$\Sigma(2030)$ F_{17}

$I(J^P) = 1(\frac{7}{2}^+)$ Status: ∗∗∗∗

Discovered by COOL 66 and by WOHL 66. For most results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** (1982).

This entry only includes results from partial-wave analyses. Parameters of peaks seen in cross sections and invariant-mass distributions around 2030 MeV may be found in our 1984 edition, Reviews of Modern Physics **56** No. 2 Pt. II (1984).

$\Sigma(2030)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2025 to 2040 (≈ 2030) OUR ESTIMATE				
2036± 5	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
2038±10	CORDEN	77B		$K^- N \rightarrow N\overline{K}^*$
2040± 5	GOPAL	77	DPWA	$\overline{K}N$ multichannel
2030± 3	[1] CORDEN	76	DPWA	$K^- n \rightarrow \Lambda\pi^-$
2035±15	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$
2038±10	HEMINGWAY	75	DPWA	$K^- p \rightarrow \overline{K}N$
2042±11	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
2020± 6	KANE	74	DPWA	$K^- p \rightarrow \Sigma\pi$
2035±10	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
2020±30	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$
2025±10	LITCHFIELD	74D	DPWA	$K^- p \rightarrow \Lambda(1820)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2027 to 2057	GOYAL	77	DPWA	$K^- N \rightarrow \Sigma\pi$
2030	DEBELLEFON	76	IPWA	$K^- p \rightarrow \Lambda\pi^0$

$\Sigma(2030)$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
150 to 200 (≈ 180) OUR ESTIMATE				
172±10	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
137±40	CORDEN	77B		$K^- N \rightarrow N\overline{K}^*$
190±10	GOPAL	77	DPWA	$\overline{K}N$ multichannel
201± 9	[1] CORDEN	76	DPWA	$K^- n \rightarrow \Lambda\pi^-$
180±20	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$
172±15	HEMINGWAY	75	DPWA	$K^- p \rightarrow \overline{K}N$
178±13	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
111± 5	KANE	74	DPWA	$K^- p \rightarrow \Sigma\pi$
160±20	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
200±30	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$

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

260	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
126 to 195	GOYAL	77	DPWA	$K^- N \to \Sigma\pi$
160	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$
70 to 125	LITCHFIELD	74D	DPWA	$K^- p \to \Lambda(1820)\pi^0$

Σ(2030) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\overline{K}$	17–23 %
Γ_2	$\Lambda\pi$	17–23 %
Γ_3	$\Sigma\pi$	5–10 %
Γ_4	ΞK	<2 %
Γ_5	$\Sigma(1385)\pi$	5–15 %
Γ_6	$\Sigma(1385)\pi$, F-wave	
Γ_7	$\Lambda(1520)\pi$	10–20 %
Γ_8	$\Lambda(1520)\pi$, D-wave	
Γ_9	$\Lambda(1520)\pi$, G-wave	
Γ_{10}	$\Delta(1232)\overline{K}$	10–20 %
Γ_{11}	$\Delta(1232)\overline{K}$, F-wave	
Γ_{12}	$\Delta(1232)\overline{K}$, H-wave	
Γ_{13}	$N\overline{K}^*(892)$	<5 %
Γ_{14}	$N\overline{K}^*(892)$, S=1/2, F-wave	
Γ_{15}	$N\overline{K}^*(892)$, S=3/2, F-wave	
Γ_{16}	$\Lambda(1820)\pi$, P-wave	

The above branching fractions are our estimates, not fits or averages.

Σ(2030) BRANCHING RATIOS

See "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
0.17 to 0.23 OUR ESTIMATE				
0.19±0.03	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
0.18±0.03	HEMINGWAY	75	DPWA	$K^- p \to \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
0.24±0.02	GOPAL	77	DPWA	See GOPAL 80

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda\pi$ $\quad(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.18 \pm 0.02$	GOPAL	77	DPWA	$\overline{K}N$ multichannel
$+0.20 \pm 0.01$	[1] CORDEN	76	DPWA	$K^- n \to \Lambda\pi^-$
$+0.18 \pm 0.02$	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$
$+0.20 \pm 0.01$	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
$+0.195 \pm 0.053$	DEVENISH	74B		Fixed-t dispersion rel.
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.20	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Sigma\pi$ $\quad(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.09 ± 0.01	[2] CORDEN	77C		$K^- n \to \Sigma\pi$
-0.06 ± 0.01	[2] CORDEN	77C		$K^- n \to \Sigma\pi$
-0.15 ± 0.03	GOPAL	77	DPWA	$\overline{K}N$ multichannel
-0.10 ± 0.01	KANE	74	DPWA	$K^- p \to \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.085 ± 0.02	[3] GOYAL	77	DPWA	$K^- N \to \Sigma\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Xi K$ $\quad(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.023	MULLER	69B	DPWA	$K^- p \to \Xi K$
<0.05	BURGUN	68	DPWA	$K^- p \to \Xi K$
<0.05	TRIPP	67	RVUE	$K^- p \to \Xi K$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda(1820)\pi$, *P*-wave $\quad(\Gamma_1\Gamma_{16})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.14 ± 0.02	CORDEN	75B	DBC	$K^- n \to N\overline{K}\pi^-$
0.18 ± 0.04	LITCHFIELD	74D	DPWA	$K^- p \to \Lambda(1820)\pi^0$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda(1520)\pi$, *D*-wave $\quad(\Gamma_1\Gamma_8)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.114 \pm 0.010$	[4] CAMERON	77	DPWA	$K^- p \to \Lambda(1520)\pi^0$
0.14 ± 0.03	LITCHFIELD	74B	DPWA	$K^- p \to \Lambda(1520)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.10 ± 0.03	[5] CORDEN	75B	DBC	$K^- n \to N\overline{K}\pi^-$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda(1520)\pi$, *G*-wave $\quad(\Gamma_1\Gamma_9)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.146 \pm 0.010$	[4] CAMERON	77	DPWA	$K^- p \to \Lambda(1520)\pi^0$
0.02 ± 0.02	LITCHFIELD	74B	DPWA	$K^- p \to \Lambda(1520)\pi^0$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Delta(1232)\overline{K}$, *F*-wave $\quad(\Gamma_1\Gamma_{11})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.16 ± 0.03	LITCHFIELD	74C	DPWA	$K^- p \to \Delta(1232)\overline{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17 ± 0.03	[5] CORDEN	75B	DBC	$K^- n \to N\overline{K}\pi^-$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Delta(1232)\overline{K}$, H-wave $(\Gamma_1\Gamma_{12})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.00 ± 0.02	LITCHFIELD	74C	DPWA	$K^- p \to \Delta(1232)\overline{K}$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Sigma(1385)\pi$ $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.153\pm0.026$	[4] CAMERON	78	DPWA	$K^- p \to \Sigma(1385)\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to N\overline{K}^*(892)$, S=1/2, F-wave $(\Gamma_1\Gamma_{14})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.06\pm0.03$	[4] CAMERON	78B	DPWA	$K^- p \to N\overline{K}^*$
-0.02 ± 0.01	CORDEN	77B		$K^- d \to NN\overline{K}^*$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to N\overline{K}^*(892)$, S=3/2, F-wave $(\Gamma_1\Gamma_{15})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.04\pm0.03$	[6] CAMERON	78B	DPWA	$K^- p \to N\overline{K}^*$
-0.12 ± 0.02	CORDEN	77B		$K^- d \to NN\overline{K}^*$

$\Sigma(2030)$ FOOTNOTES

[1] Preferred solution 3; see CORDEN 76 for other possibilities.
[2] The two entries for CORDEN 77C are from two different acceptable solutions.
[3] This coupling is extracted from unnormalized data.
[4] The published sign has been changed to be in accord with the baryon-first convention.
[5] An upper limit.
[6] The upper limit on the G_3 wave is 0.03.

$\Sigma(2030)$ REFERENCES

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PDG	82	PL 111B	M. Roos et al.	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
CAMERON	78	NP B143 189	W. Cameron et al.	(RHEL, LOIC) IJP
CAMERON	78B	NP B146 327	W. Cameron et al.	(RHEL, LOIC) IJP
CAMERON	77	NP B131 399	W. Cameron et al.	(RHEL, LOIC) IJP
CORDEN	77B	NP B121 365	M.J. Corden et al.	(BIRM) IJP
CORDEN	77C	NP B125 61	M.J. Corden et al.	(BIRM) 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
GOYAL	77	PR D16 2746	D.P. Goyal, A.V. Sodhi	(DELH) IJP
CORDEN	76	NP B104 382	M.J. Corden et al.	(BIRM) 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
CORDEN	75B	NP B92 365	M.J. Corden et al.	(BIRM) IJP
HEMINGWAY	75	NP B91 12	R.J. Hemingway et al.	(CERN, HEIDH, MPIM) IJP
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DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+)
KANE	74	LBL-2452	D.F. Kane	(LBL) IJP

LITCHFIELD	74B	NP B74 19	P.J. Litchfield *et al.*	(CERN, HEIDH)	IJP
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