$\phi(1680)$

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

ϕ(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 $e^+e^- \rightarrow K^0_L K^0_S$
∼ 1500		[4] ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$, $\omega\pi^+\pi^-$, K^+K^-
∼ 1900		[5] ACHASOV	98H	RVUE	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$
1700±20		[6] CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-$, $K^0_S K\pi$
1657±27	367	BISELLO	91C	DM2	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$
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	$e^+e^- \rightarrow K^0_S K\pi$

[1] From a fit with two incoherent Breit-Wigners.
[2] From the simultaneous fit to the $K\overline{K}^*(892)+$ 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^-, $K^0_S K^0_L$, $K^0_S K^\pm\pi^\mp$. 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 ω, $\rho(1700)$.

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 $\gamma p \rightarrow K^+K^-p$
1726±22	[10] BUSENITZ	89	TPS	$\gamma p \rightarrow K^+K^-X$
1760±20	[10] ATKINSON	85C	OMEG	20–70 $\gamma p \rightarrow K\overline{K}X$
1690±10	[10] ASTON	81F	OMEG	25–70 $\gamma p \rightarrow K^+K^-X$

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

$p\overline{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1700±8	[11] AMSLER	06	CBAR	0.9 $\overline{p}p \rightarrow K^+K^-\pi^0$

[11] Could also be $\rho(1700)$.

$\phi(1680)$ WIDTH

e^+e^- PRODUCTION

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
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 $e^+e^- \rightarrow K^0_L K^0_S$
300±60		[15] CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-$, $K^0_S K\pi$
146±55	367	BISELLO	91C	DM2	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$
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	$e^+e^- \rightarrow K^0_S K\pi$

[12] From a fit with two incoherent Breit-Wigners.
[13] From the simultaneous fit to the $K\overline{K}^*(892)+$ 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^-, $K^0_S K^0_L$, $K^0_S K^\pm\pi^\mp$. 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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • 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 $\gamma p \rightarrow K\overline{K}X$
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 $\phi(1680)$.

$p\overline{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
143±24	[20] AMSLER	06	CBAR	0.9 $\overline{p}p \rightarrow K^+K^-\pi^0$

[20] Could also be $\rho(1700)$.

$\phi(1680)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$K\overline{K}^*(892)+$ c.c.	dominant
Γ_2	$K^0_S K\pi$	seen
Γ_3	$K\overline{K}$	seen
Γ_4	$K^0_L K^0_S$	

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	$\eta\phi$	seen
Γ_{10}	$\eta\gamma$	seen
Γ_{11}	$K^+K^-\pi^0$	

ϕ(1680) Γ(i)$\Gamma(e^+e^-)/\Gamma^2$(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^-.

$\Gamma(K^0_L K^0_S)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_4/\Gamma \times \Gamma_5/\Gamma$

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 $e^+e^- \to K^0_L K^0_S$

[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.

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

VALUE (units 10^{-6})	*EVTS*	*DOCUMENT ID*	*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.15 \pm 0.16 \pm 0.01$		[22] AUBERT 08S	BABR	10.6 $e^+e^- \to K\overline{K}^*(892)\gamma$ + c.c.
3.29 ± 1.57	367	[23] BISELLO 91C	DM2	1.35–2.40 $e^+e^- \to K^0_S K^\pm\pi^\mp$

[22] From the simultaneous fit to the $K\overline{K}^*(892)+$ 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($K\overline{K}^*(892)$ + c.c.) $\times$ $\Gamma(e^+e^-)$.

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

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*	*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.86 \pm 0.14 \pm 0.21$	4.8k	[24] SHEN 09	BELL	10.6 $e^+e^- \to K^+K^-\pi^+\pi^-\gamma$

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

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

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 $e^+e^- \to \phi\eta\gamma$

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

$\phi(1680)$ BRANCHING RATIOS

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(K^0_S K\pi)$ — Γ_1/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
dominant	MANE	82	DM1	$e^+e^- \to K^0_S K^\pm \pi^\mp$

$\Gamma(K\overline{K})/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_3/Γ_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^-

$\Gamma(\omega\pi\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_6/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
<0.10	BUON	82	DM1	e^+e^-

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	35	[26] ACHASOV	14	SND	1.15–2.00 $e^+e^- \to \eta\gamma$

[26] From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

$\Gamma(\eta\phi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_9/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
≈ 0.37	[27] AUBERT	08S	BABR	10.6 $e^+e^- \to$ hadrons

[27] From the fit including data from AUBERT 07AK.

$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ — Γ_{10}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	35	[28] ACHASOV	14	SND	1.15–2.00 $e^+e^- \to \eta\gamma$

[28] From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

$\phi(1680)$ REFERENCES

ACHASOV	14	PR D90 032002	M.N. Achasov et al.	(SND Collab.)
PDG	12	PR D86 010001	J. Beringer et al.	(PDG Collab.)
SHEN	09	PR D80 031101	C.P. Shen et al.	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert et al.	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert et al.	(BABAR Collab.)
AMSLER	06	PL B639 165	C. Amsler et al.	(CBAR Collab.)
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin et al.	(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 et al.	(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 et al.	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello et al.	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky et al.	(NOVO)
BUSENITZ	89	PR D40 1	J.K. Busenitz et al.	(ILL, FNAL)
BISELLO	88B	ZPHY C39 13	D. Bisello et al.	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov et al.	(NOVO)
		Translated from ZETFP 46 132.		

ATKINSON	85C	ZPHY C27 233	M. Atkinson *et al.*	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon *et al.*	(LALO, MONP)
MANE	82	PL 112B 178	F. Mane *et al.*	(LALO)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
IVANOV	81	PL 107B 297	P.M. Ivanov *et al.*	(NOVO)
MANE	81	PL 99B 261	F. Mane *et al.*	(ORSAY)