doubt its existence or quantum numbers. A measurement of the energy-level shifts and widths for the atomic levels of kaonic hydrogen (and deuterium) would give a valuable check on analyses of the $(\Sigma\pi, N\overline{K})$ amplitudes, since the energy of the $K^- p$ atom lies roughly midway between those for the two sets of data. The three measurements of $(\Delta E - i\Gamma/2)$ for kaonic hydrogen are inconsistent with one another and require that the sign of $\mathrm{Re}(A_{I=0} + A_{I=1})$ be opposite that deduced from $N\overline{K}$ reaction data (see BATTY 89). Accurate measurements of $(\Delta E - i\Gamma/2)$ values for kaonic hydrogen are badly needed, but may not be possible until the KAON factory becomes operational.

To definitively settle the nature of the $\Lambda(1405)$ will require much further work, both experimental and theoretical. Higher-statistics experiments on the production and decay of the $\Lambda(1405)$ are needed, but suitable K^- beams will not be available until KAON. The low-energy reaction cross sections, especially for the $\overline{K}^0 p$ interactions, last studied 25 years ago, need to be better determined.

$\Lambda(1405)$ 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	$\pi^- p$ 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	$\pi^- p$, $\pi^+ d$ 1.68 GeV/c
1400 ±24		MUSGRAVE	65	HBC	$\overline{p}p$ 3–4 GeV/c
1410		ALEXANDER	62	HBC	$\pi^- p$ 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. • • •				
1411	[3] MARTIN	81		K-matrix fit
1406	[4] 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	[5] KITTEL	66	HBC	0–effective-range fit
1410.7±1.0	KIM	65	HBC	0–effective-range fit
1409.6±1.7	[5] 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	$\pi^- p$ 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. • • •				
30	[3] MARTIN	81		K-matrix fit
55	[4,6] 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	[5] KITTEL	66	HBC	
37.0±3.2	KIM	65	HBC	
28.2±4.1	[5] 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

$\Lambda(1405)$ FOOTNOTES

[1] DALITZ 91 fits the HEMINGWAY 85 data.
[2] THOMAS 73 data is fit by CHAO 73 (see next section).
[3] The MARTIN 81 fit includes the $K^\pm p$ forward scattering amplitudes and the dispersion relations they must satisify.
[4] See also the accompanying paper of THOMAS 73.
[5] Data of SAKITT 65 are used in the fit by KITTEL 66.
[6] An asymmetric shape, with $\Gamma/2 = 41$ MeV below resonance, 14 MeV above.

$\Lambda(1405)$ REFERENCES

BURKHARDT 91 PR C44 607 +Lowe (NOTT, UNM, BIRM)
DALITZ 91 JPG 17 289 +Deloff (OXFTP, WINR)
HEMINGWAY 85 NP B253 742 (CERN) J
MARTIN 81 NP B179 33 (DURH)
CHAO 73 NP B56 46 +Kraemer, Thomas, Martin (RHEL, CMU, LOUC)
THOMAS 73 NP B56 15 +Engler, Fisk, Kraemer (CMU) J
MARTIN 70 NP B16 479 +Ross (DURH)
MARTIN 69 PR 183 1352 +Sakitt (LOUC, BNL)
Also 69B PR 183 1345 Martin, Sakitt (LOUC, BNL)
BARBARO-... 68B PRL 21 573 Barbaro-Galtieri, Chadwick+ (LRL, SLAC)
KIM 67 PRL 19 1074 (YALE)
BIRMINGHAM 66 PR 152 1148 (BIRM, GLAS, LOIC, OXF, RHEL)
KITTEL 66 PL 21 349 +Otter, Wacek (VIEN)
ENGLER 65 PRL 15 224 +Fisk, Kraemer, Meltzer, Westgard+ (CMU, BNL) IJ
KIM 65 PRL 14 29 (COLU)
MUSGRAVE 65 NC 35 735 +Petmezas+ (BIRM, CERN, EPOL, LOIC, SACL)
SAKITT 65 PR 139B 719 +Day, Glasser, Seeman, Friedman+ (UMD, LRL)
ALEXANDER 62 PRL 8 447 +Kalbfleisch, Miller, Smith (LRL) I
ALSTON 62 CERN Conf. 311 +Alvarez, Ferro-Luzzi+ (LRL) I
ALSTON 61B PRL 6 698 +Alvarez, Eberhard, Good+ (LRL) I

OTHER RELATED PAPERS

FINK 90 PR C41 2720 +He, Landau, Schnick (IBMY, ORST, ANSM)
LEINWEBER 90 ANP 198 203 (MCMS)
MUELLER-GR... 90 NP A513 557 Mueller-Groeling, Holinde, Speth (JULI)
BARRETT 89 NC 102A 179 (SURR)
BATTY 89 NC 102A 255 +Gal (RAL, HEBR)
CAPSTICK 89 Excited Baryons '88, p. 32 (GUEL)
LOWE 89 NC 102A 167 (BIRM)
WHITEHOUSE 89 PRL 63 1352 + (BIRM, BOST, BRCO, BNL, CASE, BUDA, TRIU)
SIEGEL 88 PR C38 2221 +Weise (REGE)
WORKMAN 88 PR D37 3117 +Fearing (TRIU)
SCHNICK 87 PRL 58 1719 +Landau (ORST)
CAPSTICK 86 PR D34 2809 +Isgur (TNTO)
JENNINGS 86 PL B176 229 (TRIU)
MALTMAN 86 PR D34 1372 +Isgur (LANL, TNTO)
ZHONG 86 PL B171 471 +Thomas, Jennings, Barrett (ADLD, TRIU, SURR)
BURKHARDT 85 NP A440 653 +Lowe, Rosenthal (NOTT, BIRM, WMIU)
DAREWYCH 85 PR D32 1765 +Koniuk, Isgur (YORKC, TNTO)
VEIT 85 PR D31 1033 +Jennings, Thomas, Barrett (TRIU, ADLD, SURR)
KIANG 84 PR C30 1638 +Kumar, Nogami, VanDijk (DALH, MCMS)
MILLER 84 (LOUC)
Conf. Intersections between Particle and Nuclear Physics, p. 783
VANDIJK 84 PR D30 937 (MCMS)
VEIT 84 PL 137B 415 +Jennings, Barrett, Thomas (TRIU, SURR, CERN)
DALITZ 82 +McGinley, Belyea, Anthony (OXFTP)
Heidelberg Conf., p. 201
DALITZ 81 +McGinley (OXFTP)
Low and Intermediate Energy Kaon-Nucleon Physics, p.381
MARTIN 81B Low and Intermediate Energy Kaon-Nucleon Phys., p. 97 (DURH)
OADES 77 NC 42A 462 +Rasche (AARH, ZURI)
SHAW 73 Purdue Conf. 417 (UCI)
BARBARO-... 72 LBL-555 Barbaro-Galtieri (LBL)
DOBSON 72 PR D6 3256 +McElhaney (HAWA)
RAJASEKA... 72 PR D5 610 Rajasekaran (TATA)
Earlier papers also cited in RAJASEKARAN 72.
CLINE 71 PRL 26 1194 +Laumann, Mapp (WISC)
MARTIN 71 PL 35B 62 +Martin, Ross (DURH, LOUC, RHEL)
DALITZ 67 PR 153 1617 +Wong, Rajasekaran (OXFTP, BOMB)
DONALD 66 PL 22 711 +Edwards, Lys, Nisar, Moore (LIVP)
KADYK 66 PRL 17 599 +Oren, Goldhaber, Goldhaber, Trilling (LRL)
ABRAMS 65 PR 139B 454 +Sechi-Zorn (UMD)