$\Lambda(1405)$ S_{01}

$I(J^P) = 0(\frac{1}{2}^-)$ Status: ****

See the note on "The $\Lambda(1405)$" in our 2000 edition, Eur. Phys. J. **C15**, p. 748 (2000). For a recent discussion and earlier references on evidence for a 2-pole structure of the $\Lambda(1405)$ see MAGAS 05.

$\Lambda(1405)$ MASS

PRODUCTION EXPERIMENTS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1406.5± 4.0		[1] DALITZ	91		M-matrix fit
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1391 ± 1	700	[1] HEMINGWAY	85	HBC	K^-p 4.2 GeV/c
~ 1405	400	[2] THOMAS	73	HBC	π^-p 1.69 GeV/c
1405	120	BARBARO-...	68B	DBC	K^-d 2.1–2.7 GeV/c
1400 ± 5	67	BIRMINGHAM	66	HBC	K^-p 3.5 GeV/c
1382 ± 8		ENGLER	65	HDBC	π^-p, π^+d 1.68 GeV/c
1400 ±24		MUSGRAVE	65	HBC	$\overline{p}p$ 3–4 GeV/c
1410		ALEXANDER	62	HBC	π^-p 2.1 GeV/c
1405		ALSTON	62	HBC	K^-p 1.2–0.5 GeV/c
1405		ALSTON	61B	HBC	K^-p 1.15 GeV/c

EXTRAPOLATIONS BELOW $N\overline{K}$ THRESHOLD

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1407.56 or 1407.50	[3] KIMURA	00		potential model
1411	[4] MARTIN	81		K-matrix fit
1406	[5] CHAO	73	DPWA	0–range fit (sol. B)
1421	MARTIN	70	RVUE	Constant K-matrix
1416 ±4	MARTIN	69	HBC	Constant K-matrix
1403 ±3	KIM	67	HBC	K-matrix fit
1407.5±1.2	[6] KITTEL	66	HBC	0–effective-range fit
1410.7±1.0	KIM	65	HBC	0–effective-range fit
1409.6±1.7	[6] SAKITT	65	HBC	0–effective-range fit

$\Lambda(1405)$ WIDTH

PRODUCTION EXPERIMENTS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
50± 2		[1] DALITZ	91		M-matrix fit
• • • We do not use the following data for averages, fits, limits, etc. • • •					
32± 1	700	[1] HEMINGWAY	85	HBC	K^-p 4.2 GeV/c
45 to 55	400	[2] THOMAS	73	HBC	π^-p 1.69 GeV/c
35	120	BARBARO-...	68B	DBC	K^-d 2.1–2.7 GeV/c
50±10	67	BIRMINGHAM	66	HBC	K^-p 3.5 GeV/c
89±20		ENGLER	65	HDBC	
60±20		MUSGRAVE	65	HBC	
35± 5		ALEXANDER	62	HBC	
50		ALSTON	62	HBC	
20		ALSTON	61B	HBC	

EXTRAPOLATIONS BELOW $N\overline{K}$ THRESHOLD

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
50.24 or 50.26	[3] KIMURA	00		potential model
30	[4] MARTIN	81		K-matrix fit
55	[5,7] CHAO	73	DPWA	0–range fit (sol. B)
20	MARTIN	70	RVUE	Constant K-matrix
29 ±6	MARTIN	69	HBC	Constant K-matrix
50 ±5	KIM	67	HBC	K-matrix fit
34.1±4.1	[6] KITTEL	66	HBC	
37.0±3.2	KIM	65	HBC	
28.2±4.1	[6] SAKITT	65	HBC	

$\Lambda(1405)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Sigma\pi$	100 %
Γ_2	$\Lambda\gamma$	
Γ_3	$\Sigma^0\gamma$	
Γ_4	$N\overline{K}$	

$\Lambda(1405)$ PARTIAL WIDTHS

$\Gamma(\Lambda\gamma)$ Γ_2

VALUE (keV)	DOCUMENT ID		COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
27±8	BURKHARDT	91	Isobar model fit

$\Gamma(\Sigma^0\gamma)$ Γ_3

VALUE (keV)	DOCUMENT ID		COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10 ± 4 or 23 ± 7	BURKHARDT	91	Isobar model fit

$\Lambda(1405)$ BRANCHING RATIOS

$\Gamma(N\overline{K})/\Gamma(\Sigma\pi)$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3	95	HEMINGWAY	85	HBC	K^-p 4.2 GeV/c

Λ(1405) FOOTNOTES

[1] DALITZ 91 fits the HEMINGWAY 85 data.
[2] THOMAS 73 data is fit by CHAO 73 (see next section).
[3] The KIMURA 00 values are from fits A and B from a coupled-channel potential model using low-energy $\overline{K}N$ and $\Sigma\pi$ data, kaonic-hydrogen x-ray measurements, and our Λ(1405) mass and width. The results bear mainly on the *nature* of the Λ(1405): three-quark state or $\overline{K}N$ bound state.
[4] The MARTIN 81 fit includes the $K^{\pm}p$ forward scattering amplitudes and the dispersion relations they must satisfy.
[5] See also the accompanying paper of THOMAS 73.
[6] Data of SAKITT 65 are used in the fit by KITTEL 66.
[7] An asymmetric shape, with $\Gamma/2 = 41$ MeV below resonance, 14 MeV above.

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HEMINGWAY	85	NP B253 742	R.J. Hemingway	(CERN) J
MARTIN	81	NP B179 33	A.D. Martin	(DURH)
CHAO	73	NP B56 46	Y.A. Chao *et al.*	(RHEL, CMU, LOUC)
THOMAS	73	NP B56 15	D.W. Thomas *et al.*	(CMU) J
MARTIN	70	NP B16 479	A.D. Martin, G.G. Ross	(DURH)
MARTIN	69	PR 183 1352	B.R. Martin, M. Sakitt	(LOUC, BNL)
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