

$\Lambda(1820) \ 5/2^+$ $I(J^P) = 0(\frac{5}{2}^+)$ Status: * * * *

This resonance is the cornerstone for all partial-wave analyses in this region. Most of the results published before 1973 are now obsolete and have been omitted. They may be found in our 1982 edition Physics Letters **111B** 1 (1982).

 $\Lambda(1820)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1812 to 1825 (\approx 1818) OUR ESTIMATE			
1813 \pm 3	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1824 $^{+2}_{-1}$	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1814	ZHANG	13A	DPWA $\bar{K}N$ multichannel
¹ From the preferred solution A in KAMANO 15.			

–2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
75 to 80 (\approx 77) OUR ESTIMATE			
78 \pm 7	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
77 \pm 2	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
85	ZHANG	13A	DPWA $\bar{K}N$ multichannel
¹ From the preferred solution A in KAMANO 15.			

 $\Lambda(1820)$ POLE RESIDUES

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

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.60 \pm 0.12	–22 \pm 5	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.558	–13	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
¹ From the preferred solution A in KAMANO 15.				

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma\pi$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.34 \pm 0.07	174 \pm 5	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.357	168	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
¹ From the preferred solution A in KAMANO 15.				

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$

<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. • • •

0.0184	-3	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
--------	----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Xi K$

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

~ 0

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

0.00111	70	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
---------	----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$, P -wave

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

0.07 \pm 0.02	-60 \pm 50	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-----------------------------------	--------------------------------	-----------	----	------------------------------

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

0.340	161	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
-------	-----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$, F -wave

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

0.11 \pm 0.04	5 \pm 45	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-----------------------------------	------------------------------	-----------	----	------------------------------

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

0.201	151	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
-------	-----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$, $S=1/2$, F -wave

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

0.02 \pm 0.02		SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-----------------------------------	--	-----------	----	------------------------------

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

0.00750	41	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
---------	----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$, $S=3/2$, P -wave

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

0.35 \pm 0.15	-30 \pm 45	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-----------------------------------	--------------------------------	-----------	----	------------------------------

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

0.171	-139	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
-------	------	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$, $S=3/2$, F -wave

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

0.02 \pm 0.02		SARANTSEV	19	DPWA $\bar{K}N$ multichannel
-----------------------------------	--	-----------	----	------------------------------

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

0.000517	161	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
----------	-----	---------------------	----	------------------------------

¹From the preferred solution A in KAMANO 15. **$\Lambda(1820)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1815 to 1825 (≈ 1820) OUR ESTIMATE			
1822 ± 4	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1823.5 ± 0.8	ZHANG	13A	DPWA $\bar{K}N$ multichannel
1823 ± 3	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1819 ± 2	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
1821 ± 2	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1830	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
1822 ± 2	GOPAL	77	DPWA $\bar{K}N$ multichannel
1817 or 1819	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. **$\Lambda(1820)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
70 to 90 (≈ 80) OUR ESTIMATE			
80 ± 8	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
89 ± 2	ZHANG	13A	DPWA $\bar{K}N$ multichannel
77 ± 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
72 ± 5	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
87 ± 3	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
82	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
81 ± 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
76 or 76	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. **$\Lambda(1820)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\bar{K}$	55–65 %
Γ_2 $\Sigma \pi$	8–14 %
Γ_3 $\Sigma(1385)\pi$	5–10 %
Γ_4 $\Sigma(1385)\pi$, <i>P</i> -wave	
Γ_5 $\Sigma(1385)\pi$, <i>F</i> -wave	(2.0 \pm 1.0) %
Γ_6 $\Lambda\eta$	
Γ_7 ΞK	
Γ_8 $\Sigma \pi \pi$	
Γ_9 $N\bar{K}^*(892)$, <i>S</i> =1/2, <i>F</i> -wave	
Γ_{10} $N\bar{K}^*(892)$, <i>S</i> =3/2, <i>P</i> -wave	(3.0 \pm 1.0) %
Γ_{11} $N\bar{K}^*(892)$, <i>S</i> =3/2, <i>F</i> -wave	

$\Lambda(1820)$ BRANCHING RATIOS

Errors quoted do not include uncertainties in the parametrizations used in the partial-wave analyses and are thus too small. See also "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>
0.55 to 0.65 OUR ESTIMATE			
0.58 \pm 0.12	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
0.54 \pm 0.01	ZHANG	13A	DPWA $\bar{K}N$ multichannel
0.58 \pm 0.02	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
0.60 \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. • • •			
0.547	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel
0.51	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
0.57 \pm 0.02	GOPAL	77	DPWA See GOPAL 80
0.59 or 0.58	² MARTIN	77	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

²The 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>
0.19 \pm0.04			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.218	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
\sim 0.01	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.173	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.02 \pm0.01			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.055	¹ KAMANO	15	DPWA $\bar{K}N$ multichannel

¹From the preferred solution A in KAMANO 15.

 $\Gamma(\Lambda\eta)/\Gamma_{\text{total}}$ Γ_6/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. • • •			
0.001	¹ KAMANO	15	DPWA Multichannel

¹From the preferred solution A in KAMANO 15.

$\Gamma(\Xi K)/\Gamma_{\text{total}}$ 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. • • •

not seen ¹ KAMANO 15 DPWA Multichannel¹ From the preferred solution A in KAMANO 15. $\Gamma(\Sigma \pi \pi)/\Gamma_{\text{total}}$ Γ_8/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

no clear signal ¹ ARMENTEROS68C HDBC $K^- N \rightarrow \Sigma \pi \pi$ ¹ There is a suggestion of a bump, enough to be consistent with what is expected from $\Sigma(1385) \rightarrow \Sigma \pi$ decay. $\Gamma(N\bar{K}^*(892), S=1/2, F\text{-wave})/\Gamma_{\text{total}}$ 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. • • •

not seen ¹ KAMANO 15 DPWA Multichannel¹ From the preferred solution A in KAMANO 15. $\Gamma(N\bar{K}^*(892), S=3/2, P\text{-wave})/\Gamma_{\text{total}}$ Γ_{10}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

0.03 ± 0.01 ZHANG 13A DPWA Multichannel

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

0.006 ¹ KAMANO 15 DPWA Multichannel¹ From the preferred solution A in KAMANO 15. $\Gamma(N\bar{K}^*(892), S=3/2, F\text{-wave})/\Gamma_{\text{total}}$ Γ_{11}/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 Multichannel¹ From the preferred solution A in KAMANO 15. $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma \pi$ $(\Gamma_1 \Gamma_2)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

−0.28 ± 0.01 ZHANG 13A DPWA Multichannel

−0.28 ± 0.03 GOPAL 77 DPWA $\bar{K} N$ multichannel−0.28 ± 0.01 KANE 74 DPWA $K^- p \rightarrow \Sigma \pi$

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

−0.25 or −0.25 ¹ MARTIN 77 DPWA $\bar{K} N$ multichannel¹ 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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi, P\text{-wave}$ $(\Gamma_1 \Gamma_4)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

−0.20 ± 0.02 ZHANG 13A DPWA Multichannel

−0.167 ± 0.054 ¹ CAMERON 78 DPWA $K^- p \rightarrow \Sigma(1385)\pi$ +0.27 ± 0.03 PREVOST 74 DPWA $K^- N \rightarrow \Sigma(1385)\pi$ ¹ 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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$, F-wave	$(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$+0.065 \pm 0.029$	¹ CAMERON 78 DPWA $K^- p \rightarrow \Sigma(1385)\pi$

¹ 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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$	$(\Gamma_1 \Gamma_6)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN
$-0.096^{+0.040}_{-0.020}$	RADER 73 MPWA

$\Lambda(1820)$ 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
DECLAIS 77	CERN 77-16	Y. Declais <i>et al.</i>	(CAEN, CERN) 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+)
ARMENTEROS 68C	NP B8 216	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) I