REACTION MECHANISM AS SEEN FROM POLARIZATION IN HEAVY ION REACTIONS

Noriaki Takahashi

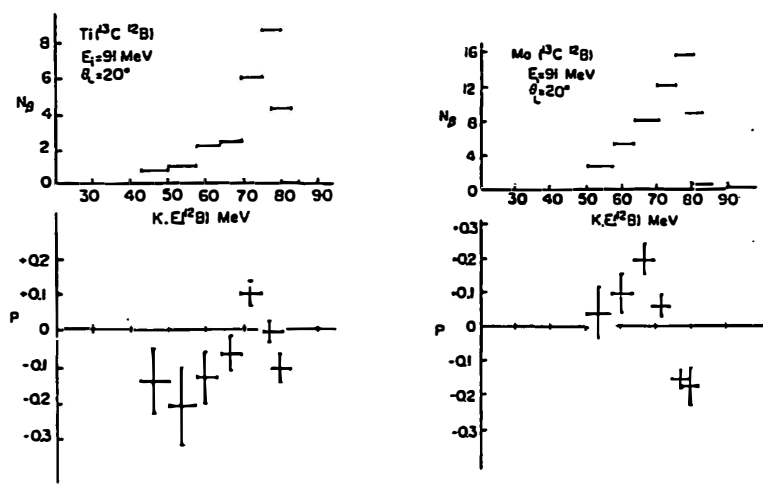
Institute of Physics
College of General Education
Osaka University
Toyonaka, 560 JAPAN

Systematic behaviour of polarization of reaction products ^{12}B is revealed for single-nucleon transfer reactions. Reaction mechanisms are inferred from such a systematic and a comparison is made with one obtained for two-nucleon transfer reactions.

Spin polarizations of reaction products is a unique probe to look into the reaction mechanisms as envisaged from the systematic studies in two-proton transfer reaction $(^{14}N,^{12}B)$[1].

Asymmetric beta decay and the range method have been used to determine polarization of reaction products ^{12}B in single-nucleon transfer reactions $(^{13}C,^{12}B)$ and $(^{11}B,^{12}B)$ as functions of reaction Q-value. Details of the experimental method are described elsewhere[2].

Fig. 1 shows that the dependence of polarization is different between heavy target (^{nat}Mo) and light target (^{nat}Ti) in the region of kinetic energy of ^{12}B. For the large kinetic energies polarization looks essentially the same. Here, the sign of polarization is taken positive, when it is parallel to $\vec{k}_f \times \vec{k}_i$.



1. Spectra (upper) and polarization (lower) of reactions products ^{12}B for two kinds of target at 91 MeV.

Fig. 2 shows the dependence of polarization on Q-value for the reaction $^{nat}Cu(^{13}C,^{12}B)$ at 68 MeV and 91 MeV. Positive polarization for the highest kinetic energy is difficult to be interpolated from the data given in Fig. 1.

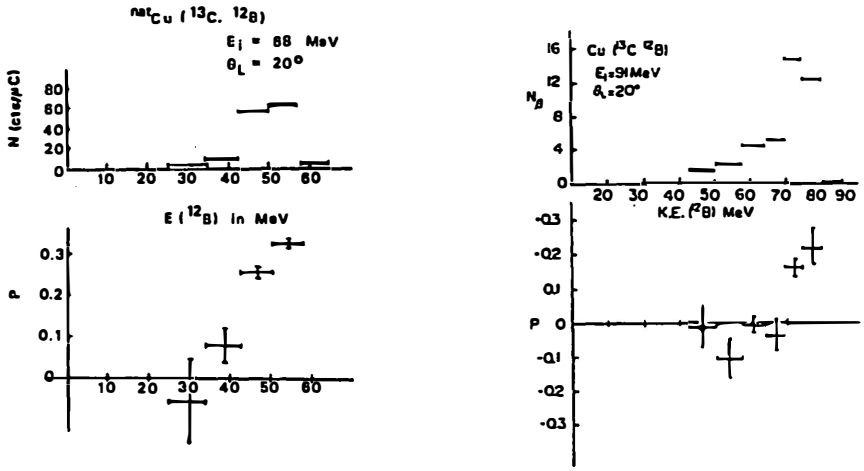


Fig. 2 Spectra (upper) and polarization (lower) of ^{12}B from the $^{nat}Cu(^{13}C,^{12}B)$ reaction for two values of incident energy.

Polarization in the region of large kinetic energy reflects contribution of direct reaction mechanism as in the case of $(^{14}N,^{12}B)$ reactions. That in the region of small kinetic energy is the results of balance of the Coulomb repulsive and the inter-nuclear attractive forces indicating the possibility of orbiting in the reactions on heavy target nuclei.

The ^{13}C and ^{11}B beams of 60 ~ 70 MeV were obtained at the Max-Planck-Institut für Kernphysik, Heidelberg and the work were carried out together with R. Čaplar, R. Wolski, H. Ho, E. Steffens, K. Rusek, G. -Y. Fan, P. Wurns, N. Kato and A. Weller. The measurements at the incident energy for ^{13}C beam of 91 MeV were carried out at the Department of Nuclear Physics, The Weizmann Institute of Science in collaboration with I. Tserruya, Z. Fraenkel, P. Jacobs and S. Lantzman.

1. N. Takahashi, AIP Conf. Ser. 69 (1981) 1016.
2. K. Sugimoto, M. Ishihara and N. Takahashi, Polarization Phenomena in Heavy-Ion Reactions in Heavy Ion Science Series, Ed., D. A. Bromley, Plenum Press, New York, in press.