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K-p and pp CHARGE EXCHANGE CROSS SECTIONS BELOW 1.1 GeV/c

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K^-p AND $\bar{p}p$ CHARGE EXCHANGE CROSS SECTIONS
BELOW 1.1 GeV/c

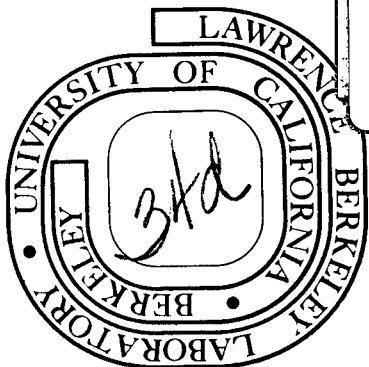
M. Alston-Garnjost, R. Kenney, D. Pollard, R. Ross,
R. Tripp, H. Nicholson, and M. Ferro-Luzzi

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K^-p and $\bar{p}p$ CHARGE EXCHANGE CROSS SECTIONS
BELOW 1.1 GeV/c*

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We have measured the cross sections for $K^-p \rightarrow \bar{K}^0n$ at 48 momenta from 520 to 1060 MeV/c and the cross sections for $\bar{p}p \rightarrow \bar{n}n$ at 22 momenta from 270 to 960 MeV/c with a typical point-to-point precision of about 1%. The experiment was performed at the Brookhaven AGS in the low-energy separated beam and employed the apparatus shown in Fig. 1 for the $\bar{p}p \rightarrow \bar{n}n$ reaction. The incident beam was defined by scintillation counters M and S_2 . For $\bar{p}p$, background mesons in the beam were rejected by time of flight between M and a counter S_1 placed at the mass slit 5 meters in front of M, by a threshold Čerenkov counter C, and by a pulse height in M. A veto box consisting of counters $A_1 \dots A_5$ detected all reactions except those yielding neutral final states, while counters $G_1 \dots G_5$ detected gamma rays converted by approximately one radiation length of lead placed between the A and G counters. The signature for a charge exchange reaction was an incident antiproton, $\phi = S_1 \cdot M \cdot S_2 \cdot \bar{C}$, with no signal in either the A or G counters, $\phi \cdot \bar{A} \cdot \bar{G}$. Empty target rates, typically 5% of full rates, were measured at each momentum and subtracted.

* Work done under the auspices of the U.S. Energy Research and Development Administration.

For K^- the Čerenkov counter alone was used to reject background particles. Here the kaons were identified in the differential Čerenkov mode while pions were rejected in the threshold mode. The K^-p veto box was thicker than shown in Fig. 1 and consisted of two identical layers of lead and scintillator to increase the rejection of neutral final states with gamma rays present. The reaction $K^-p \rightarrow K_L n$ was identified by the signature $\phi \cdot \bar{A} \cdot \bar{G}$.

Monte Carlo calculations were made to correct the cross sections. The major corrections were: 1) attenuation and decay (for K^-) of the beam in passing through the 16-inch hydrogen target, and 2) interactions of n , K_L , or \bar{n} in the hydrogen target or the AG veto box surrounding the target.

The corrected cross sections are shown in preliminary form for K^-p in Fig. 2 and $\bar{p}p$ in Fig. 3. The K^-p exchange data agree well with bubble chamber data of much lower statistical accuracy. We note the following points: 1) There is a sharp dip in the cross section between 700 and 800 MeV/c due to interference between $\Lambda(1670)$ and the $I = 1$ S-wave amplitude, with evidence for a cusp-like behavior at $\Lambda\eta$ threshold (725 MeV/c). 2) Some small structure may be present near $\Sigma\eta$ threshold (889 MeV/c), while the plateau from 800 to 900 MeV/c is poorly reproduced by previous partial wave analyses.⁽¹⁾ 3) The large enhancement at 1050 MeV/c is due mainly to the highly elastic $\Lambda(1815)$. 4) No evidence is found for $\Sigma(1590)$ at 560 MeV/c, suggesting that its spin is at least $3/2$.

The $\bar{p}p$ charge exchange cross section displayed in Fig. 3 appears to have no narrow structure but instead falls monotonically, behaving approximately as p^{-1} above 500 MeV/c. In particular there is no evidence for a bump at 475 MeV/c, where an 18-mb narrow enhancement has been reported⁽²⁾ in the $\bar{p}p$ total cross section. If this enhancement is interpreted as a resonance in pure isospin state, then by unitarity our result implies that the spin of the resonance must be at least 4.

(1) R. Armenteros et al., Nucl. Phys. B8, 195 (1968) and B14, 91 (1969);
A. Lea et al., Nucl. Phys. B56, 77 (1973).

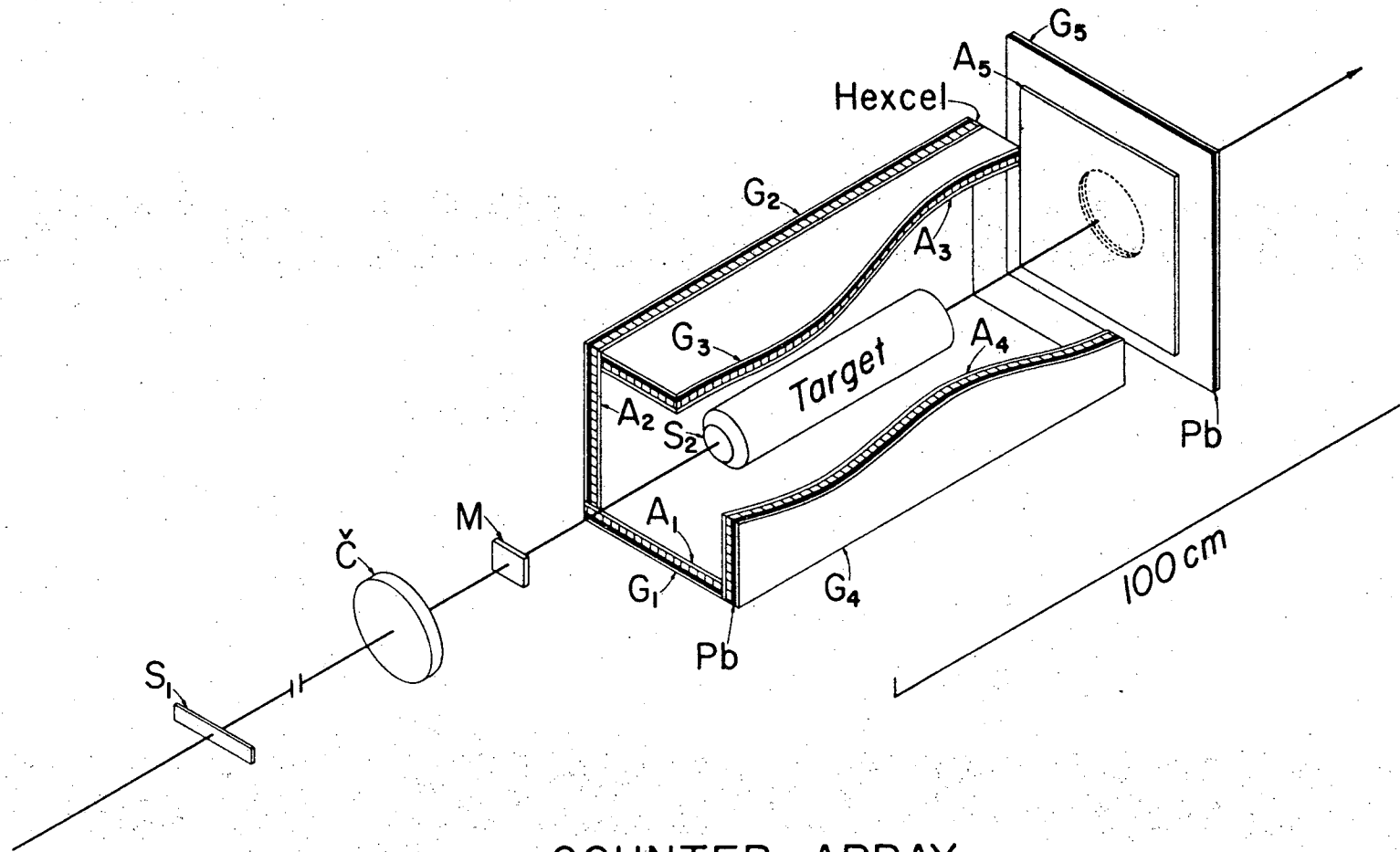
(2) A. Carroll et al., Phys. Rev. Lett. 32, 247 (1974).

Figure Captions

Fig. 1 Isometric projection of the apparatus. G_5 and its lead converter have 5-inch-diam holes through which the beam passes.

Fig. 2 Cross section for the reaction $K^- p \rightarrow \bar{K}^0 n$ vs lab momentum.

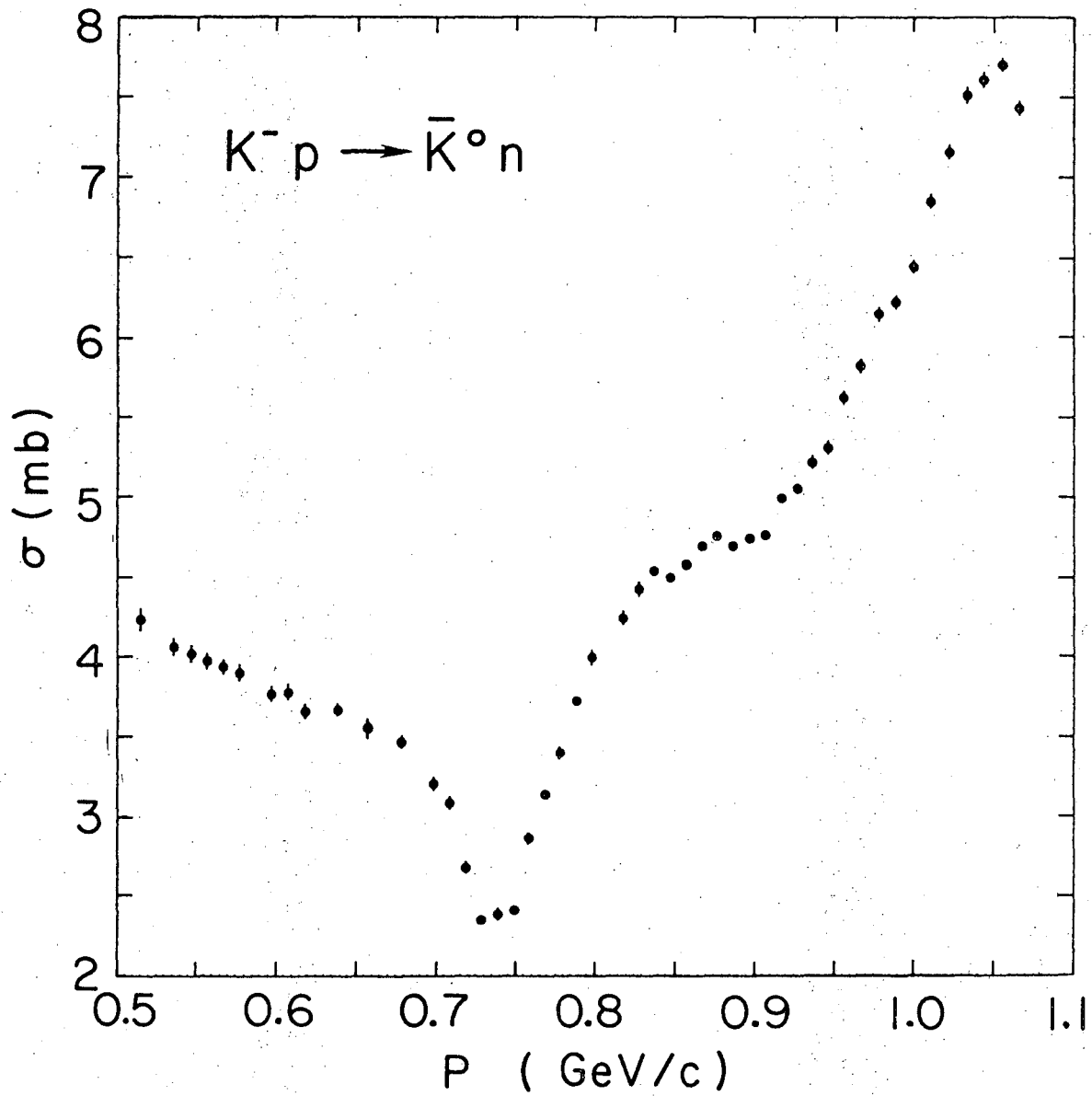
Fig. 3 Cross section for the reaction $\bar{p} p \rightarrow \bar{n} n$ vs lab momentum. The full points are from this experiment. The open circles are bubble chamber points and crosses are from a counter experiment. The dashed curve is a theoretical calculation of Bryan and Phillips. The resonance curve at 475 MeV/c is calculated from the total-cross-section results of Ref. 2 assuming $J = 4$, and is shown with and without our resolution folded in.



COUNTER ARRAY

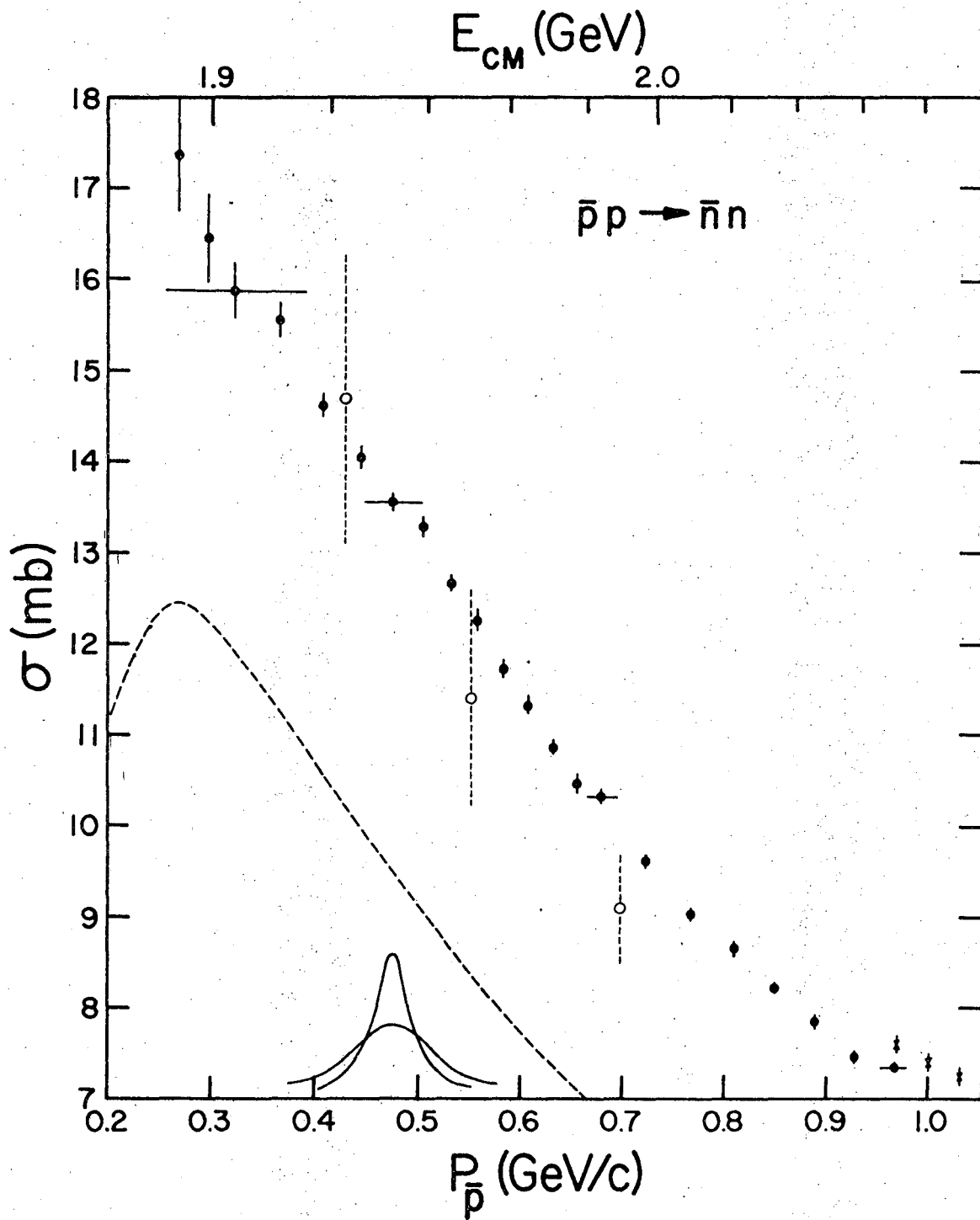
Fig. 1

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Fig. 2



XBL 756-3306

Fig. 3

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