$\Lambda(1820)$ $5/2^+$

$I(J^P) = 0(\frac{5}{2}^+)$ 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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1812 to 1825 (≈ 1818) OUR ESTIMATE				
1813±3	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
1824^{+2}_{-1}	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1814	ZHANG	13A	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
75 to 80 (≈ 77) OUR ESTIMATE				
78±7	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
77±2	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
85	ZHANG	13A	DPWA	$\overline{K}N$ 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 $N\overline{K} \rightarrow \Lambda(1820) \rightarrow N\overline{K}$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.60 ±0.12	**−22 ± 5**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.558	−13	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.34 ±0.07	**174 ± 5**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.357	168	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0184	−3	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
∼ 0		SARANTSEV 19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.00111	70	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
0.07 ±0.02	**−60 ± 50**	SARANTSEV 19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.340	161	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
0.11 ±0.04	**5 ± 45**	SARANTSEV 19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.201	151	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
0.02 ±0.02		SARANTSEV 19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.00750	41	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
0.35 ±0.15	**−30 ± 45**	SARANTSEV 19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.171	−139	[1] KAMANO 15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.02 ±0.02		SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.000517	161	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From 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	$\overline{K}N$ multichannel
1823.5±0.8	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
1823 ±3	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
1819 ±2	ALSTON-...	78	DPWA	$\overline{K}N \rightarrow \overline{K}N$
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	$\overline{K}N \rightarrow \overline{K}N$
1822 ±2	GOPAL	77	DPWA	$\overline{K}N$ multichannel
1817 or 1819	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel

[1] The 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	$\overline{K}N$ multichannel
89±2	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
77±5	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
72±5	ALSTON-...	78	DPWA	$\overline{K}N \rightarrow \overline{K}N$
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	$\overline{K}N \rightarrow \overline{K}N$
81±5	GOPAL	77	DPWA	$\overline{K}N$ multichannel
76 or 76	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel

[1] The 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	$N\overline{K}$	55–65 %
Γ_2	$\Sigma\pi$	8–14 %
Γ_3	$\Sigma(1385)\pi$	5–10 %
Γ_4	$\Sigma(1385)\pi$, P-wave	
Γ_5	$\Sigma(1385)\pi$, F-wave	(2.0±1.0) %

Γ_6	$\Lambda\eta$	
Γ_7	ΞK	
Γ_8	$\Sigma\pi\pi$	
Γ_9	$N\overline{K}^*(892)$, S=1/2, F-wave	
Γ_{10}	$N\overline{K}^*(892)$, S=3/2, P-wave	(3.0±1.0) %
Γ_{11}	$N\overline{K}^*(892)$, S=3/2, F-wave	

Λ(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.

$\Gamma(N\overline{K})/\Gamma_{total}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.55 to 0.65 OUR ESTIMATE				
0.58 ±0.12	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
0.54 ±0.01	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
0.58 ±0.02	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
0.60 ±0.03	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.547	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel
0.51	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
0.57 ±0.02	GOPAL	77	DPWA	See GOPAL 80
0.59 or 0.58	[2] MARTIN	77	DPWA	$\overline{K}N$ 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.

$\Gamma(\Sigma\pi)/\Gamma_{total}$ — Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.19 ±0.04	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.218	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

VALUE	DOCUMENT ID		TECN	COMMENT
~ 0.01	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.173	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.02 ±0.01	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.055	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Lambda\eta)/\Gamma_{total}$ — Γ_6/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.001	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Xi K)/\Gamma_{total}$ — Γ_7/Γ

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

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma\pi\pi)/\Gamma_{total}$ — Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
no clear signal	[1] ARMENTEROS	68C	HDBC	$K^- N \to \Sigma\pi\pi$

[1] There is a suggestion of a bump, enough to be consistent with what is expected from $\Sigma(1385) \to \Sigma\pi$ decay.

$\Gamma(N\overline{K}^*(892), S=1/2, F\text{-wave})/\Gamma_{total}$ — Γ_9/Γ

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

[1] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, P\text{-wave})/\Gamma_{total}$ — Γ_{10}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
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	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, F\text{-wave})/\Gamma_{total}$ — Γ_{11}/Γ

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

[1] From the preferred solution A in KAMANO 15.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1820) \to \Sigma\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.28 ± 0.01	ZHANG	13A	DPWA	Multichannel
-0.28 ± 0.03	GOPAL	77	DPWA	$\overline{K}N$ multichannel
-0.28 ± 0.01	KANE	74	DPWA	$K^- p \to \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.25 or -0.25	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel

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

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1820) \to \Sigma(1385)\pi$, P-wave — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.20 ± 0.02	ZHANG	13A	DPWA	Multichannel
-0.167 ± 0.054	[1] CAMERON	78	DPWA	$K^- p \to \Sigma(1385)\pi$
$+0.27 \pm 0.03$	PREVOST	74	DPWA	$K^- N \to \Sigma(1385)\pi$

[1] The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1820) \to \Sigma(1385)\pi$, F-wave — $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.065 \pm 0.029$	[1] CAMERON	78	DPWA	$K^- p \to \Sigma(1385)\pi$

[1] The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1820) \to \Lambda\eta$ — $(\Gamma_1\Gamma_6)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN
$-0.096^{+0.040}_{-0.020}$	RADER	73	MPWA

$\Lambda(1820)$ REFERENCES

SARANTSEV	19	EPJ A55 180	A.V. Sarantsev et al.	(BONN, PNPI)
KAMANO	15	PR C92 025205	H. Kamano et al.	(ANL, OSAK)
ZHANG	13A	PR C88 035205	H. Zhang et al.	(KSU)
PDG	82	PL 111B 1	M. Roos et al.	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
ALSTON-...	78	PR D18 182	M. Alston-Garnjost et al.	(LBL, MTHO+) IJP
Also		PRL 38 1007	M. Alston-Garnjost et al.	(LBL, MTHO+) IJP
CAMERON	78	NP B143 189	W. Cameron et al.	(RHEL, LOIC) IJP
DECLAIS	77	CERN 77-16	Y. Declais et al.	(CAEN, CERN) IJP
GOPAL	77	NP B119 362	G.P. Gopal et al.	(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 et al.	(SACL, CERN, HEID)
RADER	73	NC 16A 178	R.K. Rader et al.	(SACL, HEID, CERN+)
ARMENTEROS	68C	NP B8 216	R. Armenteros et al.	(CERN, HEID, SACL) I