

$\phi(1680)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

$\phi(1680)$ MASS

e^+e^- PRODUCTION

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1680±20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1689± 7±10	4.8k	¹ SHEN 09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1709±20±43		² AUBERT 08S	BABR	10.6 $e^+e^- \rightarrow$ hadrons
1623±20	948	³ AKHMETSHIN 03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
~ 1500		⁴ ACHASOV 98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, \omega\pi^+\pi^-,$ K^+K^-
~ 1900		⁵ ACHASOV 98H	RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700±20		⁶ CLEGG 94	RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
1657±27	367	BISELLO 91C	DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1655±17		⁷ BISELLO 88B	DM2	$e^+e^- \rightarrow K^+K^-$
1680±10		⁸ BUON 82	DM1	$e^+e^- \rightarrow$ hadrons
1677±12		⁹ MANE 82	DM1	$e^+e^- \rightarrow K_S^0 K\pi$

¹ From a fit with two incoherent Breit-Wigners.

² From the simultaneous fit to the $K\bar{K}^*(892)+$ c.c. and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ, ω , and ϕ . Neither isospin nor flavor structure known.

⁴ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and ANTONELLI 92.

⁵ Using the data from BISELLO 91C.

⁶ Using BISELLO 88B and MANE 82 data.

⁷ From global fit including ρ, ω, ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.

⁸ From global fit of ρ, ω, ϕ and their radial excitations to channels $\omega\pi^+\pi^-, K^+K^-, K_S^0 K_L^0, K_S^0 K^\pm \pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.

⁹ Fit to one channel only, neglecting interference with $\omega, \rho(1700)$.

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1753± 3	¹⁰ LINK	02K	FOCS 20–160 $\gamma p \rightarrow K^+K^-\rho$
1726±22	¹⁰ BUSENITZ	89	TPS $\gamma p \rightarrow K^+K^-\chi$
1760±20	¹⁰ ATKINSON	85C	OMEG 20–70 $\gamma p \rightarrow K\bar{K}\chi$
1690±10	¹⁰ ASTON	81F	OMEG 25–70 $\gamma p \rightarrow K^+K^-\chi$

¹⁰ We list here a state decaying into K^+K^- possibly different from $\phi(1680)$.

$\rho\bar{\rho}$ ANNIHILATION

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1700±8	¹¹ AMSLER	06	CBAR 0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
¹¹ Could also be $\rho(1700)$.			

 $\phi(1680)$ WIDTH **e^+e^- PRODUCTION**

<u>VALUE (MeV)</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
150±50 OUR ESTIMATE				This is only an educated guess; the error given is larger than the error on the average of the published values.
• • • We do not use the following data for averages, fits, limits, etc. • • •				
211±14± 19	4.8k	¹² SHEN	09 BELL	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
322±77±160		¹³ AUBERT	08S BABR	10.6 $e^+e^- \rightarrow$ hadrons
139±60	948	¹⁴ AKHMETSHIN	03 CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
300±60		¹⁵ CLEGG	94 RVUE	$e^+e^- \rightarrow K^+ K^-, K_S^0 K \pi$
146±55	367	BISELLO	91C DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
207±45		¹⁶ BISELLO	88B DM2	$e^+e^- \rightarrow K^+ K^-$
185±22		¹⁷ BUON	82 DM1	$e^+e^- \rightarrow$ hadrons
102±36		¹⁸ MANE	82 DM1	$e^+e^- \rightarrow K_S^0 K \pi$

¹² From a fit with two incoherent Breit-Wigners.¹³ From the simultaneous fit to the $K\bar{K}^*(892) +$ c.c. and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.¹⁴ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.¹⁵ Using BISELLO 88B and MANE 82 data.¹⁶ From global fit including ρ , ω , ϕ and $\rho(1700)$ ¹⁷ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0 K_L^0$, $K_S^0 K^\pm \pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.¹⁸ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.**PHOTOPRODUCTION**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
122±63	¹⁹ LINK	02K FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$
121±47	¹⁹ BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
80±40	¹⁹ ATKINSON	85C OMEG	20–70 $\gamma p \rightarrow K\bar{K}X$
100±40	¹⁹ ASTON	81F OMEG	25–70 $\gamma p \rightarrow K^+ K^- X$
¹⁹ We list here a state decaying into $K^+ K^-$ possibly different from $\phi(1680)$.			

 $\rho\bar{\rho}$ ANNIHILATION

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
143±24	²⁰ AMSLER	06	CBAR 0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
²⁰ Could also be $\rho(1700)$.			

$\phi(1680)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	dominant
Γ_2 $K_S^0 K\pi$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $K_L^0 K_S^0$	
Γ_5 $e^+ e^-$	seen
Γ_6 $\omega\pi\pi$	not seen
Γ_7 $\phi\pi\pi$	
Γ_8 $K^+ K^- \pi^+ \pi^-$	seen
Γ_9 $\phi\eta$	
Γ_{10} $K^+ K^- \pi^0$	

$\phi(1680) \Gamma(i)\Gamma(e^+ e^-)/\Gamma^2(\text{total})$

This combination of a branching ratio into channel (*i*) and branching ratio into $e^+ e^-$ is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (*i*) or $e^+ e^-$.

$$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \qquad \Gamma_4/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

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

0.131 ± 0.059 948 ²¹ AKHMETSHIN 03 CMD2 1.05–1.38 $e^+ e^- \rightarrow K_L^0 K_S^0$

²¹ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. Recalculated by us.

$$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \qquad \Gamma_1/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

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

1.15 ± 0.16 ± 0.01 ²² AUBERT 08S BABR 10.6 $e^+ e^- \rightarrow K\bar{K}^*(892)\gamma +$

3.29 ± 1.57 367 ²³ BISELLO 91C DM2 1.35–2.40 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

²² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

²³ Recalculated by us with the published value of $B(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-)$.

$$\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \qquad \Gamma_7/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT

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

1.86 ± 0.14 ± 0.21 4.8k ²⁴ SHEN 09 BELL 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

²⁴ Multiplied by 3/2 to take into account the $\phi\pi^0\pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.

$\Gamma(\phi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_9/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-6}) DOCUMENT ID TECN COMMENT

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

$0.43 \pm 0.10 \pm 0.09$ ²⁵ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \phi\eta\gamma$

²⁵ From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

$\phi(1680)$ BRANCHING RATIOS

$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K_S^0 K\pi) \qquad \Gamma_1/\Gamma_2$

VALUE DOCUMENT ID TECN COMMENT

dominant MANE 82 DM1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \qquad \Gamma_3/\Gamma_1$

VALUE DOCUMENT ID TECN COMMENT

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

0.07 ± 0.01 BUON 82 DM1 e^+e^-

$\Gamma(\omega\pi\pi)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \qquad \Gamma_6/\Gamma_1$

VALUE DOCUMENT ID TECN COMMENT

<0.10 BUON 82 DM1 e^+e^-

$\Gamma(\phi\eta)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \qquad \Gamma_9/\Gamma_1$

VALUE DOCUMENT ID TECN COMMENT

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

≈ 0.37 ²⁶ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \text{hadrons}$

²⁶ From the fit including data from AUBERT 07AK.

$\phi(1680)$ REFERENCES

SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin	
		Translated from YAF 65 1255.		
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BUSENITZ	89	PR D40 1	J.K. Busenitz <i>et al.</i>	(ILL, FNAL)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
		Translated from ZETFP 46 132.		
ATKINSON	85C	ZPHY C27 233	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
MANE	82	PL 112B 178	F. Mane <i>et al.</i>	(LALO)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
MANE	81	PL 99B 261	F. Mane <i>et al.</i>	(ORSAY)