

$\Sigma(1940) D_{13}$  $I(J^P) = 1(\frac{3}{2}^-)$  Status: \*\*\*

For results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

Not all analyses require this state. It is not required by the GOYAL 77 analysis of  $K^- n \rightarrow (\Sigma\pi)^-$  nor by the GOPAL 80 analysis of  $K^- n \rightarrow K^- n$ . See also HEMINGWAY 75.

 **$\Sigma(1940)$  MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>1900 to 1950 (<math>\approx</math> 1940) OUR ESTIMATE</b>			
1920 $\pm$ 50	GOPAL	77	DPWA $\bar{K}N$ multichannel
1950 $\pm$ 30	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
1949 $^{+40}_{-60}$	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
1935 $\pm$ 80	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
1940 $\pm$ 20	LITCHFIELD	74B	DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
1950 $\pm$ 20	LITCHFIELD	74C	DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1886 or 1893	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel
1940	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0, F_{17}$ wave

 **$\Sigma(1940)$  WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>150 to 300 (<math>\approx</math> 220) OUR ESTIMATE</b>			
170 $\pm$ 25	CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$
300 $\pm$ 80	GOPAL	77	DPWA $\bar{K}N$ multichannel
150 $\pm$ 75	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
160 $^{+70}_{-40}$	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
330 $\pm$ 80	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
60 $\pm$ 20	LITCHFIELD	74B	DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
70 $^{+30}_{-20}$	LITCHFIELD	74C	DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
157 or 159	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel

**$\Sigma(1940)$  DECAY MODES**

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\bar{K}$	<20 %
$\Gamma_2$ $\Lambda\pi$	seen
$\Gamma_3$ $\Sigma\pi$	seen
$\Gamma_4$ $\Sigma(1385)\pi$	seen
$\Gamma_5$ $\Sigma(1385)\pi$ , <i>S</i> -wave	
$\Gamma_6$ $\Lambda(1520)\pi$	seen
$\Gamma_7$ $\Lambda(1520)\pi$ , <i>P</i> -wave	
$\Gamma_8$ $\Lambda(1520)\pi$ , <i>F</i> -wave	
$\Gamma_9$ $\Delta(1232)\bar{K}$	seen
$\Gamma_{10}$ $\Delta(1232)\bar{K}$ , <i>S</i> -wave	
$\Gamma_{11}$ $\Delta(1232)\bar{K}$ , <i>D</i> -wave	
$\Gamma_{12}$ $N\bar{K}^*(892)$	seen
$\Gamma_{13}$ $N\bar{K}^*(892)$ , $S=3/2$ , <i>S</i> -wave	

 **$\Sigma(1940)$  BRANCHING RATIOS**

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

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$				$\Gamma_1/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
<b>&lt;0.2 OUR ESTIMATE</b>				
<0.04	GOPAL	77	DPWA $\bar{K}N$ multichannel	
0.14 or 0.13	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda\pi$				$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$-0.06 \pm 0.03$	GOPAL	77	DPWA $\bar{K}N$ multichannel	
$-0.04 \pm 0.02$	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$	
$-0.05^{+0.03}_{-0.02}$	VANHORN	75	DPWA $K^-p \rightarrow \Lambda\pi^0$	
$-0.153 \pm 0.070$	DEVENISH	74B	Fixed- <i>t</i> dispersion rel.	
••• We do not use the following data for averages, fits, limits, etc. •••				
$-0.15$ or $-0.14$	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Sigma\pi$				$(\Gamma_1\Gamma_3)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$-0.08 \pm 0.04$	GOPAL	77	DPWA $\bar{K}N$ multichannel	
$-0.14 \pm 0.04$	KANE	74	DPWA $K^-p \rightarrow \Sigma\pi$	
••• We do not use the following data for averages, fits, limits, etc. •••				
$+0.16$ or $+0.16$	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel	

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda(1520)\pi$ , <i>P-wave</i>	$(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
< 0.03	CAMERON 77 DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
$-0.11 \pm 0.04$	LITCHFIELD 74B DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$

  

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda(1520)\pi$ , <i>F-wave</i>	$(\Gamma_1 \Gamma_8)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$0.062 \pm 0.021$	CAMERON 77 DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
$-0.08 \pm 0.04$	LITCHFIELD 74B DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$

  

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Delta(1232)\bar{K}$ , <i>S-wave</i>	$(\Gamma_1 \Gamma_{10})^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$-0.16 \pm 0.05$	LITCHFIELD 74C DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$

  

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Delta(1232)\bar{K}$ , <i>D-wave</i>	$(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$-0.14 \pm 0.05$	LITCHFIELD 74C DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$

  

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Sigma(1385)\pi$	$(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$+0.066 \pm 0.025$	<sup>2</sup> CAMERON 78 DPWA $K^- p \rightarrow \Sigma(1385)\pi$

  

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow N\bar{K}^*(892)$	$(\Gamma_1 \Gamma_{12})^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$-0.09 \pm 0.02$	<sup>3</sup> CAMERON 78B DPWA $K^- p \rightarrow N\bar{K}^*$

### $\Sigma(1940)$ FOOTNOTES

- <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.  
<sup>3</sup> Upper limits on the  $D_1$  and  $D_3$  waves are each 0.03.

### $\Sigma(1940)$ REFERENCES

PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL)
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
CAMERON	77	NP B131 399	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
GOPAL	77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
GOYAL	77	PR D16 2746	D.P. Goyal, A.V. Sodhi	(DELH)
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
DEBELLEFON	76	NP B109 129	A. de Bellefon, A. Berthon	(CDEF) IJP
BAILLON	75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL) IJP
HEMINGWAY	75	NP B91 12	R.J. Hemingway <i>et al.</i>	(CERN, HEIDH, MPIM) IJP
VANHORN	75	NP B87 145	A.J. van Horn	(LBL) IJP
Also		NP B87 157	A.J. van Horn	(LBL) IJP
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+) IJP
KANE	74	LBL-2452	D.F. Kane	(LBL) IJP
LITCHFIELD	74B	NP B74 19	P.J. Litchfield <i>et al.</i>	(CERN, HEIDH) IJP
LITCHFIELD	74C	NP B74 39	P.J. Litchfield <i>et al.</i>	(CERN, HEIDH) IJP