$\phi(2170)$

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

See the review on "Spectroscopy of Light Meson Resonances."

$\phi(2170)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
2163 ± 7 OUR AVERAGE		Error includes scale factor of 1.1.			
2190 ±19 ±37		[1] ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \to K^+K^-\pi^0$
2176 ±24 ± 3		[2] ABLIKIM	21A	BES3	$e^+e^- \to \omega\eta$
2163.5± 6.2± 3.0		[3] ABLIKIM	21T	BES3	$e^+e^- \to \phi\eta$
2177.5± 4.8±19.5		[4] ABLIKIM	20M	BES3	$e^+e^- \to \eta'\phi$
2126.5±16.8±12.4		[5] ABLIKIM	20S	BES3	$e^+e^- \to K^+K^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2273.7± 5.7±19.3		[6] ABLIKIM	21AP	BES3	$e^+e^- \to K^0_S K^0_L$
2135 ± 8 ± 9	95	ABLIKIM	19I	BES3	$e^+e^- \to \eta\phi f_0(980)$
2239.2± 7.1±11.3		[7] ABLIKIM	19L	BES3	$e^+e^- \to K^+K^-$
2200 ± 6 ± 5	471	ABLIKIM	15H	BES3	$J/\psi \to \eta\phi\pi^+\pi^-$
2180 ± 8 ± 8		[8,9] LEES	12F	BABR	10.6 $e^+e^- \to \phi\pi^+\pi^-\gamma$
2079 ±13 $^{+79}_{-28}$	4.8k	[10] SHEN	09	BELL	10.6 $e^+e^- \to K^+K^-\pi^+\pi^-\gamma$
2186 ±10 ± 6	52	ABLIKIM	08F	BES	$J/\psi \to \eta\phi f_0(980)$
2125 ±22 ±10	483	AUBERT	08S	BABR	10.6 $e^+e^- \to \phi\eta\gamma$
2192 ±14	116	[11] AUBERT	07AK	BABR	10.6 $e^+e^- \to K^+K^-\pi^+\pi^-\gamma$
2169 ±20	149	[11] AUBERT	07AK	BABR	10.6 $e^+e^- \to K^+K^-\pi^0\pi^0\gamma$
2175 ±10 ±15	201	[9,12] AUBERT,BE	06D	BABR	10.6 $e^+e^- \to K^+K^-\pi\pi\gamma$

[1] By a simultaneous fit of the $K_2^*(1430)^+K^-$ and $K^*(892)^+K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

[2] From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.

[3] From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.

[4] From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

[5] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

[6] From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

[7] The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

[8] Fit includes interference with the $\phi(1680)$.

[9] From the $\phi f_0(980)$ component.

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

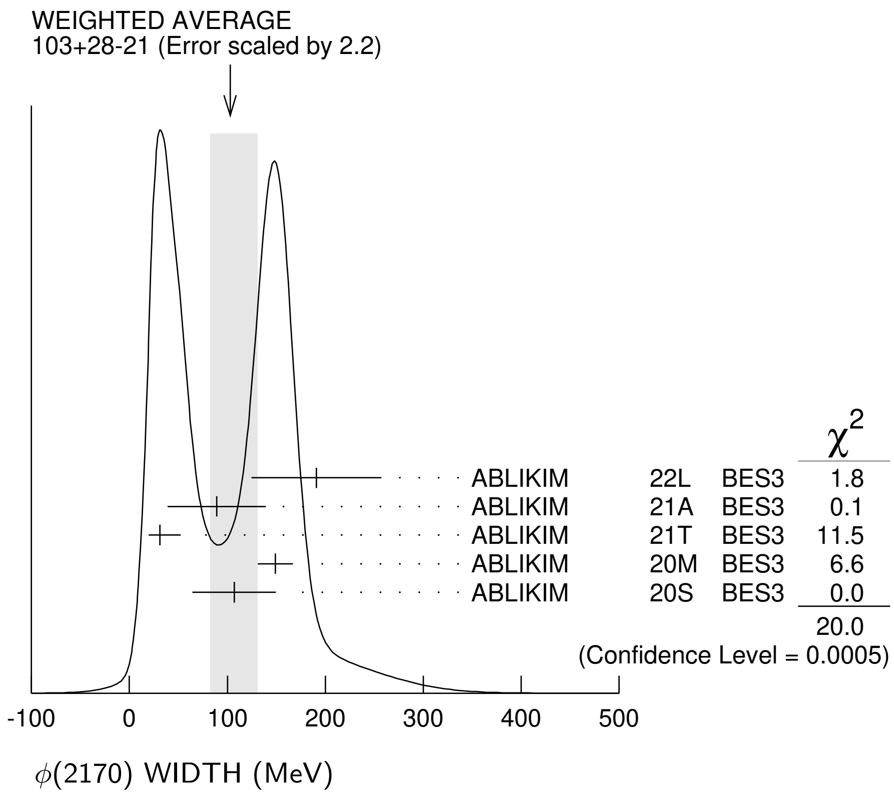
[11] From the $K^+ K^- f_0(980)$ component.
[12] Superseded by LEES 12F.

ϕ(2170) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
103 $^{+28}_{-21}$ OUR AVERAGE				Error includes scale factor of 2.2. See the ideogram below.
191 $\pm$28 $\pm$60		[1] ABLIKIM 22L	BES3	2.0–3.08 $e^+ e^- \to K^+ K^- \pi^0$
89 $\pm$50 $\pm$ 5		[2] ABLIKIM 21A	BES3	$e^+ e^- \to \omega\eta$
31.1$^{+21.1}_{-11.6}$$\pm$ 1.1		[3] ABLIKIM 21T	BES3	$e^+ e^- \to \phi\eta$
149.0$\pm$15.6$\pm$ 8.9		[4] ABLIKIM 20M	BES3	$e^+ e^- \to \eta' \phi$
106.9$\pm$32.1$\pm$28.1		[5] ABLIKIM 20S	BES3	$e^+ e^- \to K^+ K^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
86 $\pm$44 $\pm$51		[6] ABLIKIM 21AP	BES3	$e^+ e^- \to K^0_S K^0_L$
104 $\pm$24 $\pm$12	95	ABLIKIM 19I	BES3	$e^+ e^- \to \eta\phi f_0(980)$
139.8$\pm$12.3$\pm$20.6		[7] ABLIKIM 19L	BES3	$e^+ e^- \to K^+ K^-$
104 $\pm$15 $\pm$15	471	ABLIKIM 15H	BES3	$J/\psi \to \eta\phi\pi^+\pi^-$
77 $\pm$15 $\pm$10		[8,9] LEES 12F	BABR	10.6 $e^+ e^- \to \phi\pi^+\pi^-\gamma$
192 $\pm$23 $^{+25}_{-61}$	4.8k	[10] SHEN 09	BELL	10.6 $e^+ e^- \to K^+ K^- \pi^+ \pi^- \gamma$
65 $\pm$23 $\pm$17	52	ABLIKIM 08F	BES	$J/\psi \to \eta\phi f_0(980)$
61 $\pm$50 $\pm$13	483	AUBERT 08S	BABR	10.6 $e^+ e^- \to \phi\eta\gamma$
71 $\pm$21	116	[11] AUBERT 07AK	BABR	10.6 $e^+ e^- \to K^+ K^- \pi^+ \pi^- \gamma$
102 $\pm$27	149	[11] AUBERT 07AK	BABR	10.6 $e^+ e^- \to K^+ K^- \pi^0 \pi^0 \gamma$
58 $\pm$16 $\pm$20	201	[9,12] AUBERT,BE 06D	BABR	10.6 $e^+ e^- \to K^+ K^- \pi\pi\gamma$

[1] By a simultaneous fit of the $K^*_2(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.
[2] From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.
[3] From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.
[4] From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.
[5] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.
[6] From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.
[7] The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.
[8] Fit includes interference with the $\phi(1680)$.
[9] From the $\phi f_0(980)$ component.
[10] From a fit with two incoherent Breit-Wigners.
[11] From the $K^+ K^- f_0(980)$ component.

[12] Superseded by LEES 12F.



$\phi(2170)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$e^+ e^-$	seen
Γ_2	$\phi\eta$	seen
Γ_3	$\omega\eta$	seen
Γ_4	$\phi\eta'$	seen
Γ_5	$\phi\pi\pi$	
Γ_6	$\phi f_0(980)$	seen
Γ_7	$K^0_S K^0_L$	
Γ_8	$K^+ K^- \pi^+ \pi^-$	
Γ_9	$K^+ K^- f_0(980) \to K^+ K^- \pi^+ \pi^-$	seen
Γ_{10}	$K^+ K^- \pi^0 \pi^0$	
Γ_{11}	$K^+ K^- f_0(980) \to K^+ K^- \pi^0 \pi^0$	seen
Γ_{12}	$K^{*0} K^\pm \pi^\mp$	not seen
Γ_{13}	$K^*(892)^0 \overline{K}^*(892)^0$	not seen
Γ_{14}	$K^*(892)^+ K^*(892)^-$	
Γ_{15}	$K^*(892)^+ K^- +$ c.c.	
Γ_{16}	$K(1460)^+ K^- +$ c.c.	
Γ_{17}	$K_1(1270)^+ K^- +$ c.c.	

Γ_{18} $K_1(1400)^+ K^- +$ c.c.
Γ_{19} $K_2^*(1430)^+ K^- +$ c.c.

ϕ(2170) $\Gamma(i)\Gamma(e^+e^-)/\Gamma$(total)

$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.17	90		[1] ZHU	23	BELL	$e^+e^- \to \Upsilon(nS) \to \phi\eta\gamma$
$0.24^{+0.12}_{-0.07}$			[2] ABLIKIM	21T	BES3	$e^+e^- \to \phi\eta$
1.7 ±0.7 ±1.3		483	AUBERT	08S	BABR	10.6 $e^+e^- \to \phi\eta\gamma$

[1] From a solution of the fit using a vector meson dominance model with contributions from ϕ(1680), ϕ(2170) and non resonant contribution with mass and width of ϕ(2170) fixed at 2163.5 MeV and 31.1 MeV respectively. Four solutions are found with equal fit quality giving 0.17 eV (solution I and II) and 18.6 eV (III and IV) at 90% CL.
[2] From a solution of the fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes (ϕ(1680) and ϕ(2170)) and a nonresonant term. The other solution gives $10.11^{+3.87}_{-3.13}$ eV.

$\Gamma(\omega\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_3\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
0.43±0.15±0.04	[1] ABLIKIM	21A	BES3	$e^+e^- \to \omega\eta$

[1] For constructive interference with ω(1420) and $\omega(1650)/\phi(1680)$. For destructive interference: 1.25 ± 0.48 ± 0.18 eV.

$\Gamma(\phi\eta') \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_4\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
7.1±0.7±0.7	[1] ABLIKIM	20M	BES3	$e^+e^- \to \eta'\phi$

[1] From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

$\Gamma(\phi f_0(980)) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_6\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
2.3±0.3±0.3		[1,2] LEES	12F	BABR	10.6 $e^+e^- \to \phi\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.5±0.8±0.4	201	[2,3] AUBERT,BE	06D	BABR	10.6 $e^+e^- \to K^+K^-\pi\pi\gamma$

[1] From a fit with constructive interference with the ϕ(1680). In a fit with destructive interference, the value is larger by a factor of 12.
[2] From the $\phi f_0(980)$ component.
[3] Superseded by LEES 12F.

$\Gamma(K^0_S K^0_L) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_7\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.9±0.6±0.7	[1] ABLIKIM	21AP	BES3	$e^+e^- \to K^0_S K^0_L$

[1] From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to ρ(2150).

$\Gamma\big(K^*(892)^+ K^*(892)^-\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{14}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<1.9	90	[1] ABLIKIM	20S	BES3	$e^+e^- \to K^+K^-\pi^0\pi^0$

[1] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

$\Gamma\big(K^*(892)^+ K^- + \text{c.c.}\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{15}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.0 ± 0.3	[1] ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \to K^+K^-\pi^0$

[1] From a solution of a simultaneous fit of the $K_2^*(1430)^+K^-$ and $K^*(892)^+K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 7.1 ± 0.9 eV. Significance $3.7\,\sigma$.

$\Gamma\big(K(1460)^+ K^- + \text{c.c.}\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{16}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.0 ± 3.8	[1] ABLIKIM	20S	BES3	$e^+e^- \to K^+K^-\pi^0\pi^0$

[1] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

$\Gamma\big(K_1(1270)^+ K^- + \text{c.c.}\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{17}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<12.5	90	[1] ABLIKIM	20S	BES3	$e^+e^- \to K^+K^-\pi^0\pi^0$

[1] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives an upper limit value of 297.6 eV.

$\Gamma\big(K_1(1400)^+ K^- + \text{c.c.}\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{18}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7 ± 3.3	[1] ABLIKIM	20S	BES3	$e^+e^- \to K^+K^-\pi^0\pi^0$

[1] By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives a value of 98.8 ± 7.8 eV.

$\Gamma\big(K_2^*(1430)^+ K^- + \text{c.c.}\big) \times \Gamma\big(e^+e^-\big)/\Gamma_{\text{total}}$ — $\Gamma_{19}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
12.6 ± 2.4	[1] ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \to K^+K^-\pi^0$

[1] From a solution of a simultaneous fit of the $K_2^*(1430)^+K^-$ and $K^*(892)^+K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 161.1 ± 20.6 eV.

$\phi(2170)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma \times \Gamma_1/\Gamma$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.65\pm0.15\pm0.18$	4.8k	[1] SHEN	09	BELL	$10.6\ e^+e^- \to K^+K^-\pi^+\pi^-\gamma$

[1] 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)%.

$\phi(2170)$ BRANCHING RATIOS

$\Gamma(K^+K^-f_0(980) \to K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AUBERT	07AK	BABR	$10.6\ e^+e^- \to K^+K^-\pi^+\pi^-\gamma$

$\Gamma(K^+K^-f_0(980) \to K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AUBERT	07AK	BABR	$10.6\ e^+e^- \to K^+K^-\pi^0\pi^0\gamma$

$\Gamma(K^{*0}K^\pm\pi^\mp)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AUBERT	07AK	BABR	10.6 GeV e^+e^-

$\Gamma(K^*(892)^0\overline{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	ABLIKIM	10C	BES2	$J/\psi \to \eta K^+\pi^-K^-\pi^+$

$\phi(2170)$ REFERENCES

ZHU	23	PR D107 012006	W. Zhu et al.	(BELLE Collab.)
ABLIKIM	22L	JHEP 2207 045	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	21A	PL B813 136059	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	21AP	PR D104 092014	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	21T	PR D104 032007	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	20M	PR D102 012008	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	20S	PRL 124 112001	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	19I	PR D99 012014	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	19L	PR D99 032001	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	15H	PR D91 052017	M. Ablikim et al.	(BESIII Collab.)
LEES	12F	PR D86 012008	J.P. Lees et al.	(BABAR Collab.)
ABLIKIM	10C	PL B685 27	M. Ablikim et al.	(BES II Collab.)
SHEN	09	PR D80 031101	C.P. Shen et al.	(BELLE Collab.)
ABLIKIM	08F	PRL 100 102003	M. Ablikim et al.	(BES Collab.)
AUBERT	08S	PR D77 092002	B. Aubert et al.	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert et al.	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert et al.	(BABAR Collab.)