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

THE $\Lambda(1405)$

Revised March 1998 by R.H. Dalitz (Oxford University).

It is generally accepted that the $\Lambda(1405)$ is a well-established $J^P = 1/2^-$ resonance. It is assigned to the lowest L = 1supermultiplet of the 3-quark system and paired with the $J^P = 3/2^- \Lambda(1520)$. Lying about 30 MeV below the $N\overline{K}$ threshold, the $\Lambda(1405)$ can be observed directly only as a resonance bump in the $(\Sigma \pi)^0$ subsystem in final states of production experiments. It was first reported by ALSTON 61B in the reaction $K^- p \to \Sigma \pi \pi \pi$ at 1.15 GeV/c and has since been seen in at least eight other experiments. However, only two of them had enough events for a detailed analysis: THOMAS 73, with about 400 $\Sigma^{\pm}\pi^{\mp}$ events from $\pi^- p \to K^0(\Sigma\pi)^0$ at 1.69 GeV/c; and HEMINGWAY 85, with 766 $\Sigma^+\pi^-$ and 1106 $\Sigma^-\pi^+$ events from $K^-p \to (\Sigma\pi\pi)^+\pi^-$ at 4.2 GeV/c, after the selections $1600 \le M(\Sigma \pi \pi)^+ \le 1720$ MeV and momentum transfer $\leq 1.0 \; (\text{GeV}/c)^2$ to purify the $\Lambda(1405) \to (\Sigma \pi)^0$ sample. These experiments agree on a mass of about 1395–1400 MeV and a width of about 60 MeV. (Hemingway's mass of 1391 ± 1 MeV is from his best, but unacceptably poor, Breit-Wigner fit.)

The Byers-Fenster tests on these data allow any spin and either parity: neither J nor P has yet been determined *directly*. The early indications for $J^P = 1/2^-$ came from finding Re $A_{I=0}$ to be large and negative in a constant-scattering-length analysis of low-energy $N\overline{K}$ reaction data (see KIM 65, SAKITT 65, and earlier references cited therein). The first multichannel energydependent K-matrix analysis (KIM 67) strengthened the case for a resonance around 1400–1420 MeV strongly coupled to the I = 0 S-wave $N\overline{K}$ system.

HTTP://PDG.LBL.GOV Page 1 Created: 12/18/2000 15:12

THOMAS 73 and HEMINGWAY 85 both found the $\Lambda(1405)$ bump to be asymmetric and not well fitted by a Breit-Wigner resonance function with constant parameters. The asymmetry involves a rapid fall in intensity as the $N\overline{K}$ threshold energy is approached from below. This is readily understood as due to a strong coupling of the $\Lambda(1405)$ to the S-wave $N\overline{K}$ channel (see DALITZ 81). This striking S-shaped cusp behavior at a new threshold is characteristic of S-wave coupling; the other below-threshold hyperon, the $\Sigma(1385)$, has no such threshold distortion because its $N\overline{K}$ coupling is P-wave. For the $\Lambda(1405)$, this asymmetry is the sole direct evidence that $J^P = 1/2^-$.

Following the early work cited above, a considerable literature has developed on proper procedures for phenomenological extrapolation below the $N\overline{K}$ threshold, partly in order to strengthen the evidence for the spin-parity of the $\Lambda(1405)$, and partly to provide an estimate for the amplitude $f(N\overline{K})$ in the unphysical domain below the $N\overline{K}$ threshold; the latter is needed for the evaluation of the dispersion relation for $N\overline{K}$ and NK forward scattering amplitudes. For recent reviews, see MILLER 84 and BARRETT 89. In most recent work, the $(\Sigma\pi)^0$ production spectrum is included in the data fitted (see, *e.g.*, CHAO 73, MARTIN 81).

It is now accepted that the data can be fitted only with an S-wave pole in the reaction amplitudes below $N\overline{K}$ threshold (see, however, FINK 90), but there is still controversy about the physical origin of this pole (for a review, see DALITZ 81 and DALITZ 82). Two extreme possibilities are: (a) an L = 1 SU(3)-singlet *uds* state coupled with the S-wave meson-baryon systems; or (b) an unstable $N\overline{K}$ bound state, analogous to the (stable) deuteron in the NN system. The problem with (a) is that the $\Lambda(1405)$ mass is so much lower than that of

its partner, the $\Lambda(1520)$. This requires, in the QCD-inspired quark model, rather large spin-orbit couplings, whether or not one uses relativistic kinetic energies. CAPSTICK 86 and CAPSTICK 89 conclude that a proper QCD calculation leads only to small energy splittings, whereas LEINWEBER 90, using QCD sum rules, obtains a good fit to this splitting.

On the other hand, the problem with (b) is that then another $J^P = 1/2^- \Lambda$ is needed to replace the $\Lambda(1405)$ in the L =1 supermultiplet, and it would have to lie close to the $\Lambda(1520)$, a region already well explored by $N\overline{K}$ experiments without result. Intermediate structures are possible; for example, the cloudy bag model allows the configurations (a) and (b) to mix and finds the intensity of (a) in the $\Lambda(1405)$ to be only 14% (VEIT 84, VEIT 85, JENNINGS 86). Such models naturally predict a second $1/2^- \Lambda$ close to the $\Lambda(1520)$.

The determination of the mass and width of the resonance from $(\Sigma \pi)^0$ data is usually based on the "Watson approximation," which states that the production rate $R(\Sigma \pi)$ of the $(\Sigma \pi)^0$ state has a mass dependence proportional to $(\sin^2 \delta_{\Sigma \pi})/q$, q being the $\Sigma \pi$ c.m. momentum, in a $\Sigma \pi$ mass range where $\delta_{\Sigma \pi}$ is not far from $\pi/2$ and only the $\Sigma \pi$ channel is open, *i.e.*, between the $\Sigma \pi$ and the $N\overline{K}$ thresholds. Then $q R(\Sigma \pi)$ is proportional to $\sin^2 \delta_{\Sigma \pi}$, and the mass M may be defined as the energy at which $\sin^2 \delta_{\Sigma \pi} = 1$. The width Γ may be determined from the rate at which $\delta_{\Sigma \pi}$ goes through $\pi/2$, or from the FWHM; this is a matter of convention.

This determination of M and Γ from the data suffers from the following defects:

(i) The determination of $\sin^2 \delta_{\Sigma\pi}$ requires that $R(\Sigma\pi)$ be scaled to give $\sin^2 \delta_{\Sigma\pi} = 1$ at the peak for the best fit to the data; *i.e.*, the bump must be *assumed* to arise from a resonance.

However, this assumption is supported by the analysis of the low-energy $N\overline{K}$ data and its extrapolation below threshold.

(ii) Owing to the nearby $N\overline{K}$ threshold, the shape of the best fit to the $M(\Sigma\pi)$ bump is uncertain. For energies below this threshold at $E_{N\overline{K}}$, the general form for $\delta_{\Sigma\pi}$ is

$$q \cot \delta_{\Sigma \pi} = \frac{1 + \kappa \alpha}{\gamma + \kappa (\alpha \gamma - \beta^2)} . \tag{1}$$

Here α, β , and γ are the (generally energy-dependent) NN, $N\Sigma$, and $\Sigma\Sigma$ elements of the I = 0 S-wave K-matrix for the $(\Sigma\pi, N\overline{K})$ system, and κ is the magnitude of the (imaginary) c.m. momentum k_K for the $N\overline{K}$ system below threshold. The elements α, β, γ are real functions of E; they have no branch cuts at the $\Sigma\pi$ and $N\overline{K}$ thresholds, but they are permitted to have poles in E along the real E axis. The resonance asymmetry arises from the effect of κ on $\delta_{\Sigma\pi}$. We note that $\delta_{\Sigma\pi} = \pi/2$ when $\kappa = -1/\alpha$.

Accepting this close connection of $\delta_{\Sigma\pi}$ with the low-energy $N\overline{K}$ data, it is natural to analyze the two sets of data together (e.g., MARTIN 81), and there is now a large body of accurate $N\overline{K}$ data for laboratory momenta between 100 and 300 MeV/c (see MILLER 84). The two sets of data span c.m. energies from 1370 MeV to 1490 MeV, and the K-matrix elements will not be energy independent over such a broad range. For the I = 0 channels, a linear energy dependence for K^{-1} has been adopted routinely ever since the work of KIM 67, and it is essential when fitting the $q R(\Sigma\pi)$ and $N\overline{K}$ data together. However, $q R(\Sigma\pi)$ is not always well fitted in this procedure; the value obtained for the $\Lambda(1405)$ mass M varies a good deal with the type of fit, not a surprising result when the $\Sigma\pi$ mass spectrum below the pK^- threshold contributes only nine data points in a total of about 200. The value of M obtained from an overall fit

is not necessarily much better than from one using only the $q R(\Sigma \pi)$ data; and M may be a function of the representation— K-matrix, K⁻¹-matrix, relativistic-separable or nonseparable potentials, *etc.*— used in fitting over the full energy range. DALITZ 91 fitted the $q R(\Sigma^+\pi^-)$ Hemingway data with each of the first three representations just mentioned, constrained to the $I = 0 \ N\overline{K}$ threshold scattering length from low-energy $N\overline{K}$ data. The (nonseparable) meson-exchange potentials of MÜLLER-GROELING 90, fitted to the low-energy $N\overline{K}$ (and NK) data, predicted an unstable $N\overline{K}$ bound state with mass and width compatible with the $\Lambda(1405)$.

From the measurement of $2p \rightarrow 1s$ x rays from kaonichydrogen, the energy-level shift ΔE and width Γ of its 1s state can give us two further constraints on the $(\Sigma \pi, N\overline{K})$ system, at an energy roughly midway between those from the low-energy hydrogen bubble chamber studies and those from $q R(\Sigma \pi)$ observations below the pK^- threshold. IWASAKI 97 have reported the first convincing observation of this x ray, with a good initial estimate:

$$\Delta E - i\Gamma/2 = (-323 \pm 63 \pm 11) - i(204 \pm 104 \pm 50) \text{ eV}. \quad (2)$$

The errors here encompass about half of the predictions made following the various analyses and/or models for the in-flight K^-p and sub-threshold $q R(\Sigma \pi)$ data. Better measurements will be needed to discriminate between the analyses and predictions. Now that ΔE is known with some certainty, we can anticipate much-improved data on kaonic-hydrogen, perhaps from the DA Φ NE storage ring at Frascati, information vital for our quantitative understanding of the $(\Sigma \pi, N\overline{K})$ system in this region. This will lead to better knowledge of kaonic coupling

HTTP://PDG.LBL.GOV Page 5 Created: 12/18/2000 15:12

strengths and to more reliable dispersion-theoretic arguments concerning strange-particle processes.

The present status of the $\Lambda(1405)$ thus depends heavily on theoretical arguments, a somewhat unsatisfactory basis for a four-star rating. Nevertheless, there is no known reason to doubt its existence or quantum numbers. The 3-quark model for baryons has been broadly successful in accounting for all of the $L^P = 1^-$ excited baryonic states (CAPSTICK 89), apart from the relatively large mass separation between the $\Lambda(1405)$ and $\Lambda(1520)$. Quark model builders have no reservations about accepting the $\Lambda(1405)$ as a 3-quark state. However, calculations with broken-chiral-symmetric models, which combine internal 3-quark configurations with external meson-baryon states (e.q.,VEIT 85, KAISER 95) end up with descriptions of the $\Lambda(1405)$ dominated by the meson-baryon terms in the wavefunctions. Models using meson-baryon potentials readily fit its mass, and give ΔE negative, as is found empirically. The problem is not so much one of "either (a) or (b)," but rather how to achieve "both (a) and (b)." Theoreticians have not yet been able to deal with the full coupled-channels system, with qqq and $qqqq\bar{q}$ configurations (at the least) being treated on the same footing. On the experimental side, better statistics are needed, both above and below the pK^- threshold. To disentangle the physics, the I = 1 channels also need more attention. For example, low-energy pK_L^0 interactions have not been studied at all in the last 25 years.

A(1405) MASS PRODUCTION EXPERIMENTS DOCUMENT ID TECN COMMENT VALUE (MeV) EVTS ¹ DALITZ 91 1406.5± 4.0 M-matrix fit

 \bullet \bullet We do not use the following data for averages, fits, limits, etc. \bullet \bullet

1391	\pm 1	700	¹ HEMINGWAY	85	HBC	<i>K</i> ⁻ <i>p</i> 4.2 GeV/ <i>c</i>
\sim 1405		400	² THOMAS	73	HBC	$\pi^- p$ 1.69 GeV/c
1405		120	BARBARO	68 B	DBC	$K^{-}d$ 2.1–2.7 GeV/ c
1400	\pm 5	67	BIRMINGHAM	66	HBC	$K^- p$ 3.5 GeV/c
1382	\pm 8		ENGLER	65	HDBC	$\pi^{-} p, \pi^{+} d \ 1.68 \ \text{GeV}/c$
1400	± 24		MUSGRAVE	65	HBC	<i>p</i> p 3–4 GeV/ <i>c</i>
1410			ALEXANDER	62	HBC	$\pi^- p$ 2.1 GeV/c
1405			ALSTON	62	HBC	$K^- p \ 1.2$ –0.5 GeV/ c
1405			ALSTON	61 B	HBC	<i>K</i> ⁻ <i>p</i> 1.15 GeV/ <i>c</i>

EXTRAPOLATIONS BELOW NK THRESHOLD

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
\bullet \bullet \bullet 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

Л(1405) WIDTH

PRODUCTION EXPERIMENTS

VAL	UE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
50	± 2		¹ DALITZ	91		M-matrix fit
• •	• We do no	ot use the following	data for averages	, fits,	limits,	etc. • • •
32	\pm 1	700	¹ HEMINGWAY	85	HBC	<i>K</i> ⁻ <i>p</i> 4.2 GeV/ <i>c</i>
45	to 55	400	² THOMAS	73	HBC	$\pi^- p$ 1.69 GeV/c
35		120	BARBARO	68 B	DBC	$K^{-}d$ 2.1–2.7 GeV/ c
50	± 10	67	BIRMINGHAM	66	HBC	<i>К[—] р</i> 3.5 GeV/ <i>с</i>
89	± 20		ENGLER	65	HDBC	
60	± 20		MUSGRAVE	65	HBC	
35	\pm 5		ALEXANDER	62	HBC	
50			ALSTON	62	HBC	
20			ALSTON	61 B	HBC	

EXTRAPOLATIONS BELOW NK THRESHOLD VALUE (MeV) DOCUMENT ID

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following	ing data for average	es, 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	

HTTP://PDG.LBL.GOV Page 7

Created: 12/18/2000 15:12

A(1405) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ ₁	$\Sigma \pi$	100 %
Γ ₂	$\Lambda\gamma$	
Γ ₃	$\Sigma_{\underline{\gamma}}^{0}$	
Г ₄	NK	

A(1405) PARTIAL WIDTHS

$\Gamma(\Lambda\gamma)$				Г2
VALUE (keV)		DOCUMENT ID	COMMENT	
\bullet \bullet \bullet We do not use	the followin	g data for averages, fit	s, limits, etc. • • •	
27±8		BURKHARDT 91	lsobar model fit	
$\Gamma(\Sigma^0\gamma)$				Гз
VALUE (keV)		DOCUMENT ID	COMMENT	
\bullet \bullet \bullet We do not use	the followin	g data for averages, fit	s, limits, etc. • • •	
10 \pm 4 or 23 \pm 7		BURKHARDT 91	lsobar model fit	
	<i>/</i> (140	5) BRANCHING R	ATIOS	
$\Gamma(N\overline{K})/\Gamma(\Sigma\pi)$				Γ_4/Γ_1
VALUE	<u>CL%</u>	DOCUMENT ID	TECN COMMENT	
\bullet \bullet \bullet We do not use	the followin	g data for averages, fits	s, limits, etc. • • •	
<3	95	HEMINGWAY 85	HBC $K^- p$ 4.2 GeV	/c
		() <u> </u>		

A(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 Determined for the KATTEL 66

⁵ Data of SAKITT 65 are used in the fit by KITTEL 66.

⁶An asymmetric shape, with $\Gamma/2 = 41$ MeV below resonance, 14 MeV above.

*N***(1405) REFERENCES**

91	PR C44 607	H. Burkhardt, J. Lowe	(NOTT, UNM, BIRM)
91	JPG 17 289	R.H. Dalitz, A. Deloff	(OXFTP, WINR)
85	NP B253 742	R.J. Hemingway	CERN) J
81	NP B179 33	A.D. Martin	(DURH)
73	NP B56 46	Y.A. Chao <i>et al.</i>	(RHEL, CMU, LOUC)
73	NP B56 15	D.W. Thomas et al.	(CMU) J
70	NP B16 479	A.D. Martin, G.G. Ross	(DURH)
69	PR 183 1352	B.R. Martin, M. Sakitt	(LOUC, BNL)
69B	PR 183 1345	B.R. Martin, M. Sakitt	(LOUC, BNL)
68B	PRL 21 573	A. Barbaro-Galtieri <i>et al.</i>	(LRL, SLAC)
67	PRL 19 1074	J.K. Kim	(YALE)
66	PR 152 1148	M. Haque <i>et al.</i> (BIRM, GLAS, LOIC, OXF+)
66	PL 21 349	W. Kittel, G. Otter, I. Wacek	(VIEN)
65	PRL 15 224	A. Engler <i>et al.</i>	(CMU, BNL) IJ
65	PRL 14 29	J.K. Kim	(COLU)
65	NC 35 735	B. Musgrave <i>et al.</i>	(BIRM, CERN, EPOL+)
65	PR 139B 719	M. Sakitt <i>et al.</i>	(UMD, LRL)
62	PRL 8 447	G. Alexander <i>et al.</i>	(LRL) I
62	CERN Conf. 311	M.H. Alston <i>et al.</i>	(LRL) I
61B	PRL 6 698	M.H. Alston <i>et al.</i>	(LRL) I
	91 91 85 81 73 70 69 69B 68B 67 66 65 65 65 65 65 65 62 62 61B	91 PR C44 607 91 JPG 17 289 85 NP B253 742 81 NP B179 33 73 NP B56 46 73 NP B56 15 70 NP B16 479 69 PR 183 1352 69B PR 183 1345 68B PRL 21 573 67 PRL 19 1074 66 PL 21 349 65 PRL 15 224 65 PRL 14 29 65 PR 139B 719 62 PRL 8 447 62 CERN Conf. 311 61B PRL 6 698	91 PR C44 607 H. Burkhardt, J. Lowe 91 JPG 17 289 R.H. Dalitz, A. Deloff 85 NP B253 742 R.J. Hemingway 81 NP B179 33 A.D. Martin 73 NP B56 46 Y.A. Chao et al. 73 NP B56 15 D.W. Thomas et al. 70 NP B16 479 A.D. Martin, M. Sakitt 69B PR 183 1352 B.R. Martin, M. Sakitt 69B PR 183 1345 B.R. Martin, M. Sakitt 68B PRL 21 573 A. Barbaro-Galtieri et al. 67 PRL 19 1074 J.K. Kim 66 PR 152 1148 M. Haque et al. ((67 PRL 15 224 A. Engler et al. ((65 PRL 14 29 J.K. Kim (1 65 PRL 14 29 J.K. Kim (1 65 PRL 139B 719 M. Sakitt et al. (2 65 PRL 8 447 G. Alexander et al. (2 62 CERN Conf. 311 M.H. Alston et al. (3 61B PRL 6 698 M.H. Alston et al. (3

- OTHER RELATED PAPERS -

FINK 90 PR C41 220 P.J.F. Fink et al. (IBMY, ORST, ANSM) LEINWEBER 90 ANP 198 203 D.B. Leinweber (MCMS) MUELLER-GR90 NP A513 557 A. Mueller-Groeling, K. Holinde, J. Speth (JULI) BARTY 89 NC<102A 179 R.C. Barrett (SURR) BATTY 89 NC<102A 255 C.J. Batty, A. Gal (RAL, HEBR) CAPSTICK 89 Excited Baryons 88, p.32 S. Capstick (BIRM) MOST, BRCO+ SIEGEL 88 PR C33 221 P.B. Siegel, W. Weise (BIRM, BOST, BRCO+) SCHNICK 87 PR 153 117 R.L. Workman, H.W. Fearing (TRU) SCHNICK 87 PR 153 1372 K. Maltman, N. Isgur (LANL, TNTO) JENNINGS 86 PL B17 271 Y.S. Zhong et al. (ADLD, TRU, SURR) URAHARDT 85 PR D31 133 E.A. Veit et al. (TRU, ADLD, SURR)	IWASAKI	97	PRL 78 3067	M. Iwasaki <i>et al.</i>	(KEK-228 Collab.)
LEINWEBER 90 ANP 198 203 D.B. Leinweber (MCMS) MUELLER-GR90 NP A513 557 A. Mueller-Groeling, K. Holinde, J. Speth (JUL) BARTETT 89 NC 102A 179 R.C. Barrett (SURR) CAPSTICK 89 NC 102A 167 J. Lowe (BIRM) VMHTEHOUSE 89 NC 102A 167 J. Lowe (BIRM) WHITEHOUSE 89 PRL 63 1352 D.A. Whitehouse et al. (BIRM, BOST, BRCO+) SIEGEL 88 PR C38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR 037 3117 R.L. Workman, H.W. Fearing (TRIU) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) JENNINGS 86 PR D34 2809 S. Capstick, N. Isgur (LANL, TNTO) JENNINGS 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) JENGKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (TRU, ADLD, SUR,	FINK	90	PR C41 2720	P.J.Jr. Fink <i>et al.</i>	(IBMÝ, ORST, ANSM)
MUELLER-GR90 NP A513 557 A. Mueller-Groeling, K. Holinde, J. Speth (JULI) BARRETT 89 NC 102A 179 R.C. Barrett (SURR) BATTY 89 NC 102A 255 C.J. Batty, A. Gal (RAL, HEBR) CAPSTICK 89 Excited Baryons 88, p.32 S. Capstick (GUEL) LOWE 89 NC 102A 167 J. Lowe (BIRM) VMHITEHOUSE 89 PRL 63 1352 D.A. Whitehouse et al. (BIRM, BOST, BRCO+) SIEGEL 88 PR D37 3117 R.L. Workman, H.W. Fearing (TRIU) SCHNICK 87 PR J58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TARU) JENNINGS 86 PL B176 229 B.K. Jennings (TRU) JENNINGS 86 PL B176 229 B.K. Jennings (MOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (ADLD, SURR) KIANG 84 PC C30 1638 D. Kiang et al. (DALH, MCMS) <t< td=""><td>LEINWEBER</td><td>90</td><td>ANP 198 203</td><td>D.B. Leinweber</td><td>(MCMS)</td></t<>	LEINWEBER	90	ANP 198 203	D.B. Leinweber	(MCMS)
BARRETT89NC 102A 179R.C. Barrett(ŠURR)BATTY89NC 102A 255C.J. Batty, A. Gal(RAL, HEBR)CAPSTICK89Excited Baryons 88, p.32S. Capstick(GUEL)LOWE89NC 102A 167J. Lowe(BIRM)WHITEHOUSE89PRL 63 1352D.A. Whitehouse et al.(BIRM, BOST, BRCO+)SIEGEL88PR C38 2221P.B. Siegel, W. Weise(REGE)WORKMAN88PR D33 3117R.L. Workman, H.W. Fearing(TRIU)SCHNICK87PRL 58 1719J. Schnick, R.H. Landau(ORST)CAPSTICK86PL B176 229B.K. Jennings(TRIU)MALTMAN86PR D34 1372K. Maltman, N. Isgur(LANL, TNTO)JENNINGS86PL B171 471Y.S. Zhong et al.(ADLD, TRIU, SURR)URKHARDT85NP A440 653H. Burkhardt, J. Lowe, A.S. Rosenthal(NOTT+)DAREWYCH85PR D32 1765J.W. Darewych, R. Koniuk, N. Isgur(YORKC, TNTO)VEIT85PR D31 1033E.A. Veit et al.(TRIU, ADLD, SURR)MILLER84PR D30 937W. van Dijk(MCMS)VEIT84PR D30 937W. van Dijk(MCKS)VEIT84PR D30 937W. van Dijk(MCKS)DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(DXFP)HeidelbergConf.R.H. Dalitz, J.G. McGinley(OXFP)Low and Intermediate Energy Kaon-Nucelon Physics, p. 381(MARTIN(DURH)D	MUELLER-GR	.90	NP A513 557	A. Mueller-Groeling, K. Holinde,	J. Speth (JULI)
BATTY 89 NC 102A 255 C.J. Batty, A. Gal (RAL, HEBR) CAPSTICK 89 Excited Baryons 88, p.32 S. Capstick (GUEL) LOWE 89 NC 102A 167 J. Lowe (BIRM) WHITEHOUSE 89 PRL 63 1352 D.A. Whitehouse et al. (BIRM, BOST, BRCO+) SIEGEL 88 PR 233 211 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR D33 3117 R.L. Workman, H.W. Fearing (TRU) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRU, SURR) BURKHARDT 85 NP A340 663 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (DALH, MCMS) MILLER 94 PL 317B 415 E.A. Veit et al. (DALH, MC	BARRETT	89	NC 102A 179	R.C. Barrett	(SURR)
CAPSTICK 89 Excited Baryons 88, p.32 S. Capstick (GUEL) LOWE 89 NC 102A 167 J. Lowe (BIRM, BOST, BRCO+) SIEGEL 88 PR C 38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR C 38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR C 38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR C 38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR D 37 3117 R.L. Workman, H.W. Fearing (TRU) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TINTO) JENNINGS 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (TRU, ADLD, SURR) KIANG 84 PR C30 1638 D. Kiang et al. (DALH, MCMS) VEIT 84 PR D30 937 W. van Dijk <	BATTY	89	NC 102A 255	C.J. Batty, A. Gal	(RAL, HEBR)
LOWE 89 NC 102A 167 J. Lowe (BIRM) WHITEHOUSE 89 PR 63 1352 D.A. Whitehouse <i>et al.</i> (BIRM, BOST, BRCO+) SIEGEL 88 PR C38 2211 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR D37 3117 R.L. Workman, H.W. Fearing (TRIU) SCHNICK 87 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PL B176 229 B.K. Jennings (TRIU) MALTMAN 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) JHONG 86 PL B171 471 Y.S. Zhong <i>et al.</i> (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit <i>et al.</i> (TRIU, ADLD, SURR) KIANG 84 PR C30 1638 D. Kiang <i>et al.</i> (DALH, MCMS) MILLER 84 PL 337B 415 E.A. Veit <i>et al.</i> (TRIU, SURR, CERN) DALITZ 82 Heid. Conf. R.H. Dalitz, J.G. McGinley <td>CAPSTICK</td> <td>89</td> <td>Excited Baryons 88, p.32</td> <td>S. Capstick</td> <td>) (GUEL)</td>	CAPSTICK	89	Excited Baryons 88, p.32	S. Capstick) (GUEL)
WHITEHOUSE 89 PRL 63 1352 D.A. Whitehouse <i>et al.</i> (BIRM, BOST, BRCO+) SIEGEL 88 PR C38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR C38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR C38 2221 P.B. Siegel, W. Weise (REGE) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (LANL, TNTO) JENNINGS 86 PL B171 471 Y.S. Zhong <i>et al.</i> (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit <i>et al.</i> (TRIU, ADLD, SURR) KIANG 84 PR C30 1638 D. Kiang <i>et al.</i> (DALH, MCMS) MILLER 84 D.J. Miller (LOUC) Conf. IRTU, SURR, CERN) DALITZ 84 PL 137B	LOWE	89	NC 102A 167	J. Lowe	(BIRM)
SIEGEL 88 PR C38 2221 P.B. Siegel, W. Weise (REGE) WORKMAN 88 PR D37 3117 R.L. Workman, H.W. Fearing (TRU) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PL B176 229 B.K. Jennings (TRU) MALTMAN 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) ZHONG 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (TRU, ADLD, SURR) KIANG 84 PR C30 1638 D. J. Miller (LOUC) Conf. Intersections between Particle and Nuclear Physics, p. 783 (MCMS) VANDIJK 84 PR D30 937 W. van Dijk (MCMS) VEIT 84 PL 137B 415 E.A. Veit et al. (TRIU, SURR, CERN)	WHITEHOUSE	89	PRL 63 1352	D.A. Whitehouse et al.	(BIRM, BOST, BRCO+)
WORKMAN 88 PR D37 3117 R.L. Workman, H.W. Fearing (TRIU) SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PL B176 229 B.K. Jennings (LAUL, TNTO) JENNINGS 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D32 1765 J.W. Darewych, R. Koniuk, N. Isgur (YORKC, TNTO) VEIT 85 PR D31 1033 E.A. Veit et al. (TRIU, ADLD, SURR) MILLER 84 D.J. Miller (LOUC) Conf. Intersections between Particle and Nuclear Physics, p. 783 VANDIJK 84 PR D30 937 W. van Dijk (MCMS) VEIT 84 PL 137B 415 E.A. Veit et al. (TRIU, SURR, CERN) DALITZ 81 Kaon Conf. R.H. Dalitz, J.G. McGinley (OXFTP) Low and Intermediate Energy Kaon-Nu	SIEGEL	88	PR C38 2221	P.B. Siegel, W. Weise	(REGE)
SCHNICK 87 PRL 58 1719 J. Schnick, R.H. Landau (ORST) CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) ZHONG 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D31 1033 E.A. Veit et al. (TRIU, ADLD, SURR) KIANG 84 PR C30 1638 D. Kiang et al. (DALH, MCMS) MILLER 84 D.J. Miller (LOUC) Conf. Conf. Intersections between Particle and Nuclear Physics, p. 783 (MCMS) VANDIJK 84 PR D30 937 W. van Dijk (MCMS) VEIT 84 PL 137B 415 E.A. Veit et al. (TRIU, SURR, CERN) DALITZ 82 Heid. Conf. R.H. Dalitz, J.G. McGinley (OXFTP) Low and Intermediate Energy Kaon-Nucelon Physics, p. 97 OADES 77 NC 42A 462	WORKMAN	88	PR D37 3117	R.L. Workman, H.W. Fearing	(TRIU)
CAPSTICK 86 PR D34 2809 S. Capstick, N. Isgur (TNTO) JENNINGS 86 PL B176 229 B.K. Jennings (TRU) MALTMAN 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) ZHONG 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR <d31< td=""> 1033 E.A. Veit et al. (TRU, ADLD, SURR) KIANG 84 PR C30 1638 D. Kiang et al. (DALH, MCMS) MILLER 84 D.J. Miller (LOUC) Conf. (MCMS) VANDIJK 84 PR D30.937 W. van Dijk (MCMS) VAIT 84 PL 137B 415 E.A. Veit et al. (TRU, SURR, CERN) DALITZ 81 Kaon Conf. R.H. Dalitz, J.G. McGinley (OXFTP) Low and Intermediate Energy Kaon-Nucelon Physics, p. 37<</d31<>	SCHNICK	87	PRL 58 1719	J. Schnick, R.H. Landau	(ÒRST)
JENNINGS 86 PL B176 229 B.K. Jennings (TRIU) MALTMAN 86 PR D34 1372 K. Maltman, N. Isgur (LANL, TNTO) ZHONG 86 PL B171 471 Y.S. Zhong et al. (ADLD, TRIU, SURR) BURKHARDT 85 NP A440 653 H. Burkhardt, J. Lowe, A.S. Rosenthal (NOTT+) DAREWYCH 85 PR D32 1765 J.W. Darewych, R. Koniuk, N. Isgur (YORKC, TNTO) VEIT 85 PR D31 1033 E.A. Veit et al. (TRIU, ADLD, SURR) MALTR 84 PR C30 937 W. van Dijk (MCMS) VANDJJK 84 PR D30 937 W. van Dijk (MCMS) VEIT 84 PL 137B 415 E.A. Veit et al. (TRIU, SURR, CERN) DALITZ 81 Kaon Conf. R.H.	CAPSTICK	86	PR D34 2809	S. Capstick, N. Isgur	(ŤNTO)
MALTMAN86PRD341372K. Maltman, N. Isgur(LANL, TNTO)ZHONG86PLB171471Y.S. Zhong et al.(ADLD, TRIU, SURR)BURKHARDT85NPA440653H. Burkhardt, J. Lowe, A.S. Rosenthal(NOTT+)BURKHARDT85PRD321765J.W. Darewych, R. Koniuk, N. Isgur(YORKC, TNTO)VEIT85PRD311033E.A. Veit et al.(TRIU, ADLD, SURR)KIANG84PRC301638D. Kiang et al.(DALH, MCMS)MILLER84D.J. Miller(LOUC)Conf.Intersections between Particle and Nuclear Physics, p.783VANDIJK84PRD30937W. van Dijk(MCMS)VEIT84PL137B415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p. 381MARTIN(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p.97OADES(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)DASON72PRD63256P.N. Dobson, R. McElhaney(HAWA)RAJSEKA72PRD6G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARNA 72.CLINETPR26CLINE71PR L261194D.	JENNINGS	86	PL B176 229	B.K. Jennings	(TRIU)
ZHONG86PLB171Y.S. Zhong et al.(ADLD, TRIU, SURR)BURKHARDT85NPA440653H. Burkhardt, J. Lowe, A.S. Rosenthal(NOTT+)DAREWYCH85PRD321765J.W. Darewych, R. Koniuk, N. Isgur(YORKC, TNTO)VEIT85PRD311033E.A. Veit et al.(TRIU, ADLD, SURR)KIANG84PRC301638D. Kiang et al.(DALH, MCMS)MILLER84D.J. Miller(LOUC)Conf.Intersections between Particle and Nuclear Physics, p.783VANDIJK84PRD30937W. van Dijk(MCMS)VEIT84PL137B415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)HeidelbergConf., p.201DDALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucelon Physics, p.97OADEST7NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf.417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D63256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN72.CLINE71PRL 26CUINE71PRL 261194D. Cl	MALTMAN	86	PR D34 1372	K. Maltman, N. Isgur	(LANL, ŤNTO)
BURKHARDT85NPA440653H. Burkhardt, J. Lowe, A.S. Rosenthal(NOTT+)DAREWYCH85PRD321765J.W. Darewych, R. Koniuk, N. Isgur(YORKC, TNTO)VEIT85PRD311033E.A. Veit et al.(TRIU, ADLD, SURR)KIANG84PRC301638D. Kiang et al.(DALH, MCMS)MILLER84B.J. Miller(LOUC)Conf.Intersections between Particle and Nuclear Physics, p.783VANDIJK84PRD30937W. van Dijk(MCMS)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and IntermediateEnergy Kaon-NucleonPhysics, p. 381(DURH)Low and IntermediateEnergy Kaon-NucleonPhysics, p. 97OADES77OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ66PRL 27 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al. <td>ZHONG</td> <td>86</td> <td>PL B171 471</td> <td>Y.S. Zhong et al.</td> <td>(ADLD, TRIU, SURR)</td>	ZHONG	86	PL B171 471	Y.S. Zhong et al.	(ADLD, TRIU, SURR)
DAREWYCH85PRD321765J.W. Darewych, R. Koniuk, N. Isgur(YORKĊ, TNTO)VEIT85PRD311033E.A. Veit et al.(TRIU, ADLD, SURR)KIANG84PRC301638D. Kiang et al.(DALH, MCMS)MILLER84D.J. Miller(LOUC)Conf.Intersections between Particle and Nuclear Physics, p.783VANDIJK84PRD30937W. van Dijk(MCMS)VEIT84PL137B415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz, J.G. McGinley(OXFTP)LeidelbergConf., p.201DALITZ81Kaon Conf.A.D. Martin(DURH)Low and IntermediateEnergy Kaon-NucleonPhysics, p.97OADES77NC 42A462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73PurdueConf.417G.L. Shaw(UCI)BARBARO72PR D5610G. Rajasekaran(TATA)Earlier papers alsocited in RAJASEKARAN72.CLINE71PRL 261194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ66PL 22711R.A. Donald et al.(LIVP)KAMAS65PR139B454G.S. Abrams, B. Sechi-Zorn(UMD)	BURKHARDT	85	NP A440 653	H. Burkhardt, J. Lowe, A.S. Ros	enthal (NOTT+)
VEIT85PRD311033E.A. Veit et al.(TRIÙ, ADLD, SURR)KIANG84PRC301638D. Kiang et al.(DALH, MCMS)MILLER84BD.J. Miller(LOUC)Conf.Intersections between Particle and Nuclear Physics, p.783(MCMS)VANDIJK84PRD30937W. van Dijk(MCMS)VEIT84PL137B415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)HeidelbergConf., p.201COXFTP)(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p.381(DURH)Low and Intermediate Energy Kaon-Nucelon Physics, p.97OADES77NC42A462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf.417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PRD63256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PRD5610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN72.CLINE71PRL 261194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PRL 261194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR131617	DAREWYCH	85	PR D32 1765	J.W. Darewych, R. Koniuk, N. Is	sgur (YORKČ, TNTO)
KIANG84PR C30 1638D. Kiang et al.(DALH, MCMS)MILLER84D.J. Miller(LOUC)Conf. Intersections between Particle and Nuclear Physics, p. 783(MCMS)VANDIJK84PR D30 937W. van Dijk(MCMS)VEIT84PL 137B 415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)Heidelberg Conf., p. 201DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p.381(DURH)(DURH)(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p. 97OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(DXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn </td <td>VEIT</td> <td>85</td> <td>PR D31 1033</td> <td>E.A. Veit <i>et al.</i></td> <td>(TRIÙ, ADLD, SURR)</td>	VEIT	85	PR D31 1033	E.A. Veit <i>et al.</i>	(TRIÙ, ADLD, SURR)
MILLER84D.J. Miller(LOUC)Conf. Intersections between Particle and Nuclear Physics, p. 783VANDIJK84PR D30 937W. van Dijk(MCMS)VANDIJK84PR 137B 415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p. 381(DURH)(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p. 97OADES(T N C 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 358 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(DXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	KIANG	84	PR C30 1638	D. Kiang et al.	(DALH, MCMS)
Conf. Intersections between Particle and Nuclear Physics, p. 783VANDIJK84PR D30 937W. van Dijk(MCMS)VEIT84PL 137B 415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)Heidelberg Conf., p. 201DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p.381(MARTIN81BKaon Conf.A.D. Martin(DURH)Low and Intermediate Energy Kaon-Nucelon Physics, p. 97(OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DAILTZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP)DONALD66PL 22 711R.A. Donald et al.(LIVP)(KAPK(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	MILLER	84		D.J. Miller	(LOUC)
VANDIJK84PR D30 937W. van Dijk(MCMS)VEIT84PL 137B 415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)HeidelbergConf., p. 201(OXFTP)DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and IntermediateEnergy Kaon-Nucleon Physics, p. 381(DURH)MARTIN81BKaon Conf.A.D. Martin(DURH)Low and IntermediateEnergy Kaon-Nucelon Physics, p. 97(OADES77OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	Conf. Inter	section	s between Particle and N	uclear Physics, p. 783	· · · · · ·
VEIT84PL 137B 415E.A. Veit et al.(TRIU, SURR, CERN)DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)Heidelberg Conf., p. 201DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p. 381(DURH)(DURH)(DURH)Low and Intermediate Energy Kaon-Nucelon Physics, p. 97(DALES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)(DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(DXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)(LAP)(LAP)(LAR)(LAR)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)(DALITZ)	VANDIJK	84	PR D30 937	W. van Dijk	(MCMS)
DALITZ82Heid. Conf.R.H. Dalitz et al.(OXFTP)HeidelbergConf., p. 201DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and IntermediateEnergy Kaon-NucleonPhysics, p. 381(DURH)(DURH)Low and IntermediateEnergy Kaon-NucleonPhysics, p. 97(OADES(OATER)OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73PurdueConf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(UVP)KADYK66PRL 17 599J.A. Kadyk et al.(LIVP)(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	VEIT	84	PL 137B 415	E.A. Veit <i>et al.</i>	(TRIU, SURR, CERN)
Heidelberg Conf., p. 201Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p.381(DURH)MARTIN81BKaon Conf.A.D. Martin(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p. 97(DALES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(UVP)KADYK66PRL 17 599J.A. Kadyk et al.(LIVP)(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	DALITZ	82	Heid. Conf.	R.H. Dalitz <i>et al.</i>	(OXFTP)
DALITZ81Kaon Conf.R.H. Dalitz, J.G. McGinley(OXFTP)Low and Intermediate Energy Kaon-Nucleon Physics, p.381(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p. 97(DURH)Low and Intermediate Energy Kaon-Nucleon Physics, p. 97(DURH)OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PR 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)(LAP)KADYK66PRL 17 599J.A. Kadyk <i>et al.</i> (LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	Heidelberg	Conf.,	p. 201		, , , , , , , , , , , , , , , , , , ,
Low and Intermediate Energy Kaon-Nucleon Physics, p.381(DURH)MARTIN81BKaon Conf.A.D. Martin(DURH)Low and Intermediate Energy Kaon-Nucelon Physics, p. 97OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)(LAC)(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	DALITZ	81	Kaon Conf.	R.H. Dalitz, J.G. McGinley	(OXFTP)
MARTIN81BKaon Conf.A.D. Martin(DURH)Low and Intermediate Energy Kaon-Nucelon Physics, p. 97970ADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(QXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)(LAC)(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	Low and In	termed	liate Energy Kaon-Nucleon	Physics, p.381	
Low and Intermediate Energy Kaon-Nucelon Physics, p. 97OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(DXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)KADYK66PRL 17 599J.A. Kadyk <i>et al.</i> (LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	MARTIN	81B	Kaon Conf.	A.D. Martin	(DURH)
OADES77NC 42A 462G.C. Oades, G. Rasche(AARH, ZURI)SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(DXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	Low and In	termec	liate Energy Kaon-Nucelon	Physics, p. 97	
SHAW73Purdue Conf. 417G.L. Shaw(UCI)BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(QXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)KADYK66PRL 17 599J.A. Kadyk <i>et al.</i> (LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	OADES	77	NC 42A 462	G.C. Oades, G. Rasche	(AARH, ZURI)
BARBARO72LBL-555A. Barbaro-Galtieri(LBL)DOBSON72PR D6 3256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN72.(TATA)CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(QXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)KADYK66PRL 17 599J.A. Kadyk <i>et al.</i> (LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	SHAW	73	Purdue Conf. 417	G.L. Shaw	(UCI)
DOBSON72PRD63256P.N. Dobson, R. McElhaney(HAWA)RAJASEKA72PRD5610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.71PR L261194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL35B62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR1531617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL22711R.A. Donald et al.(LIVP)KADYK65PR139B454G.S. Abrams, B. Sechi-Zorn(UMD)	BARBARO	72	LBL-555	A. Barbaro-Galtieri	(LBL)
RAJASEKA72PR D5 610G. Rajasekaran(TATA)Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL 22 711R.A. Donald et al.(LIVP)KADYK66PRL 17 599J.A. Kadyk et al.(LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	DOBSON	72	PR D6 3256	P.N. Dobson, R. McElhaney	(HÂWA)
Earlier papers also cited in RAJASEKARAN 72.CLINE71PRL 26 1194D. Cline, R. Laumann, J. Mapp(WISC)MARTIN71PL 35B 62A.D. Martin, A.D. Martin, G.G. Ross(DURH, LOUC+)DALITZ67PR 153 1617R.H. Dalitz, T.C. Wong, G. Rajasekaran(OXFTP+)DONALD66PL 22 711R.A. Donald <i>et al.</i> (LIVP)KADYK66PRL 17 599J.A. Kadyk <i>et al.</i> (LRL)ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	RAJASEKA	72	PR D5 610	G. Rajasekaran	(TATA)
CLINE 71 PRL 26 1194 D. Cline, R. Laumann, J. Mapp (WISC) MARTIN 71 PL 35B 62 A.D. Martin, A.D. Martin, G.G. Ross (DURH, LOUC+) DALITZ 67 PR 153 1617 R.H. Dalitz, T.C. Wong, G. Rajasekaran (OXFTP+) DONALD 66 PL 22 711 R.A. Donald <i>et al.</i> (LIVP) KADYK 66 PRI 17 599 J.A. Kadyk <i>et al.</i> (LRL) ABRAMS 65 PR 139B 454 G.S. Abrams, B. Sechi-Zorn (UMD)	Earlier pape	ers also	o cited in RAJASEKARAN	72.	
MARTIN 71 PL 35B 62 A.D. Martin, A.D. Martin, G.G. Ross (DURH, LOUC+) DALITZ 67 PR 153 1617 R.H. Dalitz, T.C. Wong, G. Rajasekaran (OXFTP+) DONALD 66 PL 22 711 R.A. Donald <i>et al.</i> (LIVP) KADYK 66 PRL 17 599 J.A. Kadyk <i>et al.</i> (LRL) ABRAMS 65 PR 139B 454 G.S. Abrams, B. Sechi-Zorn (UMD)	CLINE	71	PRL 26 1194	D. Cline, R. Laumann, J. Mapp	(WISC)
DALITZ 67 PR 153 1617 R.H. Dalitz, T.C. Wong, G. Rajasekaran (OXFTP+) DONALD 66 PL 22 711 R.A. Donald <i>et al.</i> (LIVP) KADYK 66 PRL 17 599 J.A. Kadyk <i>et al.</i> (LRL) ABRAMS 65 PR 139B 454 G.S. Abrams, B. Sechi-Zorn (UMD)	MARTIN	71	PL 35B 62	A.D. Martin, A.D. Martin, G.G.	Ross (DURH, LOUC+)
DONALD 66 PL 22 711 R.A. Donald et al. (LIVP) KADYK 66 PRL 17 599 J.A. Kadyk et al. (LRL) ABRAMS 65 PR 139B 454 G.S. Abrams, B. Sechi-Zorn (UMD)	DALITZ	67	PR 153 1617	R.H. Dalitz, T.C. Wong, G. Raja	isekaran (OXFTP+)
KADYK 66 PRL 17 599 J.A. Kadyk et al. (LRL) ABRAMS 65 PR 139B 454 G.S. Abrams, B. Sechi-Zorn (UMD)	DONALD	66	PL 22 711	R.A. Donald <i>et al.</i>	(LIVP)
ABRAMS65PR 139B 454G.S. Abrams, B. Sechi-Zorn(UMD)	KADYK	66	PRL 17 599	J.A. Kadyk <i>et al.</i>	(LRL)
	ABRAMS	65	PR 139B 454	G.S. Abrams, B. Sechi-Zorn	(UMD)

HTTP://PDG.LBL.GOV Page 9