

$\Lambda(1830) \ 5/2^-$ $I(J^P) = 0(\frac{5}{2}^-)$ Status: ****

For results published before 1973 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

The best evidence for this resonance is in the $\Sigma\pi$ channel.

$\Lambda(1830)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

1800 to 1860 (≈ 1830) OUR ESTIMATE

1819.5 \pm 3.0	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1899 $\begin{smallmatrix} +35 \\ -37 \end{smallmatrix}$	¹ KAMANO	15	DPWA Multichannel

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

1766 $\begin{smallmatrix} +37 \\ -34 \end{smallmatrix}$	² KAMANO	15	DPWA Multichannel
1809	ZHANG	13A	DPWA Multichannel

¹The preferred solution A in KAMANO 15 reports two poles. This entry is from the preferred solution A.

²From the preferred solution A in KAMANO 15. Not seen in solution B.

-2 \times IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

50 to 80 (≈ 65) OUR ESTIMATE

62 \pm 5	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
80 $\begin{smallmatrix} +100 \\ -34 \end{smallmatrix}$	¹ KAMANO	15	DPWA Multichannel

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

212 $\begin{smallmatrix} +94 \\ -62 \end{smallmatrix}$	² KAMANO	15	DPWA Multichannel
109	ZHANG	13A	DPWA Multichannel

¹The preferred solution A in KAMANO 15 reports two poles. This entry is from the preferred solution A.

²From the preferred solution A in KAMANO 15. Not seen in solution B.

$\Lambda(1830)$ POLE RESIDUES

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

Normalized residue in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow N\bar{K}$

MODULUS	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
---------	--------------------	-------------	------	---------

0.055 \pm 0.010	20 \pm 14	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-------------------------------------	-------------------------------	-----------	----	------------------------------

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

0.00502	-80	¹ KAMANO	15	DPWA Multichannel
---------	-----	---------------------	----	-------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Sigma\pi$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.15 \pm0.03	180 \pm 10	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.00581	179	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Lambda\eta$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.00941	-65	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Xi K$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.010 \pm0.005	65 \pm 20	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.0477	94	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Sigma(1385)\pi$, D-wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.10 \pm0.04	10 \pm 25	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.0237	113	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Sigma(1385)\pi$, G-wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.03 \pm0.02		SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.000726	127	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow N\bar{K}^*(892)$, S=1/2, D-wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0278	-177	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow N\bar{K}^*(892)$, S=3/2, D-wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0255	3	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 $N\bar{K} \rightarrow \Lambda(1830) \rightarrow N\bar{K}^*(892)$, $S=3/2$, G -wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
----------------	------------------------------------	--------------------	-------------	----------------

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

0.00773	-17	¹ KAMANO	15	DPWA Multichannel
---------	-----	---------------------	----	-------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Lambda\omega$, $S=1/2$, D -wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
----------------	------------------------------------	--------------------	-------------	----------------

0.04±0.03		SARANTSEV	19	DPWA $\bar{K}N$ multichannel
------------------	--	-----------	----	------------------------------

Normalized residue in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Lambda\omega$, $S=3/2$, D -wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
----------------	------------------------------------	--------------------	-------------	----------------

0.05±0.03	-110 ± 35	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
------------------	------------------	-----------	----	------------------------------

$\Lambda(1830)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------	--------------------	-------------	----------------

1820 to 1830 (\approx 1825) OUR ESTIMATE

1821 ± 3	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1820 ± 4	ZHANG	13A	DPWA Multichannel
1831 ± 10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1825 ± 10	GOPAL	77	DPWA $\bar{K}N$ multichannel
1825 ± 1	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$

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

1817 or 1818	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
--------------	---------------------	----	------------------------------

¹The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

$\Lambda(1830)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------------	--------------------	-------------	----------------

60 to 120 (\approx 90) OUR ESTIMATE

64 ± 7	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
114 ± 10	ZHANG	13A	DPWA Multichannel
100 ± 10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
94 ± 10	GOPAL	77	DPWA $\bar{K}N$ multichannel
119 ± 3	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$

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

56 or 56	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
----------	---------------------	----	------------------------------

¹The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

$\Lambda(1830)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 $N\bar{K}$	0.04 to 0.08	
Γ_2 $\Sigma\pi$	35–75 %	
Γ_3 ΞK		
Γ_4 $\Sigma(1385)\pi$	>15 %	
Γ_5 $\Sigma(1385)\pi$, <i>D</i> -wave	(40 \pm 15) %	3.2
Γ_6 $\Sigma(1385)\pi$, <i>G</i> -wave		
Γ_7 $\Lambda\eta$		
Γ_8 $N\bar{K}^*(892)$, <i>S</i> =1/2, <i>D</i> -wave		
Γ_9 $N\bar{K}^*(892)$, <i>S</i> =3/2, <i>D</i> -wave		
Γ_{10} $N\bar{K}^*(892)$, <i>S</i> =3/2, <i>G</i> -wave		

 $\Lambda(1830)$ 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>
0.04 to 0.08 OUR ESTIMATE			
0.055 \pm 0.010	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.041 \pm 0.005	ZHANG 13A	DPWA	Multichannel
0.08 \pm 0.03	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.02 \pm 0.02	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.006	¹ KAMANO 15	DPWA	Multichannel
0.04 \pm 0.03	GOPAL 77	DPWA	See GOPAL 80
0.04 or 0.04	² MARTIN 77	DPWA	$\bar{K}N$ multichannel

¹ From the preferred solution A in KAMANO 15.

² The two MARTIN 77 values are 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>
0.42 \pm 0.08	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.017	¹ KAMANO 15	DPWA	Multichannel

¹ From the preferred solution A in KAMANO 15.

 $\Gamma(\Xi K)/\Gamma_{\text{total}}$ Γ_3/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. ● ● ●			
0.562	¹ KAMANO 15	DPWA	Multichannel

¹ From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.40 ±0.15 OUR AVERAGE Error	includes scale factor of 3.2.		
0.20 ±0.08	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
0.52 ±0.06	ZHANG	13A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.134	¹ KAMANO	15	DPWA Multichannel
¹ From the preferred solution A in KAMANO 15.			

$\Gamma(\Sigma(1385)\pi, G\text{-wave})/\Gamma_{\text{total}}$ Γ_6/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.020 ±0.015	SARANTSEV	19	DPWA $\bar{K}N$ multichannel

$\Gamma(\Lambda\eta)/\Gamma_{\text{total}}$ Γ_7/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. • • •			
0.024	¹ KAMANO	15	DPWA Multichannel
¹ From the preferred solution A in KAMANO 15.			

$\Gamma(N\bar{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_8/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. • • •			
0.134	¹ KAMANO	15	DPWA Multichannel
¹ From the preferred solution A in KAMANO 15.			

$\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_9/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. • • •			
0.115	¹ KAMANO	15	DPWA Multichannel
¹ From the preferred solution A in KAMANO 15.			

$\Gamma(N\bar{K}^*(892), S=3/2, G\text{-wave})/\Gamma_{\text{total}}$ Γ_{10}/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. • • •			
0.009	¹ KAMANO	15	DPWA Multichannel
¹ From the preferred solution A in KAMANO 15.			

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Sigma\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.13 ±0.01	ZHANG	13A	DPWA Multichannel
-0.17 ±0.03	GOPAL	77	DPWA $\bar{K}N$ multichannel
-0.15 ±0.01	KANE	74	DPWA $K^-p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.17 or -0.17	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
¹ The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.			

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Sigma(1385)\pi$ $(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.20 to 0.50 OUR ESTIMATE

+0.141 ± 0.014	¹ CAMERON	78	DPWA $K^- p \rightarrow \Sigma(1385)\pi$
+0.13 ± 0.03	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$

¹ The CAMERON 78 upper limit on G-wave decay is 0.03. The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1830) \rightarrow \Lambda\eta$ $(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN
-0.044 ± 0.020	RADER	73 MPWA

$\Lambda(1830)$ REFERENCES

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)
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
CAMERON	78	NP B143 189	W. Cameron <i>et al.</i>	(RHEL, LOIC) 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
KANE	74	LBL-2452	D.F. Kane	(LBL) IJP
PREVOST	74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID)
RADER	73	NC 16A 178	R.K. Rader <i>et al.</i>	(SACL, HEID, CERN+)