$\phi(1680)$

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

First identified using Dalitz plot analysis of $e^+e^- \rightarrow K\overline{K}^*(892)$ (BIZOT 80, DELCOURT 81). We do not list anymore ω radial excitations under this particle. See also $\omega(1420)$ and $\omega(1600)$.

$\phi(1680)$ MASS

e^+e^- PRODUCTION

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1680±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. • • •					
1657 ± 27	367	BISELLO	91C	DM2	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$
1655 ± 17		BISELLO [1]	88B	DM2	$e^+e^- \rightarrow K^+K^-$
1680 ± 10		BUON [2]	82	DM1	$e^+e^- \rightarrow$ hadrons
1677 ± 12		MANE [3]	82	DM1	$e^+e^- \rightarrow K^0_S K\pi$

PHOTOPRODUCTION

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

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

[2] 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.

[3] Fit to one channel only, neglecting interference with ω, $\rho(1700)$.

$\phi(1680)$ 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. • • •					
146 ± 55	367	BISELLO	91C	DM2	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$
207 ± 45		BISELLO [4]	88B	DM2	$e^+e^- \rightarrow K^+K^-$
185 ± 22		BUON [5]	82	DM1	$e^+e^- \rightarrow$ hadrons
102 ± 36		MANE [6]	82	DM1	$e^+e^- \rightarrow K^0_S K\pi$

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
121 ± 47	BUSENITZ	89	TPS	$\gamma p \rightarrow K^+K^-X$
80 ± 40	ATKINSON	85C	OMEG	20–70 $\gamma p \rightarrow K\overline{K}X$
100 ± 40	ASTON	81F	OMEG	25–70 $\gamma p \rightarrow K^+K^-X$

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

[5] 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.

[6] Fit to one channel only, neglecting interference with ω, $\rho(1700)$.

$\phi(1680)$ 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	e^+e^-	seen
Γ_5	$\omega\pi\pi$	not seen
Γ_6	$K^+K^-\pi^0$	

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

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 $\Gamma(I)$/total.

$\Gamma(K\overline{K}^*(892)+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ — $\Gamma_1\Gamma_4/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.48 ± 0.14	367	BISELLO	91C	DM2	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$

$\phi(1680)$ 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	$e^+e^- \rightarrow K^0_S K^\pm\pi^\mp$

$\Gamma(K\overline{K})/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_3/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.07 ±0.01	BUON	82	DM1	e^+e^-

$\Gamma(\omega\pi\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_5/Γ_1

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

$\phi(1680)$ REFERENCES

BISELLO 91C ZPHY C52 227 +Busetto, Castro, Nigro, Pescara+ (DM2 Collab.)
BUSENITZ 89 PR D40 1 +Olszewski, Callahan+ (ILL, FNAL)
BISELLO 88B ZPHY C39 13 +Busetto+ (PADO, CLER, FRAS, LALO)
ATKINSON 85C ZPHY C27 233 + (BONN, CERN, GLAS, LANC, MCHS, CURIN+)
BUON 82 PL 118B 221 +Bisello, Bizot, Cordier, Delcourt+ (LALO, MONP)
MANE 82 PL 112B 178 +Bisello, Bizot, Buon, Delcourt, Fayard+ (LALO)
ASTON 81F PL 104B 231 (BONN, CERN, EPOL, GLAS, LANC, MCHS+)
DELCOURT 81 PL 99B 257 +Bisello, Bizot, Buon, Cordier, Mane (ORSAY)
BIZOT 80 Madison Conf. 546 +Bisello, Buon, Cordier, Delcourt+ (LALO, MONP)

OTHER RELATED PAPERS

ATKINSON 86C ZPHY C30 541 + (BONN, CERN, GLAS, LANC, MCHS, CURIN+)
ATKINSON 84 NP B231 15 + (BONN, CERN, GLAS, LANC, MCHS, CURIN+)
ATKINSON 84B NP B231 1 + (BONN, CERN, GLAS, LANC, MCHS, CURIN+)
ATKINSON 83C NP B229 269 + (BONN, CERN, GLAS, LANC, MCHS, CURIN+)
CORDIER 81 PL 106B 155 +Bisello, Bizot, Buon, Delcourt, Mane (ORSAY)
MANE 81 PL 99B 261 +Bisello, Bizot, Buon, Cordier, Delcourt (ORSAY)
ASTON 80F NP B174 269 (BONN, CERN, EPOL, GLAS, LANC, MCHS+)

$\rho_3(1690)$

$I^G(J^{PC}) = 1^+(3^{--})$

$\rho_3(1690)$ MASS

We include only high statistics experiments in the average for the 2π, $K\overline{K}$, and $K\overline{K}\pi$ modes.

2π, $K\overline{K}$, AND $K\overline{K}\pi$ MODES

VALUE (MeV)	DOCUMENT ID
1691 ±5 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.
1691.4±2.7 OUR AVERAGE	Includes data from the 2 datablocks that follow this one.

2π MODE

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

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
1686 ± 4 OUR AVERAGE						
1677 ± 14		EVANGELISTA	81	OMEG	$-$	12 $\pi^-p \rightarrow 2\pi p$
1679.0 ± 11.0	476	BALTAY	78B	HBC	0	15 $\pi^+p \rightarrow \pi^+\pi^-n$
1678.0 ± 12.0	175	ANTIPOV [1]	77	CIBS	0	25 $\pi^-p \rightarrow p3\pi$
1690 ± 7	600	ENGLER [1]	74	DBC	0	6 $\pi^+n \rightarrow \pi^+\pi^-p$
1693 ± 8		GRAYER [2]	74	ASPK	0	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1678 ± 12		MATTHEWS	71C	DBC	0	7 π^+N
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1734.0 ± 10.0		CORDEN [3]	79	OMEG		12–15 $\pi^-p \rightarrow n2\pi$
1692 ± 12		ESTABROOKS [2,4]	75	RVUE		17 $\pi^-p \rightarrow \pi^+\pi^-n$
1737.0 ± 23.0		ARMENISE	70	DBC	0	9 π^+N
1650.0 ± 35.0	122	BARTSCH	70B	HBC	$+$	8 $\pi^+p \rightarrow N2\pi$
1687 ± 21		STUNTEBECK	70	HDBC	0	8 π^-p, 5.4 π^+d
1683 ± 13		ARMENISE	68	DBC	0	5.1 π^+d
1670.0 ± 30.0		GOLDBERG	65	HBC	0	6 π^+d, 8 π^-p

[1] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

[2] Uses same data as HYAMS 75.

[3] From a phase shift solution containing a $f'_2(1525)$ width two times larger than the $K\overline{K}$ result.

[4] From phase-shift analysis. Error takes account of spread of different phase-shift solutions.