Differential Cross-Section Measurements for $\pi^0$ Photoproduction in the Region of the Third Nucleon Resonance (*)

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Summary. — Differential cross-sections have been measured for $\pi^0$ photoproduction over the energy range 0.8 GeV to 1.4 GeV and at angles between 50° and 90° c.m.

1. - Introduction.

The determination of the electromagnetic couplings of the nucleonic resonant states is of importance for any theory which attempts to account for these states on the basis of an internal structure. A simple quark model has in fact been used by various authors (1-3) to make predictions regarding the type of electromagnetic coupling for a few of the lowest resonant states and Walker (3) has shown that it is possible to obtain agreement with many of the broad features observed in the first, second and third resonance regions. However, there is a serious lack of experimental data, particularly above the second

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resonance region. The third resonance region, with its centre at 1.05 GeV incident-photon energy, consists of several overlapping states and precise data of a variety of types will be needed for a complete analysis. The experiment reported here represents the first of a series which is being carried out at this laboratory to provide data for such an analysis. Preliminary results were presented at the 4th International Symposium of Electron and Photon Interactions (3).

The experiment was carried out to help to remedy the shortage of differential cross-section data on $\pi^0$ photoproduction throughout the third resonance region. In the case of $\pi^+$ photoproduction there are measurements of good accuracy over a wide angular range up to a photon energy of 1.2 GeV (4). Much of the previous work on differential cross-sections for $\pi^0$ photoproduction above 800 MeV has been carried out at the California Institute of Technology (5-7), an extensive series of measurements by WOLVERTON and WALKER being presented in preliminary form at the above symposium (8). A revised tabulation of these data has recently been published in the comprehensive compilation of GENZEL and PFEIL (7), in which references and notes for all the published work on photoproduction below 1.5 GeV can be found. In the third resonance region, in addition to the experiments just mentioned, there are measurements of good accuracy at 180° by BUSCHHORN et al. (9) and by CASSIDAY et al. (10), and between 115° and 180° by DELCOURT et al. (11).

2. – Method.

Measurements of $\pi^0$ photoproduction cross-sections have been carried out in various ways. The recoil proton has been detected in coincidence with one or both decay photons of the meson, the $\pi^0$-meson has been detected alone, via a double coincidence between the two decay photons, or the recoil proton alone has been measured. The last two methods have been used respectively at small and large angles of emission of the meson, while the first method is preferred for measurements at intermediate angles. In each case measurements

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