$\rho(1700)$

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

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

Updated March 2000 by S. Eidelman (Novosibirsk) and J. Hernandez (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 from 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.

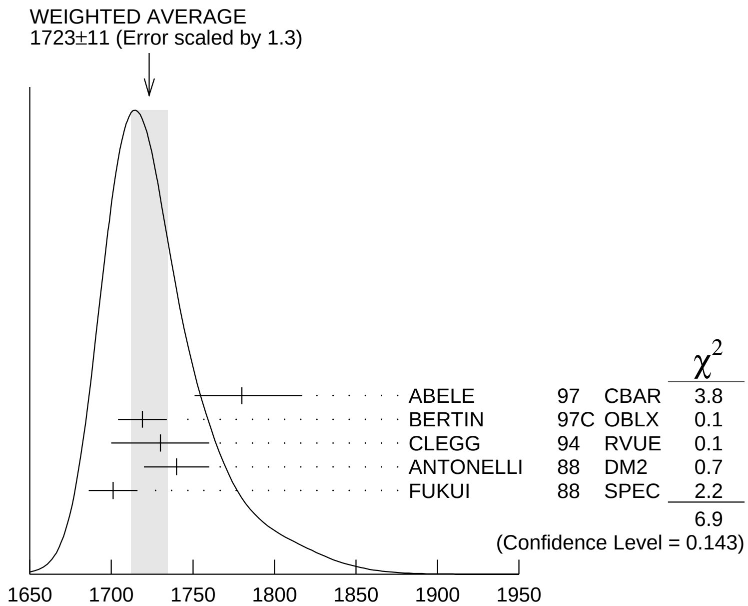
We also list under the $\rho(1450)$ the $\phi\pi$ state with $J^{PC} = 1^{--}$ or $C(1480)$ observed by BITYUKOV 87. While ACHASOV 96B shows that it may be a threshold effect, CLEGG 88 and LANDSBERG 92 suggest two independent vector states with this decay mode. Note, however, that $C(1480)$ in its $\phi\pi$ 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 $J^P = 1^-$ $\rho(770) \rightarrow \omega\pi$ 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 $\rho(1450)$.

$\rho(1700)$ 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	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701±15	[2] 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.				
1780 $^{+37}_{-29}$	[3] ABELE	97	CBAR	$\overline{p}n \rightarrow \pi^-\pi^0\pi^0$
1719 ±15	[3] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
1730 ±30	CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1768 ±21	BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1745.7±91.9	DUBNICKA	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1546 ±26	GESHKEN...	89	RVUE	
1650	[4] ERKAL	85	RVUE	20–70 $\gamma p \rightarrow \gamma\pi$
1550 ±70	ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+\pi^- p$
1590 ±20	[5] ASTON	80	OMEG	20–70 $\gamma p \rightarrow p 2\pi$
1600 ±10	[6] ATIYA	79B	SPEC	50 γC $\rightarrow$ C2π
1598 $^{+24}_{-22}$	BECKER	79	ASPK	17 $\pi^- p$ polarized
1659 ±25	[4] LANG	79	RVUE	
1575	[4] MARTIN	78C	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1610 ±30	[4] FROGGATT	77	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1590 ±20	[7] HYAMS	73	ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

$\pi\omega$ MODE

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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		[8] CORDIER	82	DM1	$e^+e^- \to 2(\pi^+\pi^-)$
1520± 30		[5] ASTON	81E	OMEG	20–70 $\gamma p \to p4\pi$
1654± 25		[9] DIBIANCA	81	DBC	$\pi^+ d \to pp2(\pi^+\pi^-)$
1666± 39		[8] BACCI	80	FRAG	$e^+e^- \to 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^-p \to 2(\pi^+\pi^-)$
1500		[10] ATIYA	79B	SPEC	50 $\gamma C \to C4\pi^\pm$
1570± 60	65	[11] ALEXANDER	75	HBC	7.5 $\gamma p \to p4\pi$
1550± 60		[5] CONVERSI	74	OSPK	$e^+e^- \to 2(\pi^+\pi^-)$
1550± 50	160	SCHACHT	74	STRC	5.5–9 $\gamma p \to p4\pi$
1450±100	340	SCHACHT	74	STRC	9–18 $\gamma p \to p4\pi$
1430± 50	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. • • •				
1660±30	ATKINSON	85B	OMEG	20–70 γp

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

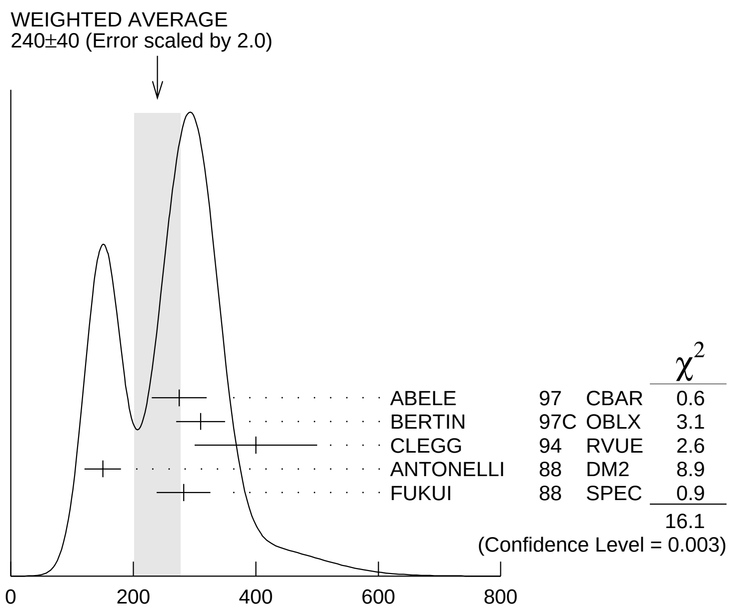
VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1783±15	CLEGG	90	RVUE	$e^+e^- \to 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

[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] Simple relativistic Breit-Wigner fit with model dependent width.
[9] One peak fit result.
[10] Parameters roughly estimated, not from a fit.
[11] 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

The data in this block is included in the average printed for a previous datablock.

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
150±30	ANTONELLI	88	DM2	$e^+e^- \to \eta\pi^+\pi^-$
282±44	[13] FUKUI	88	SPEC	8.95 $\pi^- p \to \eta\pi^+\pi^- n$

$\pi\pi$ MODE

The data in this block is included in the average printed for a previous datablock.

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
275 ± 45	[14] ABELE	97	CBAR	$\overline{p}n \to \pi^-\pi^0\pi^0$
310 ± 40	[14] BERTIN	97C	OBLX	0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$
400 ±100	CLEGG	94	RVUE	$e^+e^- \to \pi^+\pi^-$

• • • 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	[15] 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	[16] ASTON	80	OMEG	20–70 $\gamma p \to p 2\pi$
283 ± 14	[17] ATIYA	79B	SPEC	50 γC $\to$ C2π
175^{+98}_{-53}	BECKER	79	ASPK	17 $\pi^- p$ polarized
232 ± 34	[15] LANG	79	RVUE	
340	[15] MARTIN	78C	RVUE	17 $\pi^- p \to \pi^+ \pi^- n$
300 ±100	[15] FROGGATT	77	RVUE	17 $\pi^- p \to \pi^+ \pi^- n$
180 ± 50	[18] 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	[12] ABELE	99D	CBAR	±	0.0 $\overline{p} p \to K^+ K^- \pi^0$
265 ±120	1600	CLELAND	82B	SPEC	±	50 $\pi p \to K^0_S K^\pm p$

[12] 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		[19] CORDIER	82	DM1	$e^+ e^- \to 2(\pi^+ \pi^-)$
400± 50		[16] ASTON	81E	OMEG	20–70 $\gamma p \to p 4\pi$
400±146		[20] DIBIANCA	81	DBC	$\pi^+ d \to p p 2(\pi^+ \pi^-)$
700±160		[19] BACCI	80	FRAG	$e^+ e^- \to 2(\pi^+ \pi^-)$
100	34	KILLIAN	80	SPEC	11 $e^- p \to 2(\pi^+ \pi^-)$
600		[21] ATIYA	79B	SPEC	50 γC $\to$ C$4\pi^\pm$
340±160	65	[22] ALEXANDER	75	HBC	7.5 $\gamma p \to p 4\pi$
360±100		[16] CONVERSI	74	OSPK	$e^+ e^- \to 2(\pi^+ \pi^-)$
400±120	160	[23] SCHACHT	74	STRC	5.5–9 $\gamma p \to p 4\pi$
850±200	340	[23] SCHACHT	74	STRC	9–18 $\gamma p \to p 4\pi$
650±100	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. • • •				
300±50	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. • • •				
285±20	CLEGG	90	RVUE	$e^+e^- \to 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

[13] Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.
[14] T-matrix pole.
[15] From phase shift analysis of HYAMS 73 data.
[16] Simple relativistic Breit-Wigner fit with constant width.
[17] An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
[18] Included in BECKER 79 analysis.
[19] Simple relativistic Breit-Wigner fit with model-dependent width.
[20] One peak fit result.
[21] Parameters roughly estimated, not from a fit.
[22] Skew mass distribution compensated by Ross-Stodolsky factor.
[23] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

$\rho(1700)$ DECAY MODES

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

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_{12}/\Gamma$

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

$\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_6\Gamma_{12}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13	[24] DIEKMAN	88	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
$0.029^{+0.016}_{-0.012}$	KURDADZE	83	OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

[24] Using total width = 220 MeV.

$\Gamma(K\overline{K}^*(892)+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_8\Gamma_{12}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.305 ± 0.071	[25] BIZOT	80	DM1	e^+e^-

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_9\Gamma_{12}/\Gamma$

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

$\Gamma(K\overline{K}) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{11}\Gamma_{12}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.035 ± 0.029	[25] BIZOT	80	DM1	e^+e^-

$\Gamma(\rho\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_1\Gamma_{12}/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.510 ± 0.090	[25] BIZOT	80	DM1	e^+e^-

[25] Model dependent.

$\rho(1700)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_6/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	[26] MARTIN	78C	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
<0.20	[27] COSTA...	77B	RVUE	$e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	[26] FROGGATT	77	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
<0.15	[28] EISENBERG	73	HBC	5 $\pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	[29] HYAMS	73	ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

[26] From phase shift analysis of HYAMS 73 data.
[27] Estimate using unitarity, time reversal invariance, Breit-Wigner.
[28] Estimated using one-pion-exchange model.
[29] Included in BECKER 79 analysis.

$\Gamma(\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ — Γ_6/Γ_5

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 $\gamma p \to p 2\pi$
<0.14	[30] DAVIER	73	STRC	6–18 $\gamma p \to p 4\pi$
<0.2	[31] BINGHAM	72B	HBC	9.3 $\gamma p \to p 2\pi$

[30] Upper limit is estimate.
[31] 2σ upper limit.

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(2(\pi^+\pi^-))$ — Γ_8/Γ_5

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15 ± 0.03	[32] DELCOURT	81B	DM1	$e^+e^- \to \overline{K}K\pi$

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

$\Gamma(\eta\rho)/\Gamma_{\text{total}}$ — Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.04		DONNACHIE	87B	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.02	58	ATKINSON	86B	OMEG	20–70 γp

$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ — Γ_{10}/Γ

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

$\Gamma(\eta\rho)/\Gamma(2(\pi^+\pi^-))$ — Γ_9/Γ_5

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

$\Gamma(\pi^+\pi^-\text{neutrals})/\Gamma(2(\pi^+\pi^-))$ — $(\Gamma_3+\Gamma_4+0.714\Gamma_9)/\Gamma_5$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.6 ± 0.4	[33] BALLAM	74	HBC	9.3 γp

[33] Upper limit. Background not subtracted.

$\Gamma(\pi^0\omega)/\Gamma_{\text{total}}$ — Γ_{13}/Γ

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

$\Gamma(K\overline{K})/\Gamma(2(\pi^+\pi^-))$ — Γ_{11}/Γ_5

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.015 ± 0.010		[34] DELCOURT	81B	DM1		$e^+e^- \to \overline{K}K$
<0.04	95	BINGHAM	72B	HBC	0	$9.3\ \gamma p$

[34] 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_{11}/Γ_8

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_2/Γ_5

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1.0		DELCOURT	81B	DM1	$e^+e^- \to 2(\pi^+\pi^-)$
$0.7\ \pm0.1$	500	SCHACHT	74	STRC	5.5–18 $\gamma p \to p4\pi$
0.80		[35] BINGHAM	72B	HBC	9.3 $\gamma p \to p4\pi$

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

$\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0)$ — Γ_3/Γ_4

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 $\gamma p \to p4\pi$

$\rho(1700)$ REFERENCES

AMELIN	00	NP B668 83	D. Amelin et al.	(VES Collab.)
ABELE	99D	PL B468 178	A. Abele et al.	(Crystal Barrel Collab.)
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ACHASOV	97	PR D55 2663	N.N. Achasov et al.	(NOVM)
BERTIN	97C	PL B408 476	A. Bertin et al.	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO	89	PL B220 321	D. Bisello et al.	(DM2 Collab.)
DUBNICKA	89	JPG 15 1349	S. Dubnicka et al.	(JINR, SLOV)
GESHKEN...	89	ZPHY 45 351	B.V. Geshkenbein	(ITEP)
ANTONELLI	88	PL B212 133	A. Antonelli et al.	(DM2 Collab.)
DIEKMAN	88	PRPL 159 101	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui et al.	(SUGI, NAGO, KEK, KYOT+)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ATKINSON	86B	ZPHY C30 531	M. Atkinson et al.	(BONN, CERN, GLAS+)
ATKINSON	85B	ZPHY C26 499	M. Atkinson et al.	(BONN, CERN, GLAS+)
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)
ABE	84B	PRL 53 751	K. Abe et al.	
KURDADZE	83	JETPL 37 733	L.M. Kurdadze et al.	(NOVO)
		Translated from ZETFP 37 613.		

ATKINSON	82	PL 108B 55	M. Atkinson *et al.*	(BONN, CERN, GLAS+)	
BUON	82	PL 118B 221	J. Buon *et al.*	(LALO, MONP)	
CLELAND	82B	NP B208 228	W.E. Cleland *et al.*	(DURH, GEVA, LAUS+)	
CORDIER	82	PL 109B 129	A. Cordier *et al.*	(LALO)	
DELCOURT	82	PL 113B 93	B. Delcourt *et al.*	(LALO)	
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)	
Also	82	PL 109B 129	A. Cordier *et al.*	(LALO)	
DIBIANCA	81	PR D23 595	F.A. di Bianca *et al.*	(CASE, CMU)	
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	
BACCI	80	PL 95B 139	C. Bacci *et al.*	(ROMA, FRAS)	
BIZOT	80	Madison Conf. 546	J.C. Bizot *et al.*	(LALO, MONP)	
KILLIAN	80	PR D21 3005	T.J. Killian *et al.*	(CORN)	
ATIYA	79B	PRL 43 1691	M.S. Atiya *et al.*	(COLU, ILL, FNAL)	
BECKER	79	NP B151 46	H. Becker *et al.*	(MPIM, CERN, ZEEM, CRAC)	
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)	
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)	
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)	
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	
ALEXANDER	75	PL 57B 487	G. Alexander *et al.*	(TELA)	
BALLAM	74	NP B76 375	J. Ballam *et al.*	(SLAC, LBL, MPIM)	
CONVERSI	74	PL 52B 493	M. Conversi *et al.*	(ROMA, FRAS)	
SCHACHT	74	NP B81 205	P. Schacht *et al.*	(MPIM)	
DAVIER	73	NP B58 31	M. Davier *et al.*	(SLAC)	
EISENBERG	73	PL 43B 149	Y. Eisenberg *et al.*	(REHO)	
HYAMS	73	NP B64 134	B.D. Hyams *et al.*	(CERN, MPIM)	
BINGHAM	72B	PL 41B 635	H.H. Bingham *et al.*	(LBL, UCB, SLAC)	IGJP

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ATKINSON	83B	PL 127B 132	M. Atkinson *et al.*	(BONN, CERN, GLAS+)	
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