$\Sigma(1580)$ $3/2^-$

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

OMITTED FROM SUMMARY TABLE

Seen in the isospin-1 $\overline{K}N$ cross section at BNL (LI 73, CARROLL 76) and in a partial-wave analysis of $K^- p \to \Lambda\pi^0$ for c.m. energies 1560–1600 MeV by LITCHFIELD 74. LITCHFIELD 74 finds $J^P = 3/2^-$. Not seen by ENGLER 78 or by CAMERON 78C (with larger statistics in $K^0_L p \to \Lambda\pi^+$ and $\Sigma^0\pi^+$).

Neither OLMSTED 04 (in $K^- p \to \Lambda\pi^0$) nor PRAKHOV 04 (in $K^- p \to \Lambda\pi^0\pi^0$) see any evidence for this state.

$\Sigma(1580)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1607^{+13}_{-11}	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15. Solution B reports M = 1492^{+4}_{-7} MeV.

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
253^{+30}_{-18}	[2] KAMANO	15	DPWA	Multichannel

[2] From the preferred solution A in KAMANO 15. Solution B reports M = 138^{+8}_{-14} MeV.

$\Sigma(1580)$ POLE RESIDUES

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

Normalized residue in $N\overline{K} \to \Sigma(1580) \to N\overline{K}$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.00778	51	[3] KAMANO	15	DPWA	Multichannel

[3] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \to \Sigma(1580) \to \Sigma\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0625	−6	[4] KAMANO	15	DPWA	Multichannel

[4] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Lambda\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.059	156	[5] KAMANO	15	DPWA	Multichannel

[5] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, *S*-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0368	−18	[6] KAMANO	15	DPWA	Multichannel

[6] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, *D*-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0103	123	[7] KAMANO	15	DPWA	Multichannel

[7] From the preferred solution A in KAMANO 15.

$\Sigma(1580)$ MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
≈ 1580 OUR ESTIMATE				
1583±4	[8] CARROLL	76	DPWA	Isospin-1 total σ
1582±4	[9] LITCHFIELD	74	DPWA	$K^- p \rightarrow \Lambda\pi^0$

[8] CARROLL 76 sees a total-cross-section bump with $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.06$.

[9] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

$\Sigma(1580)$ WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
15	[10] CARROLL	76	DPWA	Isospin-1 total σ
11±4	[11] LITCHFIELD	74	DPWA	$K^- p \rightarrow \Lambda\pi^0$

[10] CARROLL 76 sees a total-cross-section bump with $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.06$.

[11] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

Σ(1580) DECAY MODES

	Mode
Γ_1	$N\overline{K}$
Γ_2	$\Lambda\pi$
Γ_3	$\Sigma\pi$
Γ_4	$\Sigma(1385)\pi$, S-wave
Γ_5	$\Sigma(1385)\pi$, D-wave
Γ_6	$N\overline{K}^*(892)$, S=1/2, D-wave
Γ_7	$N\overline{K}^*(892)$, S=3/2, S-wave
Γ_8	$N\overline{K}^*(892)$, S=3/2, D-wave

Σ(1580) 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
+0.03 ±0.01	[12] LITCHFIELD	74	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.003	[13] KAMANO	15	DPWA	Multichannel

[12] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

[13] From the preferred solution A in KAMANO 15.

$\Gamma(\Lambda\pi)/\Gamma_{total}$ — Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.490	[14] KAMANO	15	DPWA	Multichannel

[14] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma\pi)/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.387	[15] KAMANO	15	DPWA	Multichannel

[15] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, S\text{-wave})/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.12	[16] KAMANO	15	DPWA	Multichannel

[16] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{total}$ Γ_5/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.001	[17] KAMANO	15	DPWA	Multichannel

[17] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{total}$ Γ_6/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	[18] KAMANO	15	DPWA	Multichannel

[18] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, S\text{-wave})/\Gamma_{total}$ Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	[19] KAMANO	15	DPWA	Multichannel

[19] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{total}$ Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	[20] KAMANO	15	DPWA	Multichannel

[20] From the preferred solution A in KAMANO 15.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1580) \to \Lambda\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	CAMERON	78C	HBC	$K^0_L p \to \Lambda\pi^+$
not seen	ENGLER	78	HBC	$K^0_L p \to \Lambda\pi^+$
$+0.10\pm0.02$	[21] LITCHFIELD	74	DPWA	$K^- p \to \Lambda\pi^0$

[21] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1580) \to \Sigma\pi$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	CAMERON	78C	HBC	$K^0_L p \to \Sigma^0\pi^+$
not seen	ENGLER	78	HBC	$K^0_L p \to \Sigma^0\pi^+$
$+0.03\pm0.04$	[22] LITCHFIELD	74	DPWA	$\overline{K}N$ multichannel

[22] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

Σ(1580) REFERENCES

KAMANO	15	PR C92 025205	H. Kamano *et al.*	(ANL, OSAK)	
OLMSTED	04	PL B588 29	J. Olmsted *et al.*	(BNL Crystal Ball Collab.)	
PRAKHOV	04	PR C69 042202	S. Prakhov *et al.*	(BNL Crystal Ball Collab.)	
CAMERON	78C	NP B132 189	W. Cameron *et al.*	(BGNA, EDIN, GLAS+)	I
ENGLER	78	PR D18 3061	A. Engler *et al.*	(CMU, ANL)	
CARROLL	76	PRL 37 806	A.S. Carroll *et al.*	(BNL)	I
LITCHFIELD	74	PL 51B 509	P.J. Litchfield	(CERN)	IJP
LI	73	Purdue Conf. 283	K.K. Li	(BNL)	I