Within these uncertainties it must be concluded that the structure of the giant dipole resonance for spherical nuclei as well as for deformed nuclei is described by the collective Hamiltonian. The influence of the odd particle will be as unimportant in the spherical nuclei as it is in the deformed nuclei.

An extensive discussion of the detailed theory and its comparison with experimental data is given by Weber, Huber, and Greiner.[13,14]

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EXPERIMENTAL EVIDENCE FOR A RESONANT STATE IN THE $\pi^+\pi^0 p$ SYSTEM AT 1.71 BeV

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This note reports evidence for an enhancement in the $\pi^+\pi^0 p$ system with a mass of 1.71 BeV and width <50 MeV.

A beam of negative pions with a momentum of 3.9 BeV/c was directed into the Lawrence Radiation Laboratory 72-in. liquid-hydrogen bubble chamber. Four-prong events were investigated. Those events with strange particles were rejected. Protons could be distinguished from positive pions for almost all particles with momentum less than 1.4 BeV/c by looking at the bubble density on the scan table.

There were 985 events which fit the reaction $\pi^- + p \rightarrow \pi^- + \pi^- + \pi^+ + \pi^0 + p$. Events are included which are consistent with this reaction by bubble density and kinematic fit; however, events are rejected which simultaneously are consistent with another reaction by both kinematic fit and bubble density. A mass plot of the $\pi^+\pi^0 p$ system is shown in Fig. 1(a); the mass plots of the other $\pi\pi p$ systems are shown in Figs. 1(b), 2(a), and 2(b) for comparison. The curves are the expected mass distributions from phase space. An enhancement is noticed at 1.71 BeV in the $\pi^+\pi^0 p$ system.

Two other strong enhancements occur in this reaction—one due to the ω in the $\pi^-\pi^+\pi^0$ system, and one due to the $N_{3,3}^*$ in the $\pi^+ p$ system. If events which have $\pi^-\pi^+\pi^0$ mass in the region of the ω or which have a $\pi^+ p$ mass in the region of the $N_{3,3}^*$ are removed, the enhancement at 1.7 BeV in the $\pi^+\pi^0 p$ system remains. This enhancement is not a decay product of a four-body resonance and does not de-

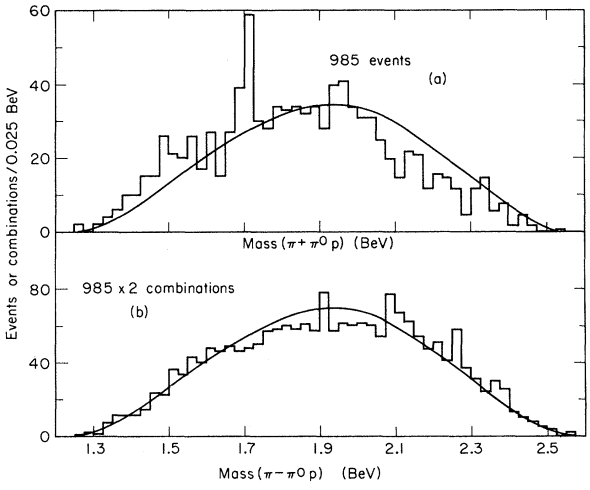

FIG. 1. (a) Invariant mass plot of the $\pi^+\pi^0 p$ system in the reaction $\pi^- + p \rightarrow \pi^- + \pi^- + \pi^+ + \pi^0 + p$. (b) Mass $\pi^-\pi^0 p$ for the same reaction.

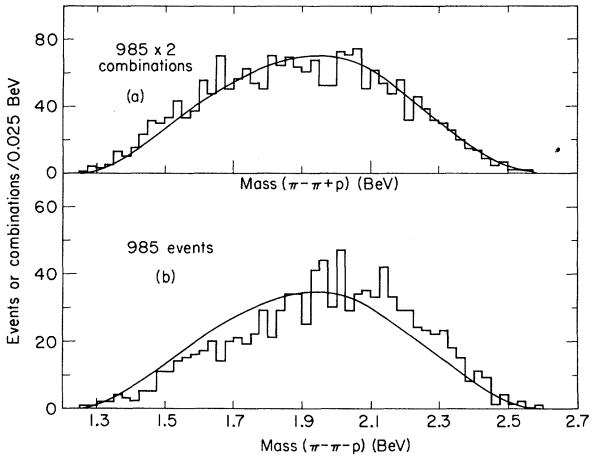

FIG. 2. (a) Mass of $\pi^-\pi^+p$. (b) Mass of $\pi^-\pi^-p$.

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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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