

$$\Lambda(2110) \ 5/2^+$$

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

For results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982). All the references have been retained.

This resonance is in the Baryon Summary Table, but the evidence for it could be better.

$\Lambda(2110)$ POLE POSITION

REAL PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2048±10	SARANTSEV 19	DPWA	$\overline{K} N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1970	ZHANG 13A	DPWA	$\overline{K} N$ multichannel

−2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
255±20	SARANTSEV 19	DPWA	$\overline{K} N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
350	ZHANG 13A	DPWA	$\overline{K} N$ multichannel

$\Lambda(2110)$ POLE RESIDUE

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

Normalized residue in $N\overline{K} \rightarrow \Lambda(2110) \rightarrow N\overline{K}$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.020±0.005	5 ± 15	SARANTSEV 19	DPWA	$\overline{K} N$ multichannel

Normalized residue in $N\overline{K} \rightarrow \Lambda(2110) \rightarrow \Sigma \pi$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13±0.03	0 ± 15	SARANTSEV 19	DPWA	$\overline{K} N$ multichannel

Normalized residue in $N\overline{K} \rightarrow \Lambda(2110) \rightarrow \Xi K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.005±0.005		SARANTSEV 19	DPWA	$\overline{K} N$ multichannel

Normalized residue in $N\overline{K} \rightarrow \Lambda(2110) \rightarrow \Lambda \omega, S=1/2, P\text{-wave}$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.01±0.01		SARANTSEV 19	DPWA	$\overline{K} N$ multichannel

Normalized residue in $N\overline{K} \rightarrow \Lambda(2110) \rightarrow \Lambda \omega, S=3/2, P\text{-wave}$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.03±0.01	−7 ± 16	SARANTSEV 19	DPWA	$\overline{K} N$ multichannel

Normalized residue in $N\bar{K} \rightarrow \Lambda(2110) \rightarrow \Lambda\omega, S=3/2, F\text{-wave}$

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
0.01±0.01		SARANTSEV 19	DPWA	$\bar{K}N$ multichannel

$\Lambda(2110)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2050 to 2130 (≈ 2090) OUR ESTIMATE			
2086±12	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
2036±13	ZHANG 13A	DPWA	$\bar{K}N$ multichannel
2092±25	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
2125±25	CAMERON 78B	DPWA	$K^-p \rightarrow N\bar{K}^*$
2106±50	DEBELLEFON 78	DPWA	$\bar{K}N \rightarrow \bar{K}N$
2140±20	DEBELLEFON 77	DPWA	$K^-p \rightarrow \Sigma\pi$
2100±50	GOPAL 77	DPWA	$\bar{K}N$ multichannel
2112±7	KANE 74	DPWA	$K^-p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2137	BACCARI 77	DPWA	$K^-p \rightarrow \Lambda\omega$
2103	¹ NAKKASYAN 75	DPWA	$K^-p \rightarrow \Lambda\omega$

$\Lambda(2110)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
200 to 300 (≈ 250) OUR ESTIMATE			
274±25	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
400±38	ZHANG 13A	DPWA	$\bar{K}N$ multichannel
245±25	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
160±30	CAMERON 78B	DPWA	$K^-p \rightarrow N\bar{K}^*$
251±50	DEBELLEFON 78	DPWA	$\bar{K}N \rightarrow \bar{K}N$
140±20	DEBELLEFON 77	DPWA	$K^-p \rightarrow \Sigma\pi$
200±50	GOPAL 77	DPWA	$\bar{K}N$ multichannel
190±30	KANE 74	DPWA	$K^-p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
132	BACCARI 77	DPWA	$K^-p \rightarrow \Lambda\omega$
391	¹ NAKKASYAN 75	DPWA	$K^-p \rightarrow \Lambda\omega$

$\Lambda(2110)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\bar{K}$	5–25 %
Γ_2 $\Sigma\pi$	10–40 %
Γ_3 $\Lambda\omega$	seen
Γ_4 $\Lambda\omega, S=1/2, P\text{-wave}$	
Γ_5 $\Lambda\omega, S=3/2, P\text{-wave}$	(5.0±2.0) %
Γ_6 $\Lambda\omega, S=3/2, F\text{-wave}$	

Γ_7	ΞK	
Γ_8	$\Sigma(1385)\pi$	seen
Γ_9	$\Sigma(1385)\pi$, P -wave	
Γ_{10}	$N\bar{K}^*(892)$	10–60 %
Γ_{11}	$N\bar{K}^*(892)$, $S=1/2$	
Γ_{12}	$N\bar{K}^*(892)$, $S=3/2$, P -wave	

$\Lambda(2110)$ BRANCHING RATIOS

See “Sign conventions for resonance couplings” in the Note on Λ and Σ Resonances.

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.05 to 0.25 OUR ESTIMATE				
0.020 ± 0.005	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
0.083 ± 0.005	ZHANG 13A	DPWA	$\bar{K}N$ multichannel	
0.07 ± 0.03	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$	
0.27 ± 0.06	² DEBELLEFON 78	DPWA	$\bar{K}N \rightarrow \bar{K}N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.07 ± 0.03	GOPAL 77	DPWA	See GOPAL 80	
$\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.88 $\pm$ 0.20	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
$\Gamma(\Lambda\omega, S=1/2, P\text{-wave})/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
<0.01	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
$\Gamma(\Lambda\omega, S=3/2, P\text{-wave})/\Gamma_{\text{total}}$				Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.05 $\pm$ 0.02	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
$\Gamma(\Lambda\omega, S=3/2, F\text{-wave})/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
<0.01	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
$\Gamma(\Xi K)/\Gamma_{\text{total}}$				Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
~ 0	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel	
$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(2110) \rightarrow \Sigma\pi$				$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$+0.04 \pm 0.01$	ZHANG 13A	DPWA	Multichannel	
$+0.14 \pm 0.01$	DEBELLEFON 77	DPWA	$K^-p \rightarrow \Sigma\pi$	
$+0.20 \pm 0.03$	KANE 74	DPWA	$K^-p \rightarrow \Sigma\pi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$+0.10 \pm 0.03$	GOPAL 77	DPWA	$\bar{K}N$ multichannel	

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(2110) \rightarrow \Lambda\omega \quad (\Gamma_1 \Gamma_3)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
<0.05	BACCARI 77	DPWA	$K^- p \rightarrow \Lambda\omega$
0.112	¹ NAKKASYAN 75	DPWA	$K^- p \rightarrow \Lambda\omega$

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(2110) \rightarrow \Sigma(1385)\pi, P\text{-wave} \quad (\Gamma_1 \Gamma_9)^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
+0.04 ± 0.01	ZHANG 13A	DPWA	Multichannel
+0.071 ± 0.025	³ CAMERON 78	DPWA	$K^- p \rightarrow \Sigma(1385)\pi$

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(2110) \rightarrow N\bar{K}^*(892), S=1/2 \quad (\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.09 ± 0.01	ZHANG 13A	DPWA	Multichannel
-0.17 ± 0.04	⁴ CAMERON 78B	DPWA	$K^- p \rightarrow N\bar{K}^*$

$$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \text{ in } N\bar{K} \rightarrow \Lambda(2110) \rightarrow N\bar{K}^*(892), S=3/2, P\text{-wave} \quad (\Gamma_1 \Gamma_{12})^{1/2} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.24 ± 0.01	ZHANG 13A	DPWA	Multichannel

$\Lambda(2110)$ FOOTNOTES

- ¹ Found in one of two best solutions.
² The published error of 0.6 was a misprint.
³ The CAMERON 78 upper limit on F -wave decay is 0.03. The sign here has been changed to be in accord with the baryon-first convention.
⁴ The published sign has been changed to be in accord with the baryon-first convention. The CAMERON 78B upper limits on the P_3 and F_3 waves are each 0.03.

$\Lambda(2110)$ REFERENCES

SARANTSEV 19	EPJ A55 180	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
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
CAMERON 78	NP B143 189	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
CAMERON 78B	NP B146 327	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
DEBELLEFON 78	NC 42A 403	A. de Bellefon <i>et al.</i>	(CDEF, SACL) IJP
BACCARI 77	NC 41A 96	B. Baccari <i>et al.</i>	(SACL, CDEF) IJP
DEBELLEFON 77	NC 37A 175	A. de Bellefon <i>et al.</i>	(CDEF, SACL) IJP
GOPAL 77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
NAKKASYAN 75	NP B93 85	A. Nakkasyan	(CERN) IJP
KANE 74	LBL-2452	D.F. Kane	(LBL) IJP