

$\Lambda(1810) \ 1/2^+$  $I(J^P) = 0(\frac{1}{2}^+)$  Status: \*\*\*

Almost all the recent analyses contain a  $P_{01}$  state, and sometimes two of them, but the masses, widths, and branching ratios vary greatly. See also the  $\Lambda(1600) \ P_{01}$ .

 **$\Lambda(1810)$  POLE POSITION****REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2097 <sup>+40</sup> <sub>-1</sub>	<sup>1</sup> KAMANO	15	DPWA Multichannel
1780	ZHANG	13A	DPWA Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15. Solution B reports  $M = 1841^{+3}_{-4}$  MeV.

**-2×IMAGINARY PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
166 <sup>+64</sup> <sub>-12</sub>	<sup>1</sup> KAMANO	15	DPWA Multichannel
64	ZHANG	13A	DPWA Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15. Solution B Reports  $\Gamma = 62^{+6}_{-4}$  MeV.

 **$\Lambda(1810)$  POLE RESIDUES**

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

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow N\bar{K}$** 

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.205	-63	<sup>1</sup> KAMANO	15	DPWA Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Sigma\pi$** 

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0325	29	<sup>1</sup> KAMANO	15	DPWA Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Lambda\eta$** 

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.155	165	<sup>1</sup> KAMANO	15	DPWA Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Xi K$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</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. • • •

0.0937	-64	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Sigma(1385)\pi$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</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. • • •

0.244	-10	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow N\bar{K}^*(892)$ ,  $S=1/2$ ,  $P$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</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. • • •

0.159	-97	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1810) \rightarrow N\bar{K}^*(892)$ ,  $S=3/2$ ,  $P$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</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. • • •

0.0497	2	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

 **$\Lambda(1810)$  MASS**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**1750 to 1850 ( $\approx 1810$ ) OUR ESTIMATE**

1821 $\pm$ 10	ZHANG	13A	DPWA Multichannel
1841 $\pm$ 20	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1853 $\pm$ 20	GOPAL	77	DPWA $\bar{K}N$ multichannel
1735 $\pm$ 5	CARROLL	76	DPWA Isospin-0 total $\sigma$
1746 $\pm$ 10	PREVOST	74	DPWA $K^-N \rightarrow \Sigma(1385)\pi$
1780 $\pm$ 20	LANGBEIN	72	IPWA $\bar{K}N$ multichannel

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

1861 or 1953	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel
1755	KIM	71	DPWA K-matrix analysis
1800	ARMENTEROS70	HBC	$\bar{K}N \rightarrow \bar{K}N$
1750	ARMENTEROS70	HBC	$\bar{K}N \rightarrow \Sigma\pi$
1690 $\pm$ 10	BARBARO-...	70	HBC $\bar{K}N \rightarrow \Sigma\pi$
1740	BAILEY	69	DPWA $\bar{K}N \rightarrow \bar{K}N$
1745	ARMENTEROS68B	HBC	$\bar{K}N \rightarrow \bar{K}N$

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

## $\Lambda(1810)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>50 to 250 (<math>\approx 150</math>) OUR ESTIMATE</b>			
174 $\pm$ 50	ZHANG	13A	DPWA Multichannel
164 $\pm$ 20	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
90 $\pm$ 20	CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$
166 $\pm$ 20	GOPAL	77	DPWA $\bar{K}N$ multichannel
46 $\pm$ 20	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$
120 $\pm$ 10	LANGBEIN	72	IPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
535 or 585	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel
28	CARROLL	76	DPWA Isospin-0 total $\sigma$
35	KIM	71	DPWA K-matrix analysis
30	ARMENTEROS70	HBC	$\bar{K}N \rightarrow \bar{K}N$
70	ARMENTEROS70	HBC	$\bar{K}N \rightarrow \Sigma\pi$
22	BARBARO-...	70	HBC $\bar{K}N \rightarrow \Sigma\pi$
300	BAILEY	69	DPWA $\bar{K}N \rightarrow \bar{K}N$
147	ARMENTEROS68B	HBC	

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

## $\Lambda(1810)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\bar{K}$	20–50 %
$\Gamma_2$ $\Sigma\pi$	10–40 %
$\Gamma_3$ $\Lambda\eta$	
$\Gamma_4$ $\Xi K$	
$\Gamma_5$ $\Sigma(1385)\pi$	seen
$\Gamma_6$ $N\bar{K}^*(892)$	30–60 %
$\Gamma_7$ $N\bar{K}^*(892)$ , $S=1/2$ , $P$ -wave	
$\Gamma_8$ $N\bar{K}^*(892)$ , $S=3/2$ , $P$ -wave	

## $\Lambda(1810)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on  $\Lambda$  and  $\Sigma$  Resonances.

<u><math>\Gamma(N\bar{K})/\Gamma_{\text{total}}</math></u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	<u><math>\Gamma_1/\Gamma</math></u>
<b>0.2 to 0.5 OUR ESTIMATE</b>				
0.19 $\pm$ 0.08	ZHANG	13A	DPWA Multichannel	
0.24 $\pm$ 0.04	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$	
0.36 $\pm$ 0.05	LANGBEIN	72	IPWA $\bar{K}N$ multichannel	

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

0.225	<sup>1</sup> KAMANO	15	DPWA	Multichannel
0.21 ± 0.04	GOPAL	77	DPWA	See GOPAL 80
0.52 or 0.49	<sup>2</sup> MARTIN	77	DPWA	$\bar{K}N$ multichannel
0.30	KIM	71	DPWA	K-matrix analysis
0.15	ARMENTEROS70		DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.55	BAILEY	69	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.4	ARMENTEROS68B		DPWA	$\bar{K}N \rightarrow \bar{K}N$

<sup>1</sup> From the preferred solution A in KAMANO 15.

<sup>2</sup> The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

**$\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$**   **$\Gamma_2/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

0.009	<sup>1</sup> KAMANO	15	DPWA	Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

**$\Gamma(\Lambda\eta)/\Gamma_{\text{total}}$**   **$\Gamma_3/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

0.111	<sup>1</sup> KAMANO	15	DPWA	Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

**$\Gamma(\Xi K)/\Gamma_{\text{total}}$**   **$\Gamma_4/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

0.051	<sup>1</sup> KAMANO	15	DPWA	Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

**$\Gamma(\Sigma(1385)\pi)/\Gamma_{\text{total}}$**   **$\Gamma_5/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

0.600	<sup>1</sup> KAMANO	15	DPWA	Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

**$\Gamma(N\bar{K}^*(892), S=1/2, P\text{-wave})/\Gamma_{\text{total}}$**   **$\Gamma_7/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

0.003	<sup>1</sup> KAMANO	15	DPWA	Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Sigma \pi \qquad (\Gamma_1 \Gamma_2)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.08 \pm 0.05$	ZHANG	13A	DPWA Multichannel
$-0.24 \pm 0.04$	GOPAL	77	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$+0.25$ or $+0.23$	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel
$< 0.01$	LANGBEIN	72	IPWA $\bar{K}N$ multichannel
0.17	KIM	71	DPWA K-matrix analysis
$+0.20$	<sup>2</sup> ARMENTEROS70	DPWA	$\bar{K}N \rightarrow \Sigma \pi$
$-0.13 \pm 0.03$	BARBARO-...	70	DPWA $\bar{K}N \rightarrow \Sigma \pi$

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

<sup>2</sup> The published sign has been changed to be in accord with the baryon-first convention.

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(1810) \rightarrow \Sigma(1385)\pi \qquad (\Gamma_1 \Gamma_5)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.18 \pm 0.10$	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(1810) \rightarrow N\bar{K}^*(892), S=1/2, P\text{-wave} \qquad (\Gamma_1 \Gamma_7)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.14 \pm 0.03$	<sup>1</sup> CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$

<sup>1</sup> The published sign has been changed to be in accord with the baryon-first convention.

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(1810) \rightarrow N\bar{K}^*(892), S=3/2, P\text{-wave} \qquad (\Gamma_1 \Gamma_8)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.38 \pm 0.06$	ZHANG	13A	DPWA Multichannel
$+0.35 \pm 0.06$	CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$

### $\Lambda(1810)$ 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)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
CAMERON	78B	NP B146 327	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
CARROLL	76	PRL 37 806	A.S. Carroll <i>et al.</i>	(BNL) I
PREVOST	74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID)
LANGBEIN	72	NP B47 477	W. Langbein, F. Wagner	(MPIM) IJP
KIM	71	PRL 27 356	J.K. Kim	(HARV) IJP
Also		Duke Conf. 161	J.K. Kim	(HARV) IJP
Hyperon Resonances, 1970				
ARMENTEROS	70	Duke Conf. 123	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) IJP
Hyperon Resonances, 1970				
BARBARO-...	70	Duke Conf. 173	A. Barbaro-Galtieri	(LRL) IJP
Hyperon Resonances, 1970				
BAILEY	69	Thesis UCRL 50617	J.M. Bailey	(LLL) IJP
ARMENTEROS	68B	NP B8 195	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) IJP