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

$I(J^P) = 1(\frac{3}{2}^-)$ 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, CAMERON 78C, OLMSTED 04, nor by PRAKHOV 04.

Neither ZHANG 13A nor SARANTSEV 19 see any evidence for this state.

Σ(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.

Σ(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.

$\Sigma(1580)$ 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

$\Sigma(1580)$ 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-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-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-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.

$\Sigma(1580)$ REFERENCES

SARANTSEV	19	EPJ A55 180	A.V. Sarantsev *et al.*	(BONN, PNPI)
KAMANO	15	PR C92 025205	H. Kamano *et al.*	(ANL, OSAK)
ZHANG	13A	PR C88 035205	H. Zhang *et al.*	(KSU)
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