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RECENT RESULTS ON Kω AND $\pi\pi$ SYSTEMS FROM LASS*

D. ASTON,[1] N. AWAJI,[2] T. BIENZ,[1] F. BIRD,[1] J. D'AMORE,[3]
W. DUNWOODIE,[1] R. ENDORF,[3] K. FUJII,[2] H. HAYASHII,[2] S. IWATA,[2]
W.B. JOHNSON,[1] R. KAJIKAWA,[2] P. KUNZ,[1] Y. KWON,[1] D.W.G.S. LEITH,[1]
L. LEVINSON,[1] J. MARTINEZ,[3] T. MATSUI,[2] B.T. MEADOWS,[3] A. MIYAMOTO,[2]
M. NUSSBAUM,[3] H. OZAKI,[2] C.O. PAK,[2] B.N. RATCLIFF,[1] P. RENSING,[1]
D. SCHULTZ,[1] S. SHAPIRO,[1] T. SHIMOMURA,[2] P. K. SINERVO,[1] A. SUGIYAMA,[2]
S. SUZUKI,[2] G. TARNOPOLSKY,[1] T. TAUCHI,[2] N. TOGE,[1] K. UKAI,[4]
A. WAITE,[1] S. WILLIAMS[1]

[1] *Stanford Linear Accelerator Center, Stanford University, CA 94309, USA*
[2] *Department of Physics, Nagoya University,Furo-cho,Chikusa-ku, Nagoya 464, JAPAN*
[3] *Department of Physics, University of Cincinnati, Cincinnati, OH 45221, USA*
[4] *Inst. for Nuclear Study, University of Tokyo, 3-2-1 Midori-cho, Tanashi-shi, Tokyo 188, JAPAN*

ABSTRACT

Preliminary results from ongoing analyses of the $K^-\omega$ and the hypercharge exchange produced $\pi^-\pi^+$ systems are presented. The data described are taken from a 4.1 event/nb exposure of the LASS spectrometer to an 11 GeV/c K$^-$ beam.

INTRODUCTION

The LASS facility at SLAC[1] is a general purpose spectrometer designed to have $\sim 4\pi$ acceptance with good resolution and particle identification. The analyses described below are derived from experiment E-135, a $\sim$113 million event exposure of LASS to an 11 GeV/c K$^-$ beam with a total sensitivity of 4.1 events/nb. The trigger was almost unbiased for events with charged particles in the final state, making E-135 equivalent to an "electronic Bubble Chamber" experiment.

THE K$^-\omega$ SYSTEM

A sample of $\sim 10^5$ $K^-\omega p$ events have been extracted from the reaction $K^-p \to K^-\pi^+\pi^-\pi^\circ p$. The analysis, more details of which can be found elsewhere,[2] is performed using joint decay spherical harmonic moments in the $K^-\omega$ Gottfried-Jackson frame and in the ω rest frame (using the normal to the decay plane as the analyser). Each moment is background subtracted using the ω sidebands with a negative weight and acceptance corrected, after which the $K^-\omega$ partial waves can be determined.

The low mass region is dominated by 1^+ waves and there is a prominent bump in the mass spectrum (not shown) at ~ 1.75 GeV/c^2 which is dominantly 2^-. Figure 1 shows the behaviour of the three most significant 2^- waves. The solid curves are the result of a fit to a single resonance, the dotted curves allow a second resonance

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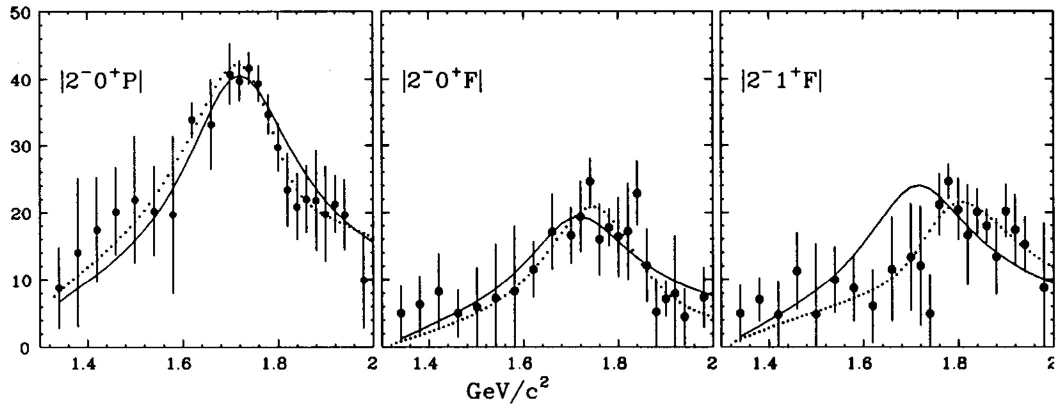

Fig. 1. The significant $K^- \omega$ 2^- waves, the curves are described in the text.

with the same width, but different relative intensities and phases in each wave. The single resonance fit gives $M = 1.728 \pm 0.008$ GeV/c^2 and $\Gamma = 0.220 \pm 0.015$ GeV/c^2, while the two resonance fit gives $M = 1.715 \pm 0.011$ and 1.787 ± 0.010 GeV/c^2 with $\Gamma = 0.212 \pm 0.023$ GeV/c^2; the errors quoted are statistical only. The two resonance fit is significantly better, and it is tempting to assign these two states to the 2^{--} and 2^{-+} states required by the quark model in this mass region.

Although the 1^+ and 2^- waves are dominant, some of the underlying waves can be extracted reliably in terms of their total J^P contribution. In particular, resonant 2^+ and 3^- signals are also seen and can be compared with other channels in the same experiment. Figure 2 shows a joint fit to the D_+ waves from $\overline{K}^\circ \pi^-$ [3] and $K^- \omega$ which gives a measurement of the ratio of branching fractions of the $K_2^*(1430) : K\omega/K\pi = 3.7 \pm 1.5\%$. Similarly, Fig. 3 shows a joint fit to the F_+ waves from $K^-\eta$,[4] $\overline{K}^\circ \pi^-$ and $K^-\omega$ which gives for the $K_3^*(1780) : K\omega/K\pi = 14.3 \pm 2.3\%$. In both cases, these are the first real measurements of the $K\omega$ branching fractions. The ratios are determined from the solid curves, where the K^*'s are constrained to have the same mass and width in each channel; the dotted curves show the effect of removing this constraint.

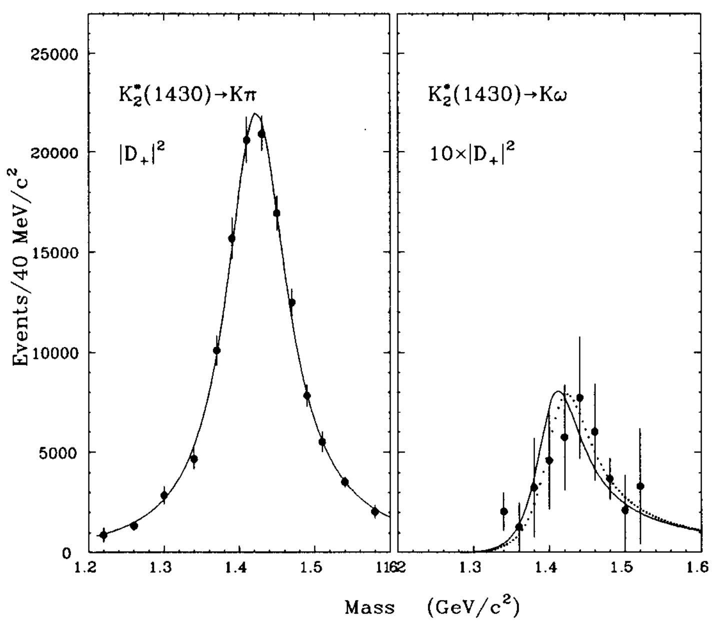

Fig. 2. The D_+ waves from the $\overline{K}^\circ \pi^-$ and $K^-\omega$ channels. The curves are described in the text.

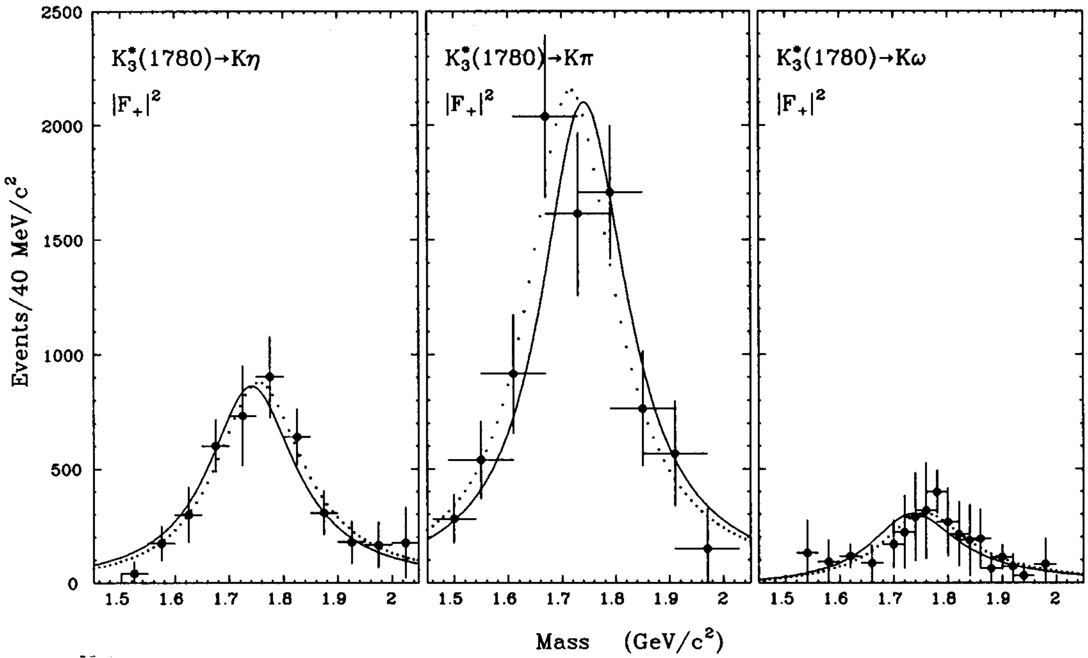

Fig. 3. The F_+ waves from the $K^-\eta$, $\overline{K}^o\pi^-$ and $K^-\omega$ channels. The curves are described in the text.

THE $\pi^-\pi^+$ SYSTEM

Figure 4 shows the mass spectrum of the forward $\pi^-\pi^+$ system in a sample of $\sim$ 26k events of the reaction $K^-p \rightarrow \pi^-\pi^+\Lambda$. There are two clear resonance-like bumps where the $\rho(770)$ and $f_2(1270)$ might be expected. An amplitude analysis of these data confirms this, but also gives clear evidence for the existence of a 1^- state at ~ 1.3 GeV/c^2.[5] The significance of this state is discussed elsewhere at this conference,[6,7] but here I will describe the results of the LASS analysis.

The spherical harmonic moments are calculated from the data in the $\pi^-\pi^+$ Gottfried-Jackson frame and corrected in the usual way by Monte Carlo. The acceptance is slowly varying, and only the need to remove overlap from Σ^{*+} production before performing the amplitude analysis causes any serious distortion of the angular distributions.

The P_+ amplitude (shown in Fig. 5 of Ref. 6) shows a striking $\rho - \omega$ interference effect as well as the $\rho'(1300)$. Figure 5 below demonstrates that the $\rho'(1300)$ is present in the raw data, and is not an artifact of the analysis. The quantity σ^P_{+-}—a simple linear combination of moments equivalent, in the absence of F waves, to $(|P_+|^2 - |P_-|^2)$—is plotted in Fig. 5(a) for the raw data. Figures 5(b), (c) and (d) show the cumulative effects of acceptance correction, removal of Σ^{*+} overlap and the final data after correction for the removal respectively. The $\rho'(1300)$ is present at each step; the solid curve on Fig. 5(d), corresponding to the $\rho'(1300)$ and the tail of the $\rho(770)$, shows good agreement with the data; the dotted curve shows the tail of the $\rho(770)$.

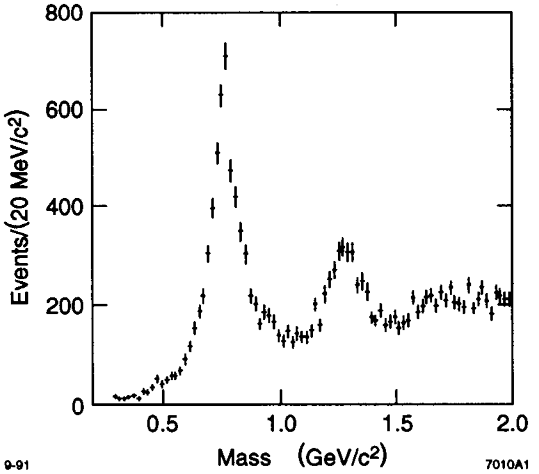

Fig. 4. The $\pi^-\pi^+$ mass spectrum of events from the reaction $K^-p \to \pi^-\pi^+\Lambda$ with $|t'| \leq 2(\mathrm{GeV/c})^2$.

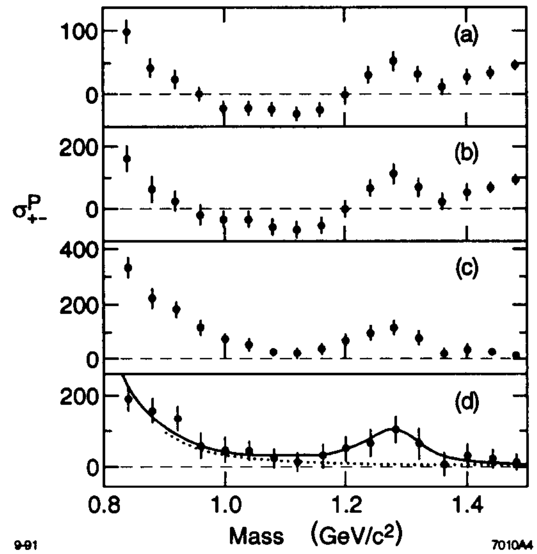

Fig. 5. The σ^P_{+-}projection of the $\pi^-\pi^+$ data at different stages of the analysis. Details are given in the text.

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