

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

Most of the quoted errors are statistical only; the systematic errors due to the particular parametrizations used in the partial-wave analyses are not included. For this reason we do not calculate weighted averages for the mass and width.

$\Lambda(1820)$ POLE POSITION

REAL PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1824^{+2}_{-1}	¹ KAMANO	15	DPWA Multichannel
1814	ZHANG	13A	DPWA Multichannel

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

¹From the preferred solution A in KAMANO 15.

−2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
77 ± 2	¹ KAMANO	15	DPWA Multichannel
85	ZHANG	13A	DPWA Multichannel

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

¹From 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 (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.558	−13	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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma\pi$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.357	168	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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$

<u>MODULUS</u>	<u>PHASE ($^{\circ}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0184	-3	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.00111	70	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.340	161	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.201	151	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.00750	41	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.171	-139	¹ KAMANO	15	DPWA Multichannel
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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>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.000517	161	¹ KAMANO	15	DPWA Multichannel
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¹From the preferred solution A in KAMANO 15.

$\Lambda(1820)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1815 to 1825 (≈ 1820) OUR ESTIMATE			
1823.5 \pm 0.8	ZHANG	13A	DPWA Multichannel
1823 \pm 3	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1819 \pm 2	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
1822 \pm 2	GOPAL	77	DPWA $\bar{K}N$ multichannel
1821 \pm 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 $\bar{K}N \rightarrow \bar{K}N$
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			
89 \pm 2	ZHANG	13A	DPWA Multichannel
77 \pm 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
72 \pm 5	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
81 \pm 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
87 \pm 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 $\bar{K}N \rightarrow \bar{K}N$
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	
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			
0.54 \pm 0.01	ZHANG	13A	DPWA 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 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

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>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.218	¹ KAMANO	15	DPWA Multichannel

¹ From 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>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.173	¹ KAMANO	15	DPWA Multichannel

¹ From 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>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.055	¹ KAMANO	15	DPWA Multichannel

¹ From 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

¹ From 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 Multichannel

¹ 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 Multichannel

¹ 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 Multichannel

¹ 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 Multichannel

¹ From the preferred solution A in KAMANO 15.

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

<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 $\bar{K}N$ 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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi, P\text{-wave}$ $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

<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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi, F\text{-wave}$ $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
+0.065 ± 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 $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$	DOCUMENT ID	TECN	$(\Gamma_1 \Gamma_6)^{1/2} / \Gamma$
VALUE			
$-0.096^{+0.040}_{-0.020}$	RADER	73	MPWA

$\Lambda(1820)$ REFERENCES

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