EXCHANGE EFFECTS IN REARRANGEMENT COLLISIONS BETWEEN NUCLEI

M.F. WERBY and M.A. NAGARAJAN
Daresbury Laboratory, Science Research Council, Warrington WA4 4AD, U.K.

R.C. GOLDFINGER and W. TOBOCMAN
Case Western Reserve University, Cleveland, Ohio, U.S.A.

It is usually assumed that in a reaction of the type A(a,b)B, the emerging light particle b is originally a constituent of the projectile a and carries a large share of the forward momentum of the projectile yielding angular distributions peaked at small angles.

The effect of the identity of the nucleons in the two nuclei in the initial and final channels allows for the reaction to proceed in several alternate forms. In particular, it is possible that the detected particle b could have been a constituent of the target nucleus A. In the frame of reference where the center-of-mass of the system is at rest, this will cause the particle b to carry a share of the momentum of the target A and thus will yield angular distributions that are peaked at large angles. The likelihood and importance of the exchange process will depend strongly upon the probability of clustering of particle b in target A and that of particle a in B, along with favourable angular momentum matching conditions.

The inclusion of both direct and exchange mechanisms can give rise to interference terms which can further characterize the shape of the angular distribution. In this study we have analyzed the angular distributions in a consistent finite range formalism for reactions that seem to exhibit exchange features. The reactions analyzed are the ground state transitions

1) $^{11}B(^{16}O,^{15}N)^{12}C$

2) $^{14}C(^{16}O,^{17}O)^{13}C$

3) $^{12}C(^{14}N,^{13}N)^{13}C$

In the reaction 1), the direct process is proton stripping while the exchange is an alpha stripping reaction. In reaction 2), the direct and exchange processes correspond to neutron transfer and ^{3}He transfer respectively. In the last reaction, we have a case of neutron and proton transfer occurring as competing mechanisms.

In all the cases, it was clear that the data could not be reproduced by the direct process alone. Significant improvement was consistently observed by the inclusion of exchange modes of the reaction.

The details of these analyses will be presented at the conference.