$$\boxed{\phi(1680)} \qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$$

$\phi(1680)$ MASS

e^+e^- PRODUCTION

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1680$\pm$20 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1674$\pm$12$\pm$ 6	6.2k	[1] LEES	14H	BABR	$e^+e^- \to K^0_S K^0_L \gamma$
1733$\pm$10$\pm$10		[2] LEES	12F	BABR	10.6 $e^+e^- \to \phi\pi^+\pi^-\gamma$
1689$\pm$ 7$\pm$10	4.8k	[3] SHEN	09	BELL	10.6 $e^+e^- \to K^+K^-\pi^+\pi^-\gamma$
1709$\pm$20$\pm$43		[4] AUBERT	08S	BABR	10.6 $e^+e^- \to$ hadrons
1623$\pm$20	948	[5] AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \to K^0_L K^0_S$
$\sim$ 1500		[6] ACHASOV	98H	RVUE	$e^+e^- \to \pi^+\pi^-\pi^0, \omega\pi^+\pi^-,$ K^+K^-
$\sim$ 1900		[7] ACHASOV	98H	RVUE	$e^+e^- \to K^0_S K^{\pm}\pi^{\mp}$
1700$\pm$20		[8] CLEGG	94	RVUE	$e^+e^- \to K^+K^-, K^0_S K\pi$
1657$\pm$27	367	BISELLO	91C	DM2	$e^+e^- \to K^0_S K^{\pm}\pi^{\mp}$
1655$\pm$17		[9] BISELLO	88B	DM2	$e^+e^- \to K^+K^-$
1680$\pm$10		[10] BUON	82	DM1	$e^+e^- \to$ hadrons
1677$\pm$12		[11] MANE	82	DM1	$e^+e^- \to K^0_S K\pi$

[1] Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

[2] Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

[3] From a fit with two incoherent Breit-Wigners.

[4] 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.

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

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

[7] Using the data from BISELLO 91C.

[8] Using BISELLO 88B and MANE 82 data.

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

[10] 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.

[11] 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$\pm$ 3	[12] LINK	02K	FOCS	20–160 $\gamma p \to K^+K^- p$
1726$\pm$22	[12] BUSENITZ	89	TPS	$\gamma p \to K^+K^- X$
1760$\pm$20	[12] ATKINSON	85C	OMEG	20–70 $\gamma p \to K\overline{K}X$
1690$\pm$10	[12] ASTON	81F	OMEG	25–70 $\gamma p \to K^+K^- X$

[12] 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	[13] AMSLER	06	CBAR	$0.9\ \overline{p}p \to\ K^+K^-\pi^0$

[13] 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. • • •					
$165\pm 38\pm\ 70$	6.2k	[14] LEES	14H	BABR	$e^+e^- \to\ K^0_S K^0_L \gamma$
$300\pm 15\pm\ 37$		[15] LEES	12F	BABR	$10.6\ e^+e^- \to\ \phi\pi^+\pi^-\gamma$
$211\pm 14\pm\ 19$	4.8k	[16] SHEN	09	BELL	$10.6\ e^+e^- \to\ K^+K^-\pi^+\pi^-\gamma$
$322\pm 77\pm 160$		[17] AUBERT	08S	BABR	$10.6\ e^+e^- \to$ hadrons
139 ± 60	948	[18] AKHMETSHIN	03	CMD2	1.05–$1.38\ e^+e^- \to\ K^0_L K^0_S$
300 ± 60		[19] CLEGG	94	RVUE	$e^+e^- \to\ K^+K^-,\ K^0_S K\pi$
146 ± 55	367	BISELLO	91C	DM2	$e^+e^- \to\ K^0_S K^{\pm}\pi^{\mp}$
207 ± 45		[20] BISELLO	88B	DM2	$e^+e^- \to\ K^+K^-$
185 ± 22		[21] BUON	82	DM1	$e^+e^- \to$ hadrons
102 ± 36		[22] MANE	82	DM1	$e^+e^- \to\ K^0_S K\pi$

[14] Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

[15] Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

[16] From a fit with two incoherent Breit-Wigners.

[17] 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.

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

[19] Using BISELLO 88B and MANE 82 data.

[20] From global fit including ρ, ω, ϕ and $\rho(1700)$

[21] 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.

[22] 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	[23] LINK	02K	FOCS	20–$160\ \gamma p \to\ K^+K^-p$
121 ± 47	[23] BUSENITZ	89	TPS	$\gamma p \to\ K^+K^-X$
80 ± 40	[23] ATKINSON	85C	OMEG	20–$70\ \gamma p \to\ K\overline{K}X$
100 ± 40	[23] ASTON	81F	OMEG	25–$70\ \gamma p \to\ K^+K^-X$

[23] 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	[24]	AMSLER	06 CBAR	$0.9\ \overline{p}p \to\ K^+K^-\pi^0$

[24] 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}	$K^+K^-\pi^0$	

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

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel (I) in e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(I)$ or the branching ratio $\Gamma(I)/\text{total}$.

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

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$14.3\pm2.4\pm6.2$	6.2k	[25] LEES	14H BABR	$e^+e^- \to\ K^0_S K^0_L \gamma$

[25] Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

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

VALUE (10^{-2} keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$4.2\pm0.2\pm0.3$	LEES	12F BABR	$10.6\ e^+e^- \to\ \phi\pi^+\pi^-\gamma$

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

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

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	[26] AKHMETSHIN 03	CMD2	1.05–$1.38\ e^+e^- \to K_L^0 K_S^0$

[26] 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.

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.15 \pm 0.16 \pm 0.01$		[27] AUBERT 08S	BABR	$10.6\ e^+e^- \to K\overline{K}^*(892)\gamma + \text{c.c.}$
3.29 ± 1.57	367	[28] BISELLO 91C	DM2	1.35–$2.40\ e^+e^- \to K_S^0 K^\pm \pi^\mp$

[27] 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.

[28] Recalculated by us with the published value of B($K\overline{K}^*(892)+$ c.c.) $\times \Gamma(e^+e^-)$.

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

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.86 \pm 0.14 \pm 0.21$	4.8k	[29] SHEN 09	BELL	$10.6\ e^+e^- \to K^+K^-\pi^+\pi^-\gamma$

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

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

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.43 \pm 0.10 \pm 0.09$	[30] AUBERT 08S	BABR	$10.6\ e^+e^- \to \phi\eta\gamma$

[30] 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

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

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

$\Gamma(K\overline{K})/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ $\qquad$ 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	[31]	ACHASOV	14	SND	1.15–2.00 $e^+e^- \to \eta\gamma$

[31] 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	[32] AUBERT	08S	BABR	10.6 $e^+e^- \to$ hadrons

[32] 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	[33]	ACHASOV	14	SND	1.15–2.00 $e^+e^- \to \eta\gamma$

[33] 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.)
LEES	14H	PR D89 092002	J.P. Lees *et al.*	(BABAR Collab)
LEES	12F	PR D86 012008	J.P. Lees *et al.*	(BABAR 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)