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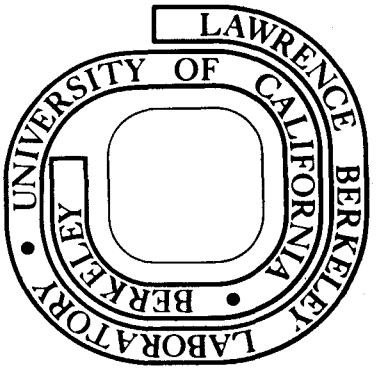

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THE VECTOR ANALYZING POWER IN THE $^2H(\vec{d},p)^3H$ REACTION BETWEEN 15 and 25 MeV*

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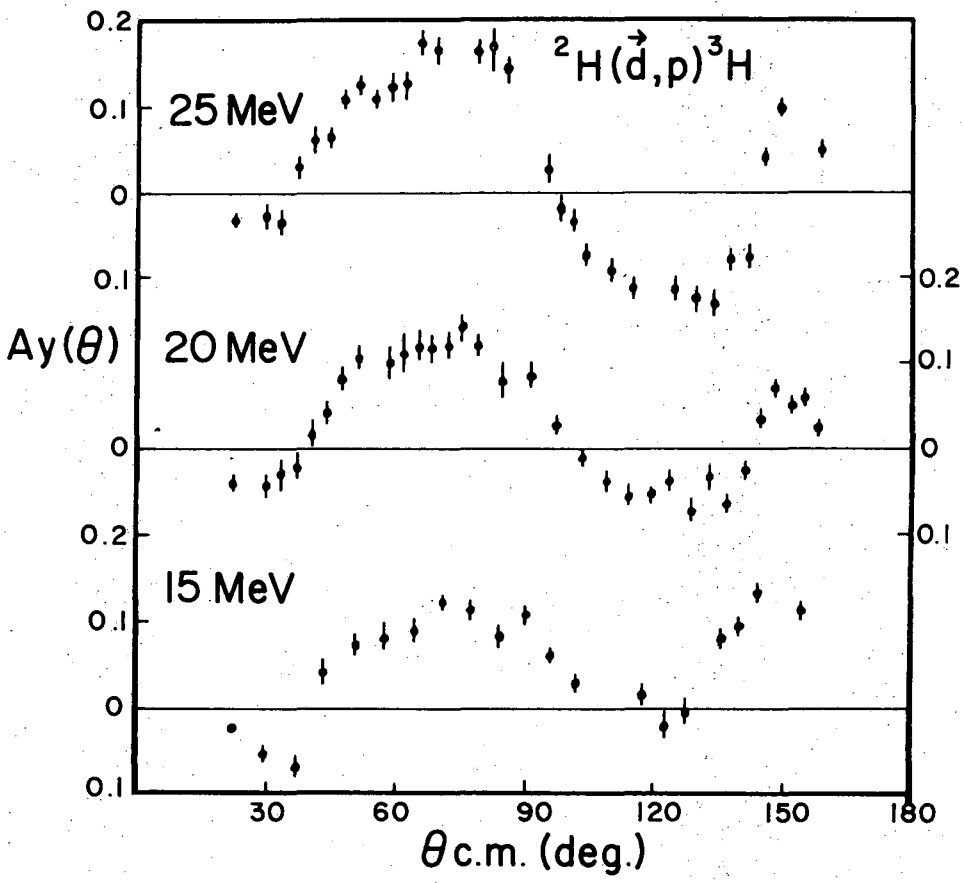
The charge-symmetric reactions $^2H(d,p)^3H$ and $^2H(d,n)^3He$ have been studied in considerable detail at energies up to 15 MeV[1,2]. Differential cross sections, nucleon polarizations, and deuteron vector and tensor analyzing powers have been measured, and differences in these observables for the two reactions have been examined for evidence of a possible deviation from the charge symmetry of the nuclear interactions. The more recent comparisons and calculations[3] have been able to explain the observed differences between the two reactions in terms of the Coulomb effect, including the Q-value difference.

These reactions, in addition to being charge symmetric, each possess the additional symmetry of entrance-channel particle identity. This requires that $\sigma(\theta) = \sigma(\pi-\theta)$ and $p(\theta) = -p(\pi-\theta)$ for the differential cross sections and the nucleon polarizations, respectively. In general, no comparable symmetry is imposed on the angular distributions of the deuteron analyzing-power components, and, indeed, no suggestion of symmetry is seen in the data at deuteron energies up to 11.5 MeV[2]. However, recent measurements of the vector analyzing power in the $^2H(\vec{d},p)^3H$ reaction at 30 MeV have disclosed the surprising result that, there, the symmetry

$$iT_{11}(\theta) = -iT_{11}(\pi-\theta) \qquad (1)$$

is approximately fulfilled[4]. Also, it has been shown that the condition (1) holds exactly if the reaction should proceed entirely by way of the direct nucleon-transfer process[5]. Thus, in this particular case deviations from the symmetry (1) constitute clear qualitative evidence that the reaction proceeds (also) via the intermediate (compound) nucleus ^4He. Thus, at the lower energies analyses of the data in terms of states in ^4He are certainly appropriate.

We report here on measurements of $A_y(\theta)$ in the $^2H(\vec{d},p)^3H$ reaction at 15, 20, and 25 MeV which were made in order to examine the transition from the complete lack of symmetry at 11.5 MeV toward that of (1) at 30 MeV. Our results, which are displayed in fig. 1, show that the transition is a gradual one. Thus, the change from the compound-nucleus reaction mechanism to the predominantly direct nucleon-transfer reaction mode is correspondingly gradual, and at 30 MeV and above analysis in terms of the direct-reaction process is clearly appropriate.



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† On leave of absence from the University of Basel, Switzerland.

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2) W. Grüebler et al., Nucl. Phys. A193 (1972) 129.
3) Reference 41 (unpublished) of ref. 2.
4) H. E. Conzett, J. S. C. McKee, R. M. Larimer and Ch. Leemann, Fourth Polarization Symp.
5) H. E. Conzett, J. S. C. McKee, R. M. Larimer and Ch. Leemann, to be published.

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