np pairing correlation study in $^{10}B+^{209}Bi$ reaction

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Introduction

There is a renewed interest in two nucleon transfer reactions [1–5] to understand the effect of pairing correlation on the reaction dynamics. The description of the reaction mechanism associated with the transfer of a pair of particles in heavy-ion reactions has always been a rather complex issue. Two nucleon transfer cross-sections are available in literature for (p,t), (t,p), (^{4}He,d), (^{3}He,p) reactions, where the different reaction channels are identified by measuring outgoing charged particle in coincidence with emitted gamma rays from target like nucleus. The second order DWBA calculations of two nucleon transfer reactions have been carried out recently by Potel *et al.* [2, 3] including simultaneous and successive transfer, and is in good agreement with all the available (p,t) data on Sn isotopes.

Pairing correlation has also been studied in two nucleon transfer focussing on N=Z nuclei, since it is a unique system to study np correlations [6, 7]. As we move away from N=Z line, nn and pp correlations are favored. Recently planned radioactive ion beam facilities worldwide are able to provide more exotic N=Z nuclei like ^{44}Ti, ^{56}Ni, ^{72}Kr etc. which will be used for np correlation studies. This has motivated us to study the np correlation effects in light N=Z nucleus ^{10}B in the reaction channels *viz*. (^{10}B,^{12}C) and (^{10}B,^{8}Be). The experimental details and preliminary results are given in the following sections.

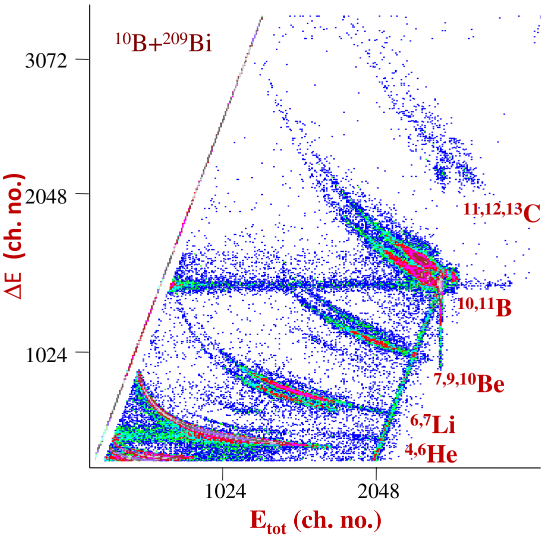

FIG. 1: (Color online) Two dimensional (ΔE-E_{tot}) plot for the projectile like fragments in the ^{10}B+^{209}Bi reaction at E_{lab} = 80 MeV.

Measurement 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. 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. Three telescope consisting of Si-surface barrier detectors (thicknesses ΔE ∼ 80 μm, E ∼ 300-1500 μm) were also used. Two Si-surface barrier monitor detectors (thicknesses 300 μm) kept at ± 20° were used for absolute normalisation. In this measurement we have covered the angular

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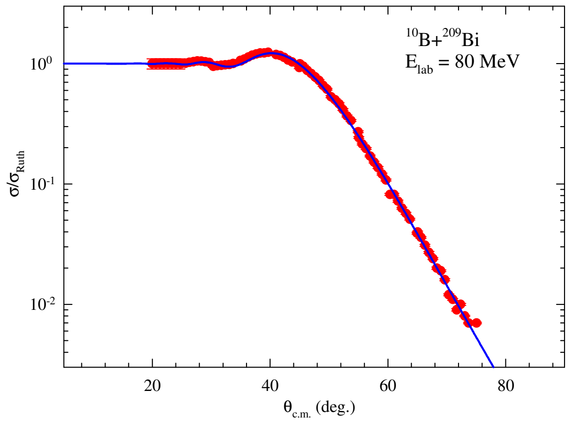

FIG. 2: (Color online) Elastic scattering angular distribution for $^{10}B+^{209}Bi$ reaction at 80 MeV along with optical model calculations done with SFRESCO.

range from 20 to 80 degree in theta direction. All the light charged particles from Z=1 to Z=6 were identified by using energy loss information from ΔE and E detectors. We also obtained good isotopic separation for respective Z bands as shown in Fig. 1.

Results and Conclusion

The preliminary data on elastic scattering angular distribution for $^{10}B+^{209}Bi$ reaction at 80 MeV is shown in Fig. 2. An optical model analysis of the elastic scattering differential cross section was performed using SFRESCO code [8]. This code has recently incorporated the well-known multiparameter search program MINUIT. The volume Woods-Saxon form was used for both the real and the imaginary part of the optical potential. The starting parameters for the search were taken from Ref. [9]. Searches were carried out by varying all six parameters (strength, radius, and diffuseness of real and imaginary potentials) simultaneously as well as an independent search for each parameter fixing all others and also with different combinations of the parameters, to achieve a best fit to the data. The fit with the elastic scattering data are given in Fig. 2. The optical model parameters extracted from the above analysis will be used in further calculations for transfer data. The data analysis for extraction of cross-sections for all transferred channels marked in Fig. 1 and the relevant theoretical calculations for explaining the data is in progress and will be reported during symposium.

Acknowledgments

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