Angular Distribution of Protons from the \((d, p)\) Reaction in \(^{56}\)Fe.

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(ricevuto il 14 Marzo 1967)

Much information of interest in nuclear spectroscopy comes from a precise measurement of nuclear energy levels. Such measurements are necessary for an accurate comparison of the position and sequence of nuclear levels, of their spins and parities as predicted by various nuclear models. The nucleus \(^{57}\)Fe is of particular interest, for the shell model predicts \(\frac{5}{2}^-\) for the spin and parity in its ground state, while it is one of the few odd-mass nuclei having for the ground state \(J^\pi = \frac{1}{2}^-\) and a small magnetic-dipole moment. The present work is concerned with the determination of the properties of its excited states as obtained from the \((d, p)\) reaction in \(^{56}\)Fe.

Protons emitted from the bombardment of an enriched \(^{56}\)Fe target with a beam of 12 MeV deuterons from the Aldermaston Tandem Generator were analysed in a multichannel magnetic spectrograph and recorded in Ilford K2 emulsions. Energy levels in \(^{57}\)Fe were obtained from the measurements of the energy spectrum of protons at 35°, 50°, 65°, 80° and 107.5°; details of the energy levels have been given elsewhere (1). In all, 66 levels have been established up to an excitation of 5.2 MeV.

Angular distributions of protons corresponding to the first 26 levels have been measured (a detailed analysis is in progress), some of which we quote in this short communication. Most of the angular distributions show the characteristic features of a direct interaction process and the results have been analysed in terms of a Butler’s plane-wave approximation as summarized in Table I. Also shown for comparison are the \(l\)-values obtained by Bochin et al. (2), Elbek (3) and Gofman and Nemets (4);


the present values are in good agreement with those quoted in the above papers. The angular distributions for the 1.002 and 1.196 MeV levels do not seem to have been formed by a direct process though an $l = 3$ transition can, to some

![Fig. 1. - Angular distributions of protons from (d, p) reaction in $^{16}$Fe with Butler plane-wave analysis with $l$-values shown in the respective cases: a) 1.002 MeV; b) 1.196 MeV; c) 1.725 MeV; d) 2.506 MeV.](image-url)