Multi-nucleon transfer study in ^{10}B+^{209}Bi reaction

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Introduction

In the last few years, multinucleon transfer reactions are widely used to populate the neutron rich nuclei. This kind of study can help in understanding the influence of projectile structure, nucleon-nucleon interaction, pairing correlations etc. [1–5]. These studies have developed the interest in development of new generation large solid angle spectrometers based on trajectory reconstruction like PRISMA, VAMOS spectrometers. The coupling of these spectrometers with large γ arrays allowed the identification of γ rays coming from the decay of weak transfer channels associated with the population of nuclei moderately far from stability. Similarly the use of silicon strip detectors helped in identification of different projectile like fragments with light nuclei as projectiles. There is remarkable improvement in theoretical front as well, strating from Semi-classical approximations, TDHF calculations to BCS theory has been developed in recent times.

In the present work, we aimed to study the pairing correlations and multi-nucleon transfer studies in ^{10}B+^{209}Bi reaction. The N=Z nuclei (e.g. ^{10}B)are ideal for studying pairing correlations since such correlation are expected to be strongest where protons and neutrons occupy the same shell model orbitals.

Experimental details

The experiment was performed at 14UD BARC-TIFR Pelletron-Linac facility in Mumbai using a ^{10}B beam of 80 MeV on ^{209}Bi target. The self supporting ^{209}Bi target with a thickness of 500 μg/cm^2, was prepared by the vacuum evaporation technique. Along with

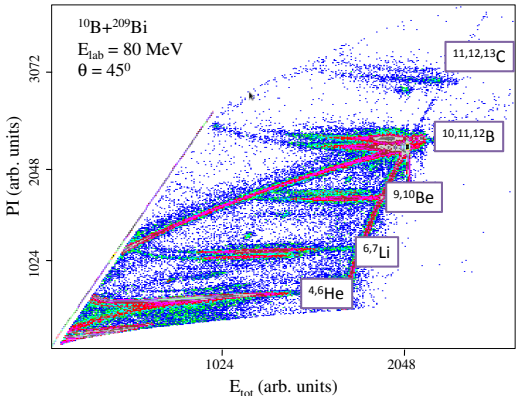

FIG. 1: The particle identification (PI) vs. E_{total} plot showing the different reaction products formed in ^{10}B+^{209}Bi reaction at 80 MeV.

^{209}Bi target, we had also used ^{124}Sn and ^{89}Y targets for calibration from elastic scattering. The experiment was performed in 1.5 m diameter multipurpose scattering chamber using silicon detectors for detection of projectile like fragments. One segmented large area Si-telescope of active area 5x5 cm^2 was used. The ΔE detector was a single sided strip detector with 16 strips and E detector was double sided strip detector with 16 strips in X and Y directions. Thicknesses of ΔE and E detectors were 50 μm and 1500 μm, respectively. One Si-surface barrier monitor detector (thicknesses 300 μm) kept at 20^0 was used for absolute normalisation. The Mesytec preamplifiers and amplifiers were used to process the signal from the strip detectors. The VME based data acquistion system was utilised for recording the analog signals. In this study, we have measured the data in the angular range from 20 to 80 degree, covering the grazing angle ($\sim$ 50 deg.). Fig. 1 shows the plot of PI (particle identification) vs E_{total} for ^{10}B+^{209}Bi re-

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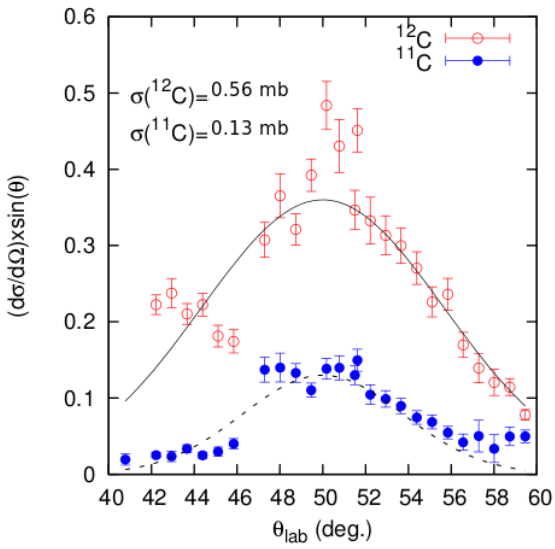

FIG. 2: Preliminary results of angular distributions for ^{11}C (p-transfer) and ^{12}C (d-transfer) data are shown along with the Gaussian fittings.

action.

Results

In Fig. 2, we have shown the representative preliminary results for angular distributions for ^{11}C (p-transfer) and ^{12}C (d-transfer) data along with the Gaussian fittings. The angle integrated cross-sections were also extracted from the fitted distribution. It is obsergved that d-transfer cross-section (0.56 mb) is much more than p-transfer (0.13 mb). Similar angular distributions are plotted and angle integrated cross-sections are extracted for different multi-nucleon transfer products. The theoretical DWBA calculations are in progress to understand this angular distributions data. From the angle integrated cross-sections for different transfer products, we get the systematics with Q-value as well as ΔN (no. of nucleons transfered) which will be presented in the symposium.

Summary and Conclusion

We have preformed multi-nucleon transfer studies for ^{10}B+^{209}Bi reaction at 80 MeV. All the transfer products from Z=2 to Z=8 are identified in the experiment. The preliminary angular distributions for transferred particles show bell shaped angular distributions. Further analysis is in progress and will be reported in symposium.

References

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