tory indicates that a dip will occur for positive u values somewhere between $u\sim+0.1$ and $u=+0.2$. If the trajectory curves slightly with decreasing u, the dip might occur closer to $u=0$. Such a zero in the amplitude near $u=0$ could cause the turnover or flattening of the K^+p angular distribution. Observation of such a turnover with good statistics for different laboratory momenta would constitute further evidence for the validity of the Reggeized baryon-exchange model.

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NEW STRUCTURES IN THE K^-p AND K^-d TOTAL CROSS SECTIONS BETWEEN 2.4 AND 3.3 GeV/c *

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Small structures observed in K^-p and K^-d total-cross-section measurements are interpreted as indications for two new $I=1$ resonances at c.m. energies of 2455 ± 10 and 2595 ± 10 MeV.

The K^-p and K^-d total cross sections have been measured with increased precision and resolution in the momentum interval 2.45 to 3.30 GeV/c using a partially separated K^- beam at the Brookhaven alternating-gradient synchrotron (AGS).[1] Data were obtained at momentum intervals of 50 MeV/c with $\Delta p/p=\pm0.75\,\%$. The statistical standard deviations are approximately $\pm0.25\,\%$ for hydrogen and $\pm0.15\,\%$ for deuterium. The experimental arrangement was the same as that which was previoulsy described.[2] The beam flux was approximately constant at 10^4 K^- for 10^{12} circulating protons.

In Figs. 1(a) and 1(b) the measured cross sections are plotted versus the laboratory momentum. The data below 2.45 GeV/c of Cool et al.[3] are also shown. The error bars represent statistical errors only. It is estimated that an over-all systematic error of less than $\pm1\,\%$ is present in the absolute cross-section

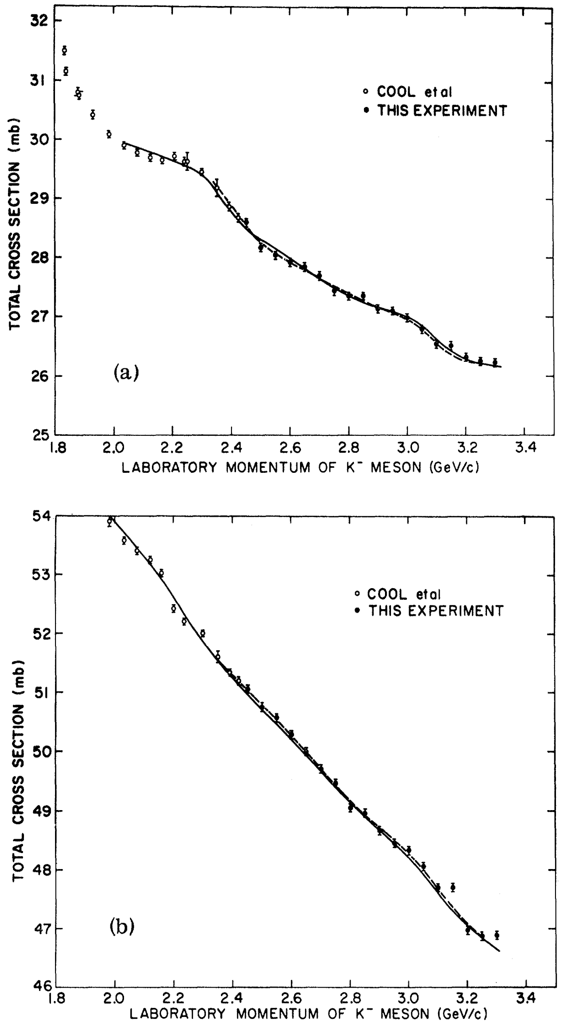

FIG. 1. The total cross section of K^- mesons on (a) protons and (b) deuterons. Errors represent statistical standard deviations. The solid curves represent a best fit to the data assuming two $I=1$ structures only, while the dotted line represents a best fit assuming two $I=1$ and two $I=0$ structures.

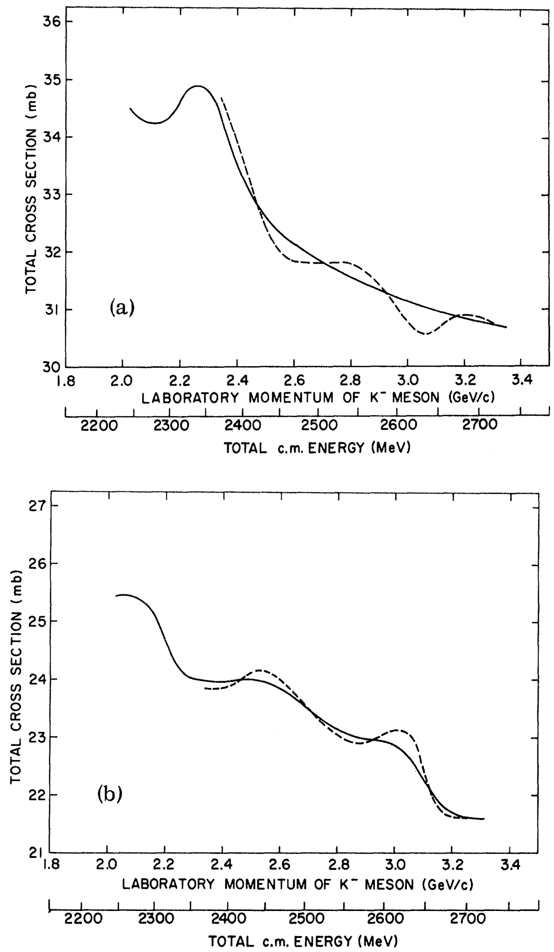

FIG. 2. The total cross section in (a) the $I=0$ isospin state and (b) the $I=1$ state. The solid curves are obtained assuming that there are no new structures in $I=0$ above 2.5 GeV/c. The dashed curve is the best fit with two $I=1$ and two $I=0$ structures.

scale of the data. Our results are in good agreement with the results of previous measurements in this momentum interval.[4,5] Only the data of Ref. 3 are displayed in Figs. 1(a) and 1(b) since earlier data had considerably larger statistical errors.

Other than the structure at 2.3 GeV/c which was previously reported,[3] there are no pronounced enchancements in the new data. However, there do appear to be two significant changes in the slope of the K^-p data, one at about 2.6 GeV/c and the other near 3.0 GeV/c. The K^-d data are suggestive of two small structures near the same two momentum values, but they are less pronounced, in part due to the smoothing out effect of the Fermi momentum in the deuteron.

The pure $I=0$ and $I=1$ isospin cross sections have been computed by the same method as for our earlier measurement.[2,3] When the calculations are based on smooth curves which best fit the data and which have χ^2 confidence level of 55% [the dashed curves of Figs. 1(a) and 1(b)], they lead to two new structures in σ_0 and two in σ_1 which are displayed as the dashed curves of Figs. 2(a) and 2(b). Since the observed structures are small and close to the experimental sensitivity, the statistical significance of the σ_0 and σ_1 structures has been tested as follows. The best-fit curves to the data were altered in such a way as to remove in turn all possible combinations of the four σ_0 and σ_1 structures.

For each case, the altered curves were varied to give a best fit to the data, and a new χ^2 confidence level was then computed. If the two σ_0 structures are simultaneously removed and the data fitted with two σ_1 structures, the confidence level falls from 55 to 7%; if the two σ_1 structures are simultaneously removed and the data fitted with two σ_0 structures, the confidence level falls below 10^{-4}. If the data are fitted with two structures, one in σ_0 and one in σ_1, then confidence level falls to 1% for one in σ_0 near 3.0 GeV/c and one in σ_1 near 2.6 GeV/c, and 0.3% for the other combination. Simultaneous removal of any three, or all four structures, reduces the confidence level of the fit below 10^{-4}. We conclude that the evidence indicates the presence of at least two new structures; they are appreciably more likely to have $I=1$ than $I=0$. The data now available do not allow a more definitive statement to be made. The solid curves in Figs. 1 and 2 display the best fit to the data for two $I=1$ structures only. It should also be noted that the existence of $I=0$ structures of magnitude comparable with the two $I=1$ bumps (about 1.2 mb) is expected to be more difficult to demonstrate conclusively by the present experiment, since the statistical uncertainties for the $I=0$ cross section are almost a factor of 4 larger than those for the $I=1$ cross section.

If the new structures are interpreted as Y_1^*'s, their fitting with Breit-Wigner formulas plus a smooth background yields masses of 2455 ±10 and 2595 $\pm$ 10 MeV, widths of approximately 140 MeV, and peak cross sections of 1.3 and 1.1 mb, respectively. They could easily fit on existing Regge trajectories. The $Y_1^*(2455)$ could be a recurrence of the $Y_1^*(1385)$ and have a spin-parity assignment of $11/2^+$. The $Y_1^*(2595)$ could be a recurrence of the $Y_1^*(1770)$ and have a spin parity of $13/2^-$. These two trajectories with opposite parity are actually coincident (exchange degeneracy). The elasticities would be of the order of 0.02 to 0.03. Alternatively, they could lie on the trajectory starting from the Σ hyperon and have spin-parity assignments $\frac{9}{2}^+$ and $11/2^-$, respectively.

Additional indication for possible Y^* states of unknown isospin near these energies comes from a recent K^- photoproduction experiment.[6]

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