Elastic Scattering of Polarized Protons by $^{16}\text{O}$. 

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(ricevuto il 30 Maggio 1964)

Summary. — The angular dependence of the polarization resulting from the elastic scattering of protons by $^{16}\text{O}$ has been measured for proton energies between 4.27 and 4.84 MeV, at laboratory angles ranging from 50° to 130°. The results are in general agreement with those predicted by the best available sets of phase shifts.

1. — Introduction.

The elastic scattering of protons by $^{16}\text{O}$ has been widely studied by several investigators in the past (1). The growing interest comes from the information this scattering provides concerning the compound nucleus $^{17}\text{F}$, under the view point of a shell structure of the nucleus.

As method of analysing the elastic scattering data, the dispersion-theory formalism allows, in principle, a determination of each resonant phase shift by a set of level parameters. Difficulty is yet experienced in the investigation of the anomalous region extending roughly between bombarding energies of 4 and 5 MeV, in which the large width of unresolved resonances indicates that these states are particularly pertinent to the shell-model description of $^{17}\text{F}$ (2).

The analysis of states in this region was recently undertaken by Salisbury and Richards at Wisconsin (3), and by Harris et al. at Rice University (4), by explaining the data in terms of the interference of two broad states. The

(*) This research has been performed under Contract Euratom-ENEL.
(1) For a review of the recent literature, see ref. (2) and (4).
Wisconsin data assign $3^-\text{ state}$ at 4.694 MeV and $3^+\text{ state}$ at 5.101 MeV, while Rice analysis indicate levels at 4.60 and 4.97 MeV with spin and parity assignment as above.

Experimental measurements of the spin polarization in this energy region can be a very sensitive method to verify the predictions of phase-shift analysis of the elastic scattering. In this connection it has been decided to undertake a systematic investigation of the polarization of protons upon p-$^{16}\text{O}$ elastic scattering. The present paper is an extension of a previous work (5), and covers the proton energy region from 4.27 to 4.84 MeV, at laboratory angles ranging from 50° to 130°.

2. - Experimental procedure.

The apparatus is essentially the same as that previously described (4). In the present experiment p-$^{12}\text{C}$ scattering is used to produce a beam of partially polarized protons. The Legnaro 6 MeV electrostatic accelerator is employed as a source of protons.

The polarizing target is a self-supporting carbon foil with a thickness of 2.3 mg/cm$^2$. The protons deflected through 48° in the laboratory system enter the polarimeter through an interchamber collimator, which defines the polarized-beam direction to ±2.6°. The oxygen used in the polarimeter is 99.9% pure. It is contained at 1 atm pressure by a mylar window, which implies that the energy of the twice-scattered protons depends in part on the scattering angle, in the angular interval subtended by the asymmetry detectors.

An important feature of this arrangement is that data may be taken at many angles simultaneously. The scattering angle is referred to the energy of the protons elastically scattered from the polarimeter reaction volume. The proper resolution of the asymmetry detectors allows to define an angular resolution of 10°. To compensate for small differences in the instrumental symmetry, the polarimeter is rotated, after each data point, around the chamber axis to the symmetrical angle with respect to the proton beam. Accurate calibration checks were performed by scattering the polarized proton beam from a xenon target.

3. - Treatment of data.

The measurement consisted of evaluating the left-right asymmetry following the scattering of the polarized beam by the $^{16}\text{O}$ target. As protons are scattered
