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Elastic, inelastic and breakup cross sections in 6Li+112Sn system

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Study of reactions involving weakly bound projectiles is very interesting because of the observation of several unusual features compared to the case of strongly bound projectiles. Suppression of complete fusion, breakup threshold anomaly in optical potential describing elastic scattering and a large production of alpha particles in the reactions are some of those interesting observations [1]. Projectile breakup in the field of a target nucleus is known to play an important role in the manifestation of all the above features. To understand the underlying reaction mechanism, the experimental data on projectile breakup cross section is thus very important to compare with the coupled-channels calculations that include the breakup channels. In order to constrain the values of coupling parameters and the potentials in the coupled-channels calculations it is also important to reproduce simultaneously the experimental data for as many reaction channels as possible for the same target+projectile.

With the above motivation, the elastic, inelastic, transfer and breakup cross sections for 6Li+112Sn system have been measured at a bombarding energy of 30 MeV using BARC-TIFR Pelletron facility at Mumbai. Four telescopes of single Si detectors (covering 30 degree) and two telescopes of double sided 16-strip Si detectors (covering 35 degree) were used for the above purpose. Preliminary results obtained from the data of single telescopes and two monitors are shown in Figure 1 below. Differential cross sections for the elastic scattering normalized with the Rutherford cross sections are shown in Fig.1(a). The inelastic cross sections corresponding to 112Sn(2+,1.25 MeV) and 112Sn(3-,2.35 MeV) are shown in Fig.1(b) and (c) respectively. The exclusive breakup cross sections corresponding to the 1st resonant state of 6Li (3+,2.18 meV) is shown in Fig.1(c). The cross sections for projectile breakup have been extracted following the procedure as described in Ref.[2].

Continuum-discretized-coupled-channels (CDCC) calculations are performed using FRESCO to estimate the projectile breakup cross sections. Breakup channels that are included in the CDCC calculations are similar to the ones in Ref.[2]. Results of the coupled-channels calculations that explain the measured data simultaneously are shown by the solid lines in Fig.1.

Fig.1.(a) Elastic, (b,c) inelastic and (c) breakup cross sections measured at Ebeam=30 MeV

[1]S. Santra et al., Phys.Rev.C 90,064620 (2014), Phys.Rev.C 83,034616 (2011),), Phys.Rev.C 85,014612 (2012), and references therein.

[2]S. Santra et al., Phys.Lett.B 677, 139 (2009).

Primary author: Dr SANTRA, Satyaranjan (Bhabha Atomic Research Centre, India)

Presenter: Dr SANTRA, Satyaranjan (Bhabha Atomic Research Centre, India)

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