ — Γ_5/Γ_6

VALUE	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.10	ATKINSON	85B	OMEG		20–70 γp
<0.15	ATKINSON	82	OMEG	0	20–70 $\gamma p \to p4\pi$

[40] $\omega\pi$ not included.
[41] Using ABELE 97.

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BISELLO	89	PL B220 321	D. Bisello *et al.*	(DM2 Collab.)
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DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)
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