Breakup of ^{7}Be on ^{12}C at 5 MeV/u

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Introduction

Breakup reaction studies of loosely bound stable and unstable nuclei may provide deeper insights into nuclear physics and nuclear astrophysics. Measurements of the breakup of ^{7}Li have been carried out extensively [1, 2]. For ^{7}Li (breakup threshold 2.467 MeV), both direct and sequential breakup through the 4.63 MeV state have been measured using several targets ranging from ^{12}C to ^{208}Pb [3–5]. Despite the fact that breakup studies with ^{7}Li has received lots of attention, there are very few works involving its mirror counterpart ^{7}Be. The ^{7}Be nucleus has a prominent α+^{3}He cluster structure with a lower breakup threshold of 1.587 MeV. Mazzocco *et al.*, [6, 7] carried out experiments involving ^{7}Be on ^{58}Ni and ^{208}Pb targets at energies around the Coulomb barrier leading to very low exclusive breakup events. Also, in the work of Amro *et al.*[8], no significant coincidence counts were observed for ^{7}Be+^{12}C studies. Direct and sequential breakup through the 4.57 MeV and 6.73 MeV resonant states of ^{7}Be have been carried out via the transfer reaction ^{112}Sn(^{6}Li,^{7}Be)[9]. However, breakup data of ^{7}Be on ^{12}C does not exist. A detailed study of breakup of ^{7}Be in comparison to ^{7}Li will shed light on the relative importance of direct and sequential breakup.

Experiment

The experiment was carried out at HIE-ISOLDE, CERN with a ^{7}Be beam of intensity $\sim 10^{5}$ pps. A CD_2 target of thickness 15 μm was used. The detector setup for charged particle detection consisted of 5 double sided 16 ×16 silicon strip detectors (W1, DSSD) in a pentagon geometry covering 40°- 80° in the lab. These were backed by unsegmented silicon-pad detectors in ΔE-E telescope configuration. The forward angles $\sim$ 8° - 25° were covered by an annular detector (S3). The back angles $\sim$ 120°- 165° were covered by two DSSDs (BB7) backed by unsegmented silicon-pad detectors. The details of the experimental setup are given in Ref.[10, 11].

Results and Discussion

The Monte Carlo simulations for the breakup of ^{7}Be from ^{7}Be + ^{12}C reaction were carried out using NPTool [12]. Clear bands of ^{3}He and

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α can be seen from the experimental ΔE-E spectra. Since ^{3}He and α may also come from transfer reactions, suitable gates and conditions were applied to identify the events only from breakup. Coincident detection of ^{3}He and α with multiplicity 2 in the pentagon detectors were applied. Fig. 1 represents the experimental energy spectra for coincident ^{3}He and α from the ^{7}Be breakup. The energy

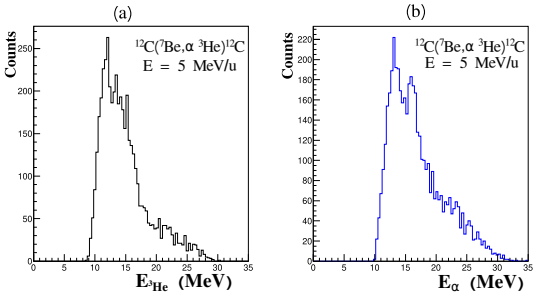

FIG. 1: The coincident energy spectra for (a) ^{3}He (b) α from ^{7}Be breakup on ^{12}C at 5 MeV/u.

correlation spectrum of coincident ^{3}He and α (Fig. 2) shows significant breakup events from ^{7}Be+^{12}C reaction. This work reports the first

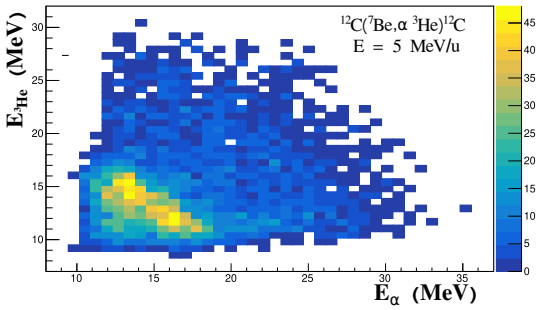

FIG. 2: Energy correlations of coincident ^{3}He and α from ^{7}Be breakup on ^{12}C at 5 MeV/u.

exclusive measurement of the breakup of ^{7}Be on ^{12}C at 5 MeV/u over a wide angular range. Analysis is in progress to study the contribution of direct and sequential breakup of ^{7}Be.

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