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

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

$-2\times$IMAGINARY PART

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
75 to 80 ($\approx$ 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 $N\overline{K} \to \Lambda(1820) \to N\overline{K}$

MODULUS	PHASE (°)		DOCUMENT ID		TECN	COMMENT
0.60 $\pm$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 $N\overline{K} \to \Lambda(1820) \to \Sigma\pi$

MODULUS	PHASE (°)		DOCUMENT ID		TECN	COMMENT
0.34 $\pm$0.07	**174 $\pm$ 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 $N\overline{K} \to \Lambda(1820) \to \Lambda\eta$

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 $N\overline{K} \to \Lambda(1820) \to \Xi K$

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 $N\overline{K} \to \Lambda(1820) \to \Sigma(1385)\pi$, *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 $N\overline{K} \to \Lambda(1820) \to \Sigma(1385)\pi$, *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 $N\overline{K} \to \Lambda(1820) \to N\overline{K}{}^*(892)$, $S{=}1/2$, *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 $N\overline{K} \to \Lambda(1820) \to N\overline{K}{}^*(892)$, $S{=}3/2$, *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 $N\overline{K} \to \Lambda(1820) \to N\overline{K}{}^*(892)$, $S{=}3/2$, *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 ($\approx$ 1820) OUR ESTIMATE				
1822 $\pm$4	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
1823.5$\pm$0.8	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
1823 $\pm$3	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
1819 $\pm$2	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
1821 $\pm$2	KANE	74	DPWA	$K^- p \to \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1830	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
1822 $\pm$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 ($\approx$ 80) OUR ESTIMATE				
80$\pm$8	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
89$\pm$2	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
77$\pm$5	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
72$\pm$5	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
87$\pm$3	KANE	74	DPWA	$K^- p \to \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
82	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
81$\pm$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$\pm$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	

$\Lambda(1820)$ 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.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.55 to 0.65 OUR ESTIMATE				
$0.58\ \pm0.12$	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
$0.54\ \pm0.01$	ZHANG	13A	DPWA	$\overline{K}N$ multichannel
$0.58\ \pm0.02$	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
$0.60\ \pm0.03$	ALSTON-...	78	DPWA	$\overline{K}N \rightarrow \overline{K}N$
• • • 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	$\overline{K}N \rightarrow \overline{K}N$
$0.57\ \pm0.02$	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 $\pm$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.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.02 $\pm$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.

$\Gamma(\Lambda\eta)/\Gamma_{total}$ $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 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.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
no clear signal	[1] ARMENTEROS68C		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.

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

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

$\Gamma(N\overline{K}{}^*(892), S=3/2, F\text{-wave})/\Gamma_{total}$ $\qquad\qquad\qquad$ 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 $N\overline{K} \to \Lambda(1820) \to \Sigma\pi$ $\qquad$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

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.

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

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.

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

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.

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

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