

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

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

OMITTED FROM SUMMARY TABLE

Seen in the isospin-1  $\bar{K}N$  cross section at BNL (LI 73, CARROLL 76) and in a partial-wave analysis of  $K^-p \rightarrow \Lambda\pi^0$  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.

**$\Sigma(1580)$  POLE POSITION**

**REAL PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$1607^{+13}_{-11}$	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup> 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
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$253^{+30}_{-18}$	<sup>2</sup> KAMANO	15	DPWA Multichannel
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<sup>2</sup> 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  $N\bar{K} \rightarrow \Sigma(1580) \rightarrow N\bar{K}$**

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.00778	51	<sup>3</sup> KAMANO	15	DPWA Multichannel
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<sup>3</sup> From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Sigma\pi$**

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0625	–6	<sup>4</sup> KAMANO	15	DPWA Multichannel
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<sup>4</sup> From the preferred solution A in KAMANO 15.

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

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.059	156	<sup>5</sup> KAMANO	15	DPWA Multichannel
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<sup>5</sup> From the preferred solution A in KAMANO 15.

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

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0368	-18	<sup>6</sup> KAMANO	15	DPWA Multichannel
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<sup>6</sup> From the preferred solution A in KAMANO 15.

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

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0103	123	<sup>7</sup> KAMANO	15	DPWA Multichannel
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<sup>7</sup> From the preferred solution A in KAMANO 15.

## $\Sigma(1580)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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### ≈ 1580 OUR ESTIMATE

1583±4	<sup>8</sup> CARROLL	76	DPWA Isospin-1 total $\sigma$
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1582±4	<sup>9</sup> LITCHFIELD	74	DPWA $K^- p \rightarrow \Lambda\pi^0$
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<sup>8</sup> CARROLL 76 sees a total-cross-section bump with  $(J+1/2) \Gamma_{el} / \Gamma_{total} = 0.06$ .

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

## $\Sigma(1580)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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15	<sup>10</sup> CARROLL	76	DPWA Isospin-1 total $\sigma$
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11±4	<sup>11</sup> LITCHFIELD	74	DPWA $K^- p \rightarrow \Lambda\pi^0$
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<sup>10</sup> CARROLL 76 sees a total-cross-section bump with  $(J+1/2) \Gamma_{el} / \Gamma_{total} = 0.06$ .

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

## $\Sigma(1580)$ DECAY MODES

Mode
$\Gamma_1$ $N\bar{K}$
$\Gamma_2$ $\Lambda\pi$
$\Gamma_3$ $\Sigma\pi$
$\Gamma_4$ $\Sigma(1385)\pi$ , S-wave
$\Gamma_5$ $\Sigma(1385)\pi$ , D-wave
$\Gamma_6$ $N\bar{K}^*(892)$ , S=1/2, D-wave
$\Gamma_7$ $N\bar{K}^*(892)$ , S=3/2, S-wave
$\Gamma_8$ $N\bar{K}^*(892)$ , S=3/2, D-wave

## $\Sigma(1580)$ BRANCHING RATIOS

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

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$	$\Gamma_1/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
+0.03 ± 0.01	<sup>12</sup> LITCHFIELD 74 DPWA $\bar{K}N$ multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.003	<sup>13</sup> KAMANO 15 DPWA Multichannel
<sup>12</sup> The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.	
<sup>13</sup> From the preferred solution A in KAMANO 15.	

$\Gamma(\Lambda\pi)/\Gamma_{\text{total}}$	$\Gamma_2/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.490	<sup>14</sup> KAMANO 15 DPWA Multichannel
<sup>14</sup> From the preferred solution A in KAMANO 15.	

$\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$	$\Gamma_3/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.387	<sup>15</sup> KAMANO 15 DPWA Multichannel
<sup>15</sup> From the preferred solution A in KAMANO 15.	

$\Gamma(\Sigma(1385)\pi, \text{S-wave})/\Gamma_{\text{total}}$	$\Gamma_4/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.12	<sup>16</sup> KAMANO 15 DPWA Multichannel
<sup>16</sup> From the preferred solution A in KAMANO 15.	

$\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.001	<sup>17</sup> KAMANO	15	DPWA Multichannel
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<sup>17</sup> From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	<sup>18</sup> KAMANO	15	DPWA Multichannel
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<sup>18</sup> From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=3/2, S\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	<sup>19</sup> KAMANO	15	DPWA Multichannel
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<sup>19</sup> From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	<sup>20</sup> KAMANO	15	DPWA Multichannel
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<sup>20</sup> From the preferred solution A in KAMANO 15.

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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not seen	CAMERON	78C	HBC $K^0_p \rightarrow \Lambda\pi^+$
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not seen	ENGLER	78	HBC $K^0_L \rightarrow \Lambda\pi^+$
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+0.10±0.02	<sup>21</sup> LITCHFIELD	74	DPWA $K^-_p \rightarrow \Lambda\pi^0$
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<sup>21</sup> The main effect observed by LITCHFIELD 74 is in the  $\Lambda\pi$  final state; the  $\bar{K}N$  and  $\Sigma\pi$  couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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not seen	CAMERON	78C	HBC $K^0_p \rightarrow \Sigma^0\pi^+$
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not seen	ENGLER	78	HBC $K^0_L \rightarrow \Sigma^0\pi^+$
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+0.03±0.04	<sup>22</sup> LITCHFIELD	74	DPWA $\bar{K}N$ multichannel
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<sup>22</sup> The main effect observed by LITCHFIELD 74 is in the  $\Lambda\pi$  final state; the  $\bar{K}N$  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 <i>et al.</i>	(BONN, PNPI)
KAMANO	15	PR C92 025205	H. Kamano <i>et al.</i>	(ANL, OSAK)
ZHANG	13A	PR C88 035205	H. Zhang <i>et al.</i>	(KSU)
OLMSTED	04	PL B588 29	J. Olmsted <i>et al.</i>	(BNL Crystal Ball Collab.)
PRAKHOV	04	PR C69 042202	S. Prakhov <i>et al.</i>	(BNL Crystal Ball Collab.)
CAMERON	78C	NP B132 189	W. Cameron <i>et al.</i>	(BGNA, EDIN, GLAS+) I
ENGLER	78	PR D18 3061	A. Engler <i>et al.</i>	(CMU, ANL)
CARROLL	76	PRL 37 806	A.S. Carroll <i>et al.</i>	(BNL) I
LITCHFIELD	74	PL 51B 509	P.J. Litchfield	(CERN) IJP
LI	73	Purdue Conf. 283	K.K. Li	(BNL) I

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