Au and Cu single crystals are well described by a model which relates the angular anisotropies in the photoemission intensity to an angle-dependent transition matrix element. Such a model is found to predict the experimental PED's considerably better than the model previously proposed by Baird, Wagner, and Fadley.[1] We note that the matrix-element model predicts the most pronounced differences to occur between spectra taken along the [001] and [111] directions, in complete agreement with the experimental observations. The present results in conjunction with the results obtained by Williams, Kemeny, and Ley[3] on MoS_2 and GaSe appear to indicate that the matrix-element model discussed above may, in general, provide a useful approximation for the interpretation of angle-resolved photoemission spectra in the x-ray range of photoemission. This would be of considerable importance for future applications.

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COMMENTS

Comment on "Search for More *J* Particles"*

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We have analyzed the reaction $pp \to K_s^0\pi^-$ + anything at 28.4 GeV/c^2. By assuming that the $K_s^0\pi^-$ and $K^+\pi^-$ states are produced at the same rate, the upper limit for producing a narrow 3-standard-deviation effect in the $K^+\pi^-$ state corresponds to a σB of 32 nb at a mass of 2.25 GeV/c^2. This is about an order of magnitude higher than the 4 nb value quoted in the Massachusetts Institute of Technology–Brookhaven National Laboratory (MIT-BNL) two-arm spectrometer experiment. At a mass of 1.875 GeV/c^2, the 3-standard-deviation upper limit for σB for the MIT-BNL experiment is 118 nb.

Recent discoveries of narrow, high-mass $K\pi$ and $K3\pi$ states in e^+e^- collisions[1] lead to a greater urgency for finding charmed-particle production in hadronic reactions. Upper limits set by bubble-chamber experiments are typically in the microbarn range,[2,3] whereas for electronic detectors, the sensitivity level is usually about one to two orders of magnitude higher. The only exception has been the high-statistics two-arm-spectrometer experiment by a Massachusetts Institute of Technology–Brookhaven National Laboratory (MIT-BNL) collaboration.[4] For the reactions

$$pBe \to \pi^+ K^- + \text{anything}, \quad (1)$$

$$pBe \to K^+ \pi^- + \text{anything}, \quad (2)$$

the upper limits for producing a narrow resonance of mass 2.25 GeV/c^2 are given as 1 and 4 nb, respectively, or about three orders of magnitude lower than those given by large-bubble-chamber experiments. On the assumption that the narrow enhancements at 1.87 GeV/c^2 decaying into $K\pi$ and $K3\pi$ states are the same charmed meson, called D^0, the relative branching ratio for $D^0 \to K\pi$ and $D^0 \to K3\pi$ is given by the SPEAR experiment. Therefore, by taking the MIT-BNL result as it is, it would suggest that further charmed-particle searches in multibody hadronic modes should have a sensitivity better than a few nanobarns.

Since the two-arm spectrometer used by the MIT-BNL group has a limited acceptance, statements on the upper limit for enhancements in Reactions (1) and (2) depend critically on the acceptance corrections. In the absence of published experimental data on inclusive two-body spectra, one can at best make an intuitive guess[5] as to its dependence on dynamic variables such as x and $P_\perp$. The form that was assumed by these authors is

$$\frac{d\sigma}{dM} = \frac{d\sigma}{dM\,dP_\perp^2\,dx}\bigg|_{x=P_\perp=0} \exp(-2P_\perp - 5x). \quad (3)$$

The differential cross sections were measured by the same team[6] at $P_\perp = x = 0$. Therefore, it is necessary that independent checks be made on these assumptions before the upper limits can be taken seriously.

In this Comment, we report the results from an analysis of the reaction

$$pp \to K_{s_l}^0 \pi^- + \text{anything} \quad (4)$$

at 28.4 GeV/c. The data come from an exposure of the BNL 80-in. hydrogen bubble chamber to a diffractively produced proton beam of momenta 13.0, 18.0, 21.1, 24.2, and 28.4 GeV/c. Separate studies for inclusive production of K_s^0 and π^- have been published previously.[7,8] With the assumption that

$$\sigma(K^0) = \sigma(K^+) \text{ and } \sigma(\bar{K}^0) = \sigma(K^-), \quad (5)$$

Reaction (4) is expected to be the same as Reaction (2) except for nuclear effects. Figure 1 shows the energy dependence of the $K_s^0\pi^-$ inclusive cross sections. The trend of rising cross sections with increasing incident laboratory momenta is somewhat similar to that for the inclusive K_s^0 production. The $K_s^0\pi^-$ differential cross sections at 28.4 GeV/c are shown in Fig. 2. A total of 306 K_s^0 and 358 $K_s^0\pi^-$ pairs are used in this analysis. The differential cross sections in

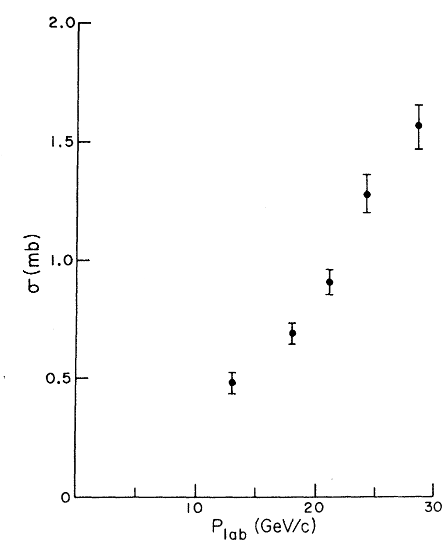

FIG. 1. Inclusive $K_s^0\pi^-$ production cross sections as a function of the incident-proton momentum.

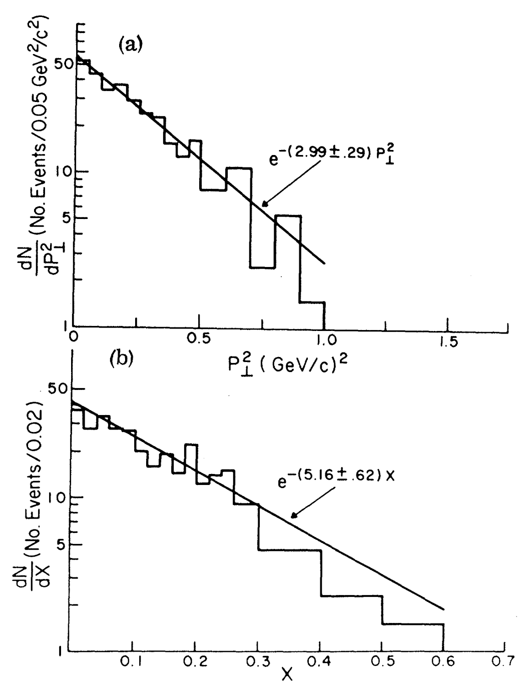

FIG. 2. Differential cross sections at 28.4 GeV/c for $K_s^0\pi^-$ pairs as a function of (a) $P_\perp^2$ and (b) x. The straight lines represent phenomenological fits to the data as discussed in the text.

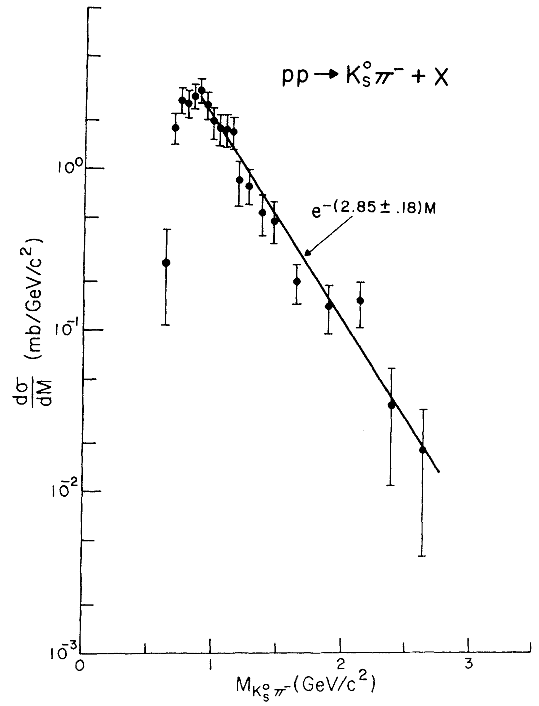

FIG. 3. Differential mass distribution as a function of the $K_s^0\pi^-$ mass at 28.4 GeV/c. The straight line is the result of an exponential fit to the data as discussed in the text.

$P_\perp^2$ and x are fitted separately to an exponential function

$$d\sigma/dP_\perp^2 = \exp[-(2.99 \pm 0.29)P_\perp^2] \quad (6)$$

and

$$d\sigma/dx = \exp[-(5.16 \pm 0.62)x]. \quad (7)$$

Although the statistics are too limited in this experiment to test the factorization assumption, available single-particle inclusive data[9] seem to support such a notion. The differential mass spectrum at 28.4 GeV/c for the $K_s^0\pi^-$ pair is shown in Fig. 3. The yield rises rapidly from threshold to peak near $M_{K_s^0\pi^-} \simeq 0.85$ GeV/c^2 and drops exponentially thereafter, in the form of $\exp[-(2.85 \pm 0.18)M]$.

At 1.875 GeV/c^2, the differential cross section is 167 ± 25 μb/(GeV/c^2). Referring to the MIT-BNL experiment,[10] the authors show ~2830 events for the $K^+\pi^-$ state in a 12.5-MeV/c^2 bin. Therefore, a narrow enhancement with a 3-standard-deviation significance in that bin must have a 160-event excess corresponding to a cross-section upper limit of 118 nb for the $K^+\pi^-$ state. A similar exercise indicates that at 2250 MeV/c^2, the upper limit for the $K^+\pi^-$ state is 32 nb. This value is about an order of magnitude higher than that reported in Ref. 4. It is worth noting that at $x = P_\perp = 0$, the MIT-BNL group observed an exponential dropoff in the $K\pi$ mass distribution in the form of e^{-5M}, whereas integrated over x and $P_\perp^2$, one observes a much milder decline with increasing masses, thus suggesting correlations between the $K^\mp\pi^\pm$ mass and the slope parameters for x and $P_\perp^2$ in this energy region. *By integration of Eq. (3) and by use of the slope parameters obtained in this experiment and the differential cross sections given in Ref. 6, the differential mass distribution for $K^-\pi^+$ is lower than our experimental results on $K_s^0\pi^-$ by a factor of 100 at 2.25 GeV/c^2. Since K^+ can be produced via associated production, it is known*[11] *that inclusive cross sections for $K^+\pi^-$ are higher than those for $K^-\pi^+$ by about a factor of 10. Adjusting for this, the cross sections for $K^-\pi^+$ are still lower than our data on $K_s^0\pi^-$ by one order of magnitude as is the case for $K^+\pi^-$.*

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