in the energy of the primary neutrons. Reducing the primary neutron flux and $\Delta E_0 / E_0$ by 10 times decreases the overall error in the determination of the binding energy to 2.7%.

Molecular neutronoscopy cannot compete with optical methods and with radio spectroscopy whenever the latter methods (which are more accurate) can be used to investigate a substance without a change in its aggregate or chemical state (which may be accompanied by a change in the very properties that are being studied).

However, molecular neutronoscopy does have the advantage of being capable of investigating molecules in specimens in any state, and is consequently capable of studying intermolecular interaction, i.e., the influence of such factors as temperature, pressure, aggregate state, presence of outside admixtures, etc., on the binding energy, and perhaps also other molecular properties mentioned above. In addition, molecular neutronoscopy uncovers still another specific possibility of interest to radiation chemistry and radiation biology, namely, a means of establishing the relative and absolute probability of breaking various molecular bonds by neutron excitation of molecules at different levels.

In conclusion I express my gratitude to F. L. Shapiro and M. I. Pevzner, whose discussions contributed much to establishing the possibility of the method proposed here.

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Excitation Function for the $Si^{28}(d, p)Si^{29}$ Reaction

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USING a method described in Ref. 1, we investigated the yields of various groups of protons from the $Si^{28}(d,p)Si^{29}$ reaction, as functions of the fixed detector angle and the primary deuteron energy. In a stripping reaction, the ratios of these yields, called hereinafter "differential excitation functions" for short, should depend in a characteristic manner on the moment of momentum introduced by the neutron in the formation of a finite nucleus in a definite excited state.

However, the stripping mechanism is not unique to the (d, p) reaction and in some cases a substantial contribution to the cross section of the reaction is introduced by the mechanism of the intermediate nucleus. The latter mechanism is of resonant character, corresponding to the formation of excited levels of the intermediate nucleus. The cross section of the (d,p) reaction consists in this case of a contribution from the stripping mechanism, a contribution from the intermediate-nucleus mechanism, and a contribution corresponding to the interference between the stripping mechanisms and the compound nucleus. The presence of such resonances in the differential excitation functions and their interference character were recently established experimentally for light nuclei.[2-9]

We obtained spectra of protons from the $Si^{28}(d,p)Si^{29}$ reaction at an angle $\theta = 109°$ with the direction of the motion of the primary particles for 15 values of deuteron energy ranging from 1.75 to 4.75 mev. A typical $Si^{28}(d,p)Si^{29}$ proton spectrum at $E = 3.45$ mev is shown in Fig. 1. The proton groups p_0, p_1, p_2, p_3, p_4, p_5 correspond to excited levels of Si^{29} at $E_{exc} = 0, 1.28, 2.03, 2.43, 3.07$, and 3.62 mev, respectively. Figure 2 shows the ratios of the differential excitation

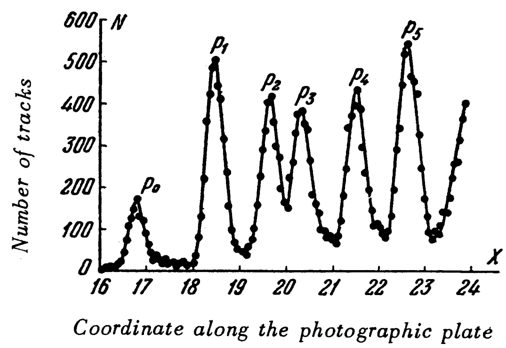

FIG. 1. Distribution of the tracks on a photographic plate. N—number of tracks, X—coordinate along the photographic plate.

functions of various levels of the final Si^{29} nucleus obtained from these spectra.

These relationships disclose 3 resonances at incident-deuteron energies $E_d = 3.26, 3.75$ and

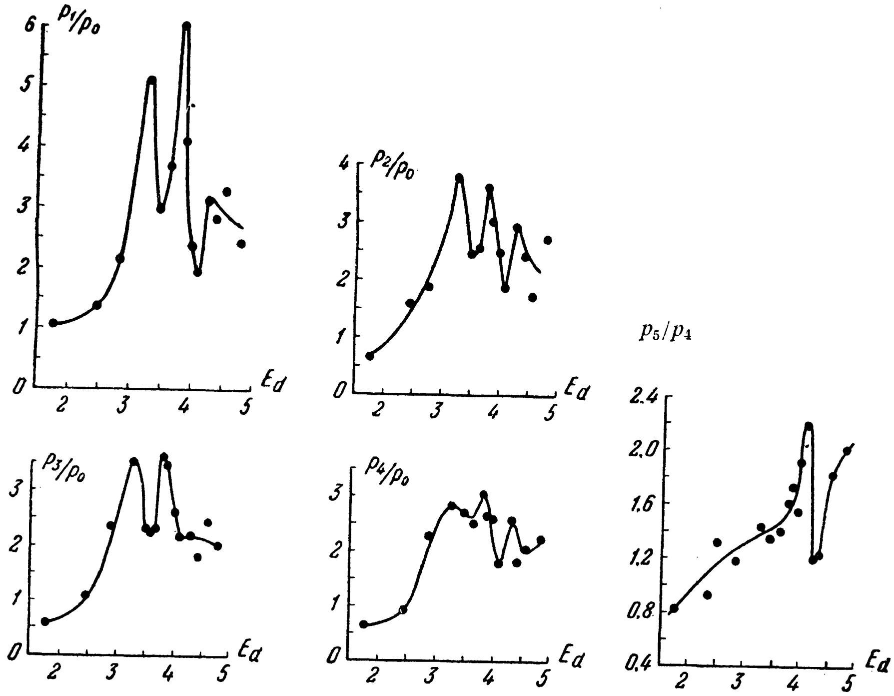

FIG. 2.

4.23 mev, corresponding to the formation of new excited (14.8, 15.3 and 15.7 mev) levels in the P^{30} nucleus. It was observed that these resonances vary with the levels of the final nucleus. The first two (E_{exc} = 1.48 and 15.3 mev) are most clearly pronounced for the ratio p_1 / p_0, and their intensities diminish with diminishing kinetic energy of the proton (i.e., as the ratios p_2/p_0, p_3/p_0, etc., are reached). The third resonance (E_{exc} = 15.7 mev) is most clearly pronounced for the ratios p_5/p_0 or p_5/p_4. Inasmuch as $k_pR \geq 2.5$ (where k_p is the proton wave vector and R the nucleus radius), it is impossible to determine uniquely the spins and parities of the state of the intermediate nucleus from the known spins and parities of the final nucleus.

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Measurement of the Saturated Vapor Pressure of a He^3-He^4 Mixture with a High He^3 Concentration

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IN connection with the separation of He^3 from He^4 by rectification, it was necessary to know the