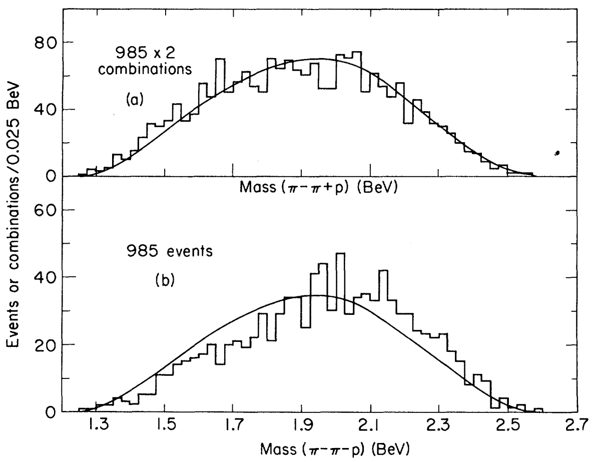

FIG. 2. (a) Mass of $\pi^-\pi^+p$. (b) Mass of $\pi^-\pi^-p$.

cay dominantly into any lower mass resonance.

The kinetic energies of the proton, π^+ and π^0, were calculated in the center of mass $\pi^+\pi^0p$ system. The Dalitz plots of the kinetic energy of the π^0 versus the kinetic energy of the proton and the π^0 versus π^+ were plotted for the events with a $\pi^+\pi^0p$ mass between (a) 1.65 and 1.69 BeV, (b) 1.69 and 1.725 BeV (the enhancement region), and (c) 1.725 and 1.765 BeV, for the unlikely possibility that a sudden change would occur when passing through the enhancement region. No difference was observed, as was expected due to the complexity of the final state.

There is no sudden change in the distribution of momentum transfer to the $\pi^+\pi^0p$ system when the $\pi^+\pi^0p$ mass goes through the enhancement region, either. Thus, the only evidence for a resonance is an enhancement in the mass plot of the $\pi^+\pi^0p$ system.

Experiments involving the same reaction at neighboring energies have not found any evidence for this enhancement; however, on the basis of their data on the π^+p total cross section, Devlin, Solomon, and Bertsch[1] have recently suggested the existence of a $T=\frac{3}{2}$ pion-nucleon resonance at 1.65 BeV with a width of 0.2 BeV. Their mass is only slightly lower than ours, but their width is much greater.

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[1]T. Devlin, J. Solomon, and G. Bertsch, Phys. Rev. Letters 14, 1031 (1965).

ANNIHILATIONS OF ANTIPROTONS IN HYDROGEN AT REST INTO TWO MESONS*

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We present in this Letter a tabulation of the rates for the annihilation of antiprotons at rest in hydrogen into various two-body channels. The tabulation is based on an analysis of 9301 two-pronged and 16 700 four-pronged pionic annihilations, and 6768 kaonic annihilations obtained from an exposure of the Columbia–Brookhaven National Laboratory 30-in. hydrogen bubble chamber to a separated low-energy antiproton beam at the Brookhaven AGS. The details of the analyses on which this tabulation is based are presented in a series of articles which will be published in the near future. The results are presented in Table I.

The fraction of annihilations from the P wave of the $\bar{p}p$ system was estimated using arguments

Table I. Rates for two-body annihilations of antiprotons at rest.

Channel	Rate (this experiment)	Rate[a]
$\pi^+\pi^-$	$(3.2 \pm 0.3) \times 10^{-3}$	$(3.3 \pm 0.4) \times 10^{-3}$
K^+K^-	$(1.1 \pm 0.1) \times 10^{-3}$	
$K^+K^-/\pi^+\pi^-$	0.33 ± 0.023	
$K_1^0K_1^0 + K_2^0K_2^0$	$(0.88^{+1.1}_{-0.9}) \times 10^{-5}$	
$K_1^0K_2^0$	$(0.61 \pm 0.09) \times 10^{-3}$	
$\pi^\pm\rho^\mp$	$(2.9 \pm 0.4) \times 10^{-2}$	$(3.4 \pm 0.7) \times 10^{-2}$ combined
$\pi^0\rho^0$	$(1.4 \pm 0.2) \times 10^{-2}$	
$\rho^0\eta^0$ [b]	$(2.2 \pm 1.7) \times 10^{-3}$	
$\rho^0\omega^0$ [c]	$(7.0 \pm 3.0) \times 10^{-3}$	$(6 \pm 3) \times 10^{-3}$
$\rho^0\rho^0$	$(3.8 \pm 3.0) \times 10^{-3}$	$<6 \times 10^{-3}$
K^0K^{0*}	$(1.2 \pm 0.2) \times 10^{-3}$	
$K^\pm K^{\mp*}$ [d]	$(0.92 \pm 0.16) \times 10^{-3}$	
$K^{\pm*}K^{\mp*}$	$(1.3 \pm 0.5) \times 10^{-3}$	
$K^{0*}\bar{K}^{0*}$	$(2.9 \pm 0.5) \times 10^{-3}$	

[a]These results were inadvertently omitted from the report by Cresti et al. at the Sienna Conference, 1963, and have recently been privately circulated. M. Cresti, A. Grigoletto, S. Limentani, A. Loria, L. Peruzzo, R. Santangelo, G. G. Chadwick, W. T. Davies, M. Derrick, C. J. B. Hawkins, P. M. D. Gray, J. H. Mulvey, P. B. Jones, D. Radojičić, and C. A. Wilkinson, private communication.
[b]For the branching ratio $(\eta^0 \rightarrow \pi^+ + \pi^- + \pi^0)/(\eta^0 \rightarrow \text{all decays})$ we have used the value 0.274 ± 0.025.
[c]For the branching ratio $(\omega^0 \rightarrow \pi^+ + \pi^- + \pi^0)/(\omega^0 \rightarrow \text{all decays})$ we have used the value 0.88.
[d]We assume that the unobserved channel $K^\pm(K^\mp\pi^0)^*$ is equal in rate to the channel $K^0(K^0\pi^0)^*$.

presented by Schwartz[1] and d'Espagnat.[2] K_1K_2 can be produced from the S state of the $\bar{p}p$ system, but K_1K_1 has to be produced from higher angular-momentum states. In the present exposure, one $\bar{p}p$ annihilation into two neutral K mesons has been observed with both K^0 mesons decaying into $\pi^+\pi^-$; this has to be compared to 239 $K^0\bar{K}^0$ events observed with one visible K^0 decay only. This leads to S state of the $\bar{p}p$ system. Previously Armenteros et al.[3] have presented evidence that capture from higher orbital states is less than 10%.

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