Title
MAXIMUM TENSOR ANALYZING POWER Ayy = 1 IN THE 3He(d,p) 4He REACTION

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DISCLAIMER

MAXIMUM TENSOR ANALYZING POWER $A_{yy} = 1$ IN THE $^3He(\vec{d},p)^4He$ REACTION*

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Data points for the cartesian analyzing power $A_{yy}(\theta)$, derived from measurements of Grüebler et al.[1], reach and even exceed unity near $E_o = 9$ MeV and $\theta_o = 27^o$ in the center of mass system (figure). This suggests the possibility of an extreme value of the analyzing power $A_{yy} = 1$ in this region[2]. For this case the conditions on the transition matrix M are

$$M_{1,\,1/2;\,1/2} = -M_{-1,\,1/2;\,1/2}$$
$$M_{1,\,-1/2;\,1/2} = -M_{-1,\,-1/2;\,1/2}, \qquad (1)$$

where the indices denote the magnetic quantum numbers of the deuteron, ^{3}He and proton spins, respectively. The data show that these four real equations are nearly fulfilled at 8 and 10 MeV. Actual compliance at some critical point (E_o,θ_o) cannot be demonstrated directly, since a reliable analysis of the reaction is not yet available. An alternate method[2] consists of inserting eqs. (1) into the formulae for the observables[3,4] and testing the resulting conditions experimentally.

$$P^{y'} = -A_{o,y} = K_{yy}^{y'} = -C_{yy,y} \qquad (2)$$

$$K_{xx}^{y'} = -C_{xx,y} \qquad (3)$$

$$K_{zz}^{y'} = -C_{zz,y} \qquad (4)$$

$$K_{x}^{x'} = K_{z}^{x'} = K_{x}^{z'} = K_{z}^{z'} = 0 \qquad (5)$$

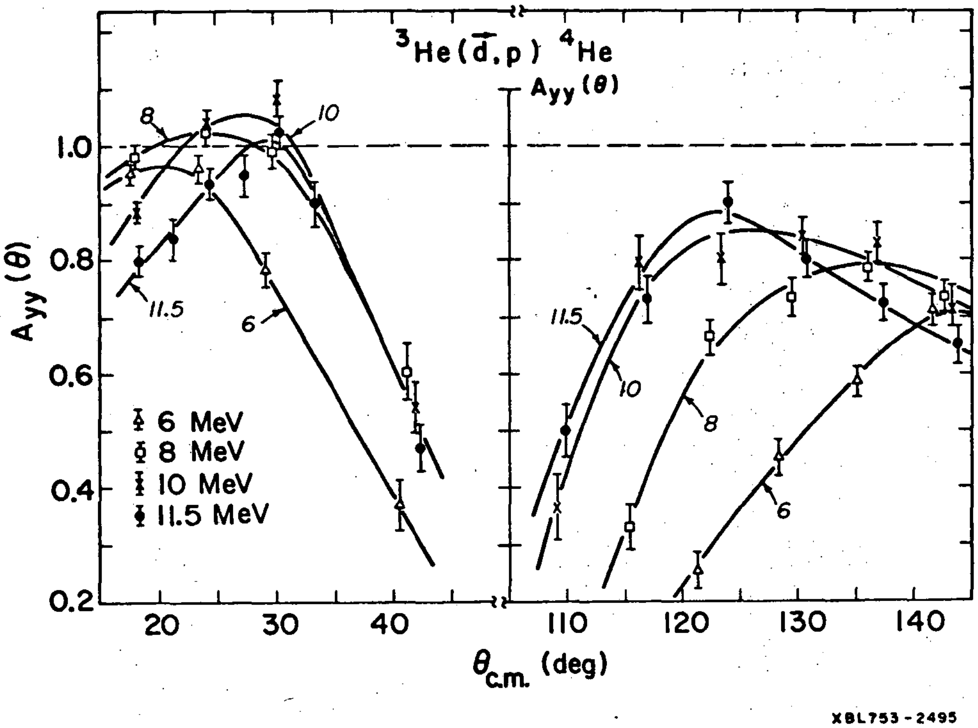
$$K_{xy}^{x'} = K_{yz}^{x'} = K_{xy}^{z'} = K_{yz}^{z'} = 0 \qquad (6)$$

$$C_{x,x} = C_{z,x} = C_{x,z} = C_{z,z} = 0 \qquad (7)$$

$$C_{xy,x} = C_{yz,x} = C_{xy,z} = C_{yz,z} = 0 \qquad (8)$$

Some values for the proton polarization $P^{y'}$, the $^3\vec{He}$ analyzing power $A_{o,y}$ and the polarization transfer coefficients K_i^j are available near the critical point (E_o,θ_o) and lend support to the assignment of an extreme value $A_{yy} = 1$ [2]. Better statistical accuracy can be obtained for efficiency correlation coefficients $C_{i,j}$, however no such data are yet available near 9 MeV.

By a proper selection of observables, measured at and around the critical point, eqs.(1) can be tested thoroughly. In this respect conditions (5) to (8) are particularly important, since they are independent of the calibration of any polarization. Once the existence of an extreme value $A_{yy} = 1$ is thus established, eqs. (1) can be used to restrict the solution space of an analysis. By analyzing angular distributions at the critical energy E_o, the <u>linear</u> conditions (1) can be imposed directly on the usual system of bilinear equations. In view of the problems encountered in the analysis of reactions, this potential use of extreme points of the analyzing power may be more important than the more obvious application as a calibration point for deuteron tensor polarization.



References

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+ On leave from the University of Basel, Switzerland.

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