International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

A new experimental study of the 12Be cluster structure

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Neutron rich Beryllium isotopes have attracted much attention for their cluster or molecule structures at excited (resonant) states [1]. Experimentally one novel method, the inelastic excitation followed by coincidently recording the decay products, was applied to probe the molecule resonant states [2, 3]. But so far, the experimental results for ^{12}Be seem quite controversial. Freer et al reported the observation of molecule resonant states in ^{6}He+^{6}He channel and ^{8}He+^{4}He channel [2]. However, most of these resonances were not identified in a similar experiment carried out later on by Charity et al [3].

We have therefore carried out a new experiment with ^{12}Be secondary beam at 31.3MeV/u provided by HIRFL-RIBLL facility in Lanzhou. Two charged fragments produced from the breakup of ^{12}Be on a Carbon target were coincidently recorded by a down-stream zero-degree telescope consisting of a 300um-thick double-sided silicon strip detector (DSSD) and a 4*4 CsI scintillator array. Typical particle identification performance for coincidently measured Helium fragments is shown in Fig.1. The molecule resonant states were reconstructed from 4He+8He and ^{6}He+^{6}He decaying channels. These states agree well with previously reported results by Freer et al.[2], and therefore support the highly clustering structure of ^{12}Be. Cross sections for these two breakup channels were also deduced.

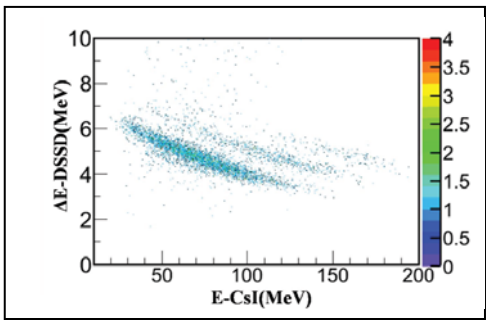

Figure 1: Coincidently measured Helium fragments resulted from the inelastic excitation and decay of the ^{12}Be nucleus. The bands starting from the bottom are for 4He, 6He and 8He, respectively.

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[2] M. Freer, J. C. Angelique, L. Axelsson, et al., Phys. Rev. Lett. 82, 1383 (1999).
[3] R.J. Charity, S.A. Komarov, and L. G. Sobotka, et al., Phys. Rev. C 76, 064313 (2007).