

$\Lambda(1670) \ 1/2^-$ $I(J^P) = 0(\frac{1}{2}^-)$ Status: ****

The measurements of the mass, width, and elasticity published before 1974 are now obsolete and have been omitted. They were last listed in our 1982 edition Physics Letters **111B** 1 (1982).

$\Lambda(1670)$ POLE POSITIONS

REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1670 to 1678 (≈ 1674) OUR ESTIMATE			
1676 ± 2	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1669 $\begin{smallmatrix} +3 \\ -8 \end{smallmatrix}$	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
1677.5 ± 0.8	GARCIA-REC...03		DPWA $\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1667	ZHANG	13A	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

-2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
28 to 36 (≈ 32) OUR ESTIMATE			
33 ± 4	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
19 $\begin{smallmatrix} +18 \\ -2 \end{smallmatrix}$	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
29.2 ± 1.4	GARCIA-REC...03		DPWA $\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
26	ZHANG	13A	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

$\Lambda(1670)$ POLE RESIDUES

The normalized residue is the residue divided by $\Gamma_{pole}/2$.

Normalized residue in $\bar{K}N \rightarrow \Lambda(1670) \rightarrow \bar{K}N$

MODULUS	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
0.30 ± 0.06	-145 ± 11	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.351	164	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Sigma\pi$

MODULUS	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
0.19 ± 0.06	145 ± 14	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.327	125	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Lambda\eta$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.26 \pm 0.09	104 \pm 14	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.474	59	¹ KAMANO 15	DPWA	Multichannel

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

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Xi K$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.02 \pm 0.02	100 \pm 25	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Lambda\omega, S=1/2, S\text{-wave}$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.09 \pm 0.04	-60 \pm 35	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Lambda\omega, S=3/2, D\text{-wave}$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.05 \pm 0.04		SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow N\bar{K}^*(892), S=1/2, S\text{-wave}$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.31 \pm 0.14	100 \pm 45	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow N\bar{K}^*(892), S=3/2, D\text{-wave}$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.06 \pm 0.03	-85 \pm 40	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Lambda\sigma$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.25 \pm 0.08	160 \pm 15	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Sigma(1385)\pi$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13 \pm 0.06	110 \pm 12	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

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

0.0988 -104 ¹KAMANO 15 DPWA Multichannel

¹From the preferred solution A in KAMANO 15.

 $\Lambda(1670)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1670 to 1678 (\approx 1674) OUR ESTIMATE			
1674.3 \pm 0.8 \pm 4.9	LEE	21A	BELL $\Lambda_C^+ \rightarrow \Lambda(1670)\pi^+$
1677 \pm 2	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1672 \pm 3	ZHANG	13A	DPWA Multichannel
1670.8 \pm 1.7	KOISO	85	DPWA $K^-p \rightarrow \Sigma\pi$
1667 \pm 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$

1671 ± 3	ALSTON-...	78	DPWA	$\bar{K}N \rightarrow \bar{K}N$
1675 ± 2	HEPP	76B	DPWA	$K^- N \rightarrow \Sigma \pi$
1679 ± 1	KANE	74	DPWA	$K^- p \rightarrow \Sigma \pi$
1665 ± 5	PREVOST	74	DPWA	$K^- N \rightarrow \Sigma(1385)\pi$

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

1673 ± 2	MANLEY	02	DPWA	$\bar{K}N$ multichannel
1668.9 ± 2.0	ABAEV	96	DPWA	$K^- p \rightarrow \Lambda \eta$
1670 ± 5	GOPAL	77	DPWA	$\bar{K}N$ multichannel
1664	¹ MARTIN	77	DPWA	$\bar{K}N$ multichannel

¹MARTIN 77 obtains identical resonance parameters from a T-matrix pole and from a Breit-Wigner fit.

$\Lambda(1670)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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25 to 35 (≈ 30) OUR ESTIMATE

36.1 ± 2.4 ± 4.8	LEE	21A	BELL	$\Lambda_C^+ \rightarrow \Lambda(1670)\pi^+$
33 ± 4	SARANTSEV	19	DPWA	$\bar{K}N$ multichannel
29 ± 5	ZHANG	13A	DPWA	$\bar{K}N$ multichannel
34.1 ± 3.7	KOISO	85	DPWA	$K^- p \rightarrow \Sigma \pi$
29 ± 5	GOPAL	80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
29 ± 5	ALSTON-...	78	DPWA	$\bar{K}N \rightarrow \bar{K}N$
46 ± 5	HEPP	76B	DPWA	$K^- N \rightarrow \Sigma \pi$
40 ± 3	KANE	74	DPWA	$K^- p \rightarrow \Sigma \pi$
19 ± 5	PREVOST	74	DPWA	$K^- N \rightarrow \Sigma(1385)\pi$

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

23 ± 6	MANLEY	02	DPWA	$\bar{K}N$ multichannel
21.1 ± 3.6	ABAEV	96	DPWA	$K^- p \rightarrow \Lambda \eta$
45 ± 10	GOPAL	77	DPWA	$\bar{K}N$ multichannel
12	¹ MARTIN	77	DPWA	$\bar{K}N$ multichannel

¹MARTIN 77 obtains identical resonance parameters from a T-matrix pole and from a Breit-Wigner fit.

$\Lambda(1670)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\bar{K}$	20–30 %
Γ_2 $\Sigma \pi$	25–55 %
Γ_3 $\Lambda \eta$	10–25 %
Γ_4 $\Sigma(1385)\pi$, <i>D</i> -wave	(6.0 ± 2.0) %
Γ_5 $N\bar{K}^*(892)$, <i>S</i> =1/2, <i>S</i> -wave	
Γ_6 $N\bar{K}^*(892)$, <i>S</i> =3/2, <i>D</i> -wave	(5 ± 4) %
Γ_7 $\Lambda \sigma$	(20 ± 8) %

$\Lambda(1670)$ BRANCHING RATIOS

See “Sign conventions for resonance couplings” in the Note on Λ and Σ Resonances.

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$ Γ_1/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.20 to 0.30 OUR ESTIMATE			
0.33 \pm 0.07	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.26 \pm 0.25	ZHANG 13A	DPWA	$\bar{K}N$ multichannel
0.18 \pm 0.03	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.17 \pm 0.03	ALSTON-...	78 DPWA	$\bar{K}N \rightarrow \bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.318	¹ KAMANO 15	DPWA	$\bar{K}N$ multichannel
0.37 \pm 0.07	MANLEY 02	DPWA	$\bar{K}N$ multichannel
0.20 \pm 0.03	GOPAL 77	DPWA	See GOPAL 80
0.15	² MARTIN 77	DPWA	$\bar{K}N$ multichannel

¹ From the preferred solution A in KAMANO 15.² MARTIN 77 obtains identical resonance parameters from a T-matrix pole and from a Breit-Wigner fit. $\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.12 \pm 0.03	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.289	¹ KAMANO 15	DPWA	Multichannel

¹ From the preferred solution A in KAMANO 15. $\Gamma(\Lambda\eta)/\Gamma_{\text{total}}$ Γ_3/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.20 \pm 0.08	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.373	KAMANO 15	DPWA	Multichannel
0.30 \pm 0.08	ABAEV 96	DPWA	$K^- p \rightarrow \Lambda\eta$

 $\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{\text{total}}$ Γ_4/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.06 \pm 0.02	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.019	KAMANO 15	DPWA	Multi-channel

 $\Gamma(\Lambda\sigma)/\Gamma_{\text{total}}$ Γ_7/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.20 \pm 0.08	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

 $\Gamma(N\bar{K}^*(892), S=1/2, S\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	¹ KAMANO 15	DPWA	Multichannel

¹ Not seen in the preferred solution A in KAMANO 15. $\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_6/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.05 \pm 0.04	ZHANG 13A	DPWA	Multichannel

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

not seen ¹ KAMANO 15 DPWA Multichannel

¹ Not seen in the preferred solution A in KAMANO 15.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Sigma \pi$ $(\Gamma_1 \Gamma_2)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.29 ± 0.06	ZHANG	13A	DPWA Multichannel
-0.26 ± 0.02	KOISO	85	DPWA $K^- p \rightarrow \Sigma \pi$
-0.31 ± 0.03	GOPAL	77	DPWA $\bar{K} N$ multichannel
-0.29 ± 0.03	HEPP	76B	DPWA $K^- N \rightarrow \Sigma \pi$
-0.23 ± 0.03	LONDON	75	HLBC $K^- p \rightarrow \Sigma^0 \pi^0$
-0.27 ± 0.02	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$

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

-0.38 ± 0.03 MANLEY 02 DPWA $\bar{K} N$ multichannel
 -0.13 ¹ MARTIN 77 DPWA $\bar{K} N$ multichannel

¹ MARTIN 77 obtains identical resonance parameters from a T-matrix pole and from a Breit-Wigner fit.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Lambda \eta$ $(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.30 ± 0.10	ZHANG	13A	DPWA Multichannel
$+0.20 \pm 0.05$	BAXTER	73	DPWA $K^- p \rightarrow$ neutrals

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

$+0.24 \pm 0.04$ MANLEY 02 DPWA $\bar{K} N$ multichannel
 0.24 KIM 71 DPWA K-matrix analysis
 0.26 ARMENTEROS69C HBC
 0.20 or 0.23 BERLEY 65 HBC

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1670) \rightarrow \Sigma(1385)\pi$, D-wave $(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.17 ± 0.06	MANLEY	02	DPWA $\bar{K} N$ multichannel
-0.18 ± 0.05	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$

Λ(1670) REFERENCES

LEE	21A	PR D103 052005	J.Y. Lee <i>et al.</i>	(BELLE Collab.)
SARANTSEV	19	EPJ A55 180	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
KAMANO	15	PR C92 025205	H. Kamano <i>et al.</i>	(ANL, OSAK)
ZHANG	13A	PR C88 035205	H. Zhang <i>et al.</i>	(KSU)
GARCIA-REC...	03	PR D67 076009	C. Garcia-Recio <i>et al.</i>	(GRAN, VALE)
MANLEY	02	PRL 88 012002	D.M. Manley <i>et al.</i>	(BNL Crystal Ball Collab.)
ABAEV	96	PR C53 385	V.V. Abaev, B.M.K. Nefkens	(UCLA)
KOISO	85	NP A433 619	H. Koiso <i>et al.</i>	(TOKY, MASA)
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
ALSTON-...	78	PR D18 182	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
Also		PRL 38 1007	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
GOPAL	77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
MARTIN	77	NP B127 349	B.R. Martin, M.K. Pidcock, R.G. Moorhouse	(LOUC+) IJP
Also		NP B126 266	B.R. Martin, M.K. Pidcock	(LOUC)
Also		NP B126 285	B.R. Martin, M.K. Pidcock	(LOUC) IJP

HEPP	76B	PL 65B 487	V. Hepp <i>et al.</i>	(CERN, HEIDH, MPIM) IJP
LONDON	75	NP B85 289	G.W. London <i>et al.</i>	(BNL, CERN, EPOL+)
KANE	74	LBL-2452	D.F. Kane	(LBL) IJP
PREVOST	74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID)
BAXTER	73	NP B67 125	D.F. Baxter <i>et al.</i>	(OXF) IJP
KIM	71	PRL 27 356	J.K. Kim	(HARV) IJP
Also		Duke Conf. 161	J.K. Kim	(HARV) IJP
Hyperon Resonances,		1970		
ARMENTEROS	69C	Lund Paper 229	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) IJP
Values are quoted		in LEVI-SETTI 69.		
BERLEY	65	PRL 15 641	D. Berley <i>et al.</i>	(BNL) IJP
