Coulomb Dissociation of ^{17}Ne*

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Introduction

The ^{17}Ne is a proton-dripline nucleus that causes special interest in nuclear structure and nuclear astrophysics. As a (^{15}O+2p) Borromean 3-body system it represents a promising candidate for a two-proton halo structure [1]. The main uncertainty of the ^{17}Ne ground state is the yet unknown mixture of the d^2 and s^2 configurations of the two protons outside the ^{15}O core. Predictions of the s^2-weight run from 15 to 70% [2, 3, 4, 5, 6, 7, 8]. The solution to this situation is an experimental determination of the s^2/d^2 mixture.

The Coulomb dissociation of ^{17}Ne can provide also an important information about a ^{15}O$(2p,\gamma)^{17}$Ne reaction, which can serve as a bypass of the ^{15}O waiting point in the CNO cycle. At high temperature and density conditions, which occure in X-ray bursts, the CNO cycle and the *rp* process are linked by the α capture reaction on ^{15}O. However, the reaction flow between the CNO cycle and the FeNi-mass region is hampered by the waiting point nuclei like ^{15}O [9]. The two-proton capture reaction can be an alternative way to process the initial CNO material towards heavier nuclei. The ^{15}O$(2p,\gamma)^{17}$Ne cross section is investigated by studying the time-reversed process, using the Coulomb dissociation method.

Experiment and preliminary results

The experiment was performed with the secondary ^{17}Ne ion beam of energy $E = 500$ MeV/nucleon, using the R^{3}B-LAND setup at GSI. To investigate the Coulomb dissociation reaction a Pb target (200 mg/cm^2) was used. All reaction products have been identified and tracked. Their mass and momenta have been determined, and the excitation energy spectrum reconstructed. The required efficiency and acceptance corrections have been estimated. The preliminary differential (Fig. 1) and integral Coulomb dissociation cross sections have been obtained - $\sigma_{tot} = 256 \pm 15\,(stat.) \pm 18\,(syst.)$ mb. The shape of the differential Coulomb dissociation cross section is in agreement with experimental results from Ref. [10] and with the theoretical predictions from Ref. [11]. In the next steps, the photoabsorption and the radiative capture cross sections will be calculated.

By analyzing different types of energy and angular correlations between internal clusters ($[core, p+p]$ or $[core+p, p]$) in Jacobi coordinates, the mixture of the d^2 and s^2 configurations can be obtained [12]. The experimental data is compared to theoretical predictions, provided by Ref. [13], convoluted with simulated experimental response, using the simulation package R3BROOT. The analysis is in progress.

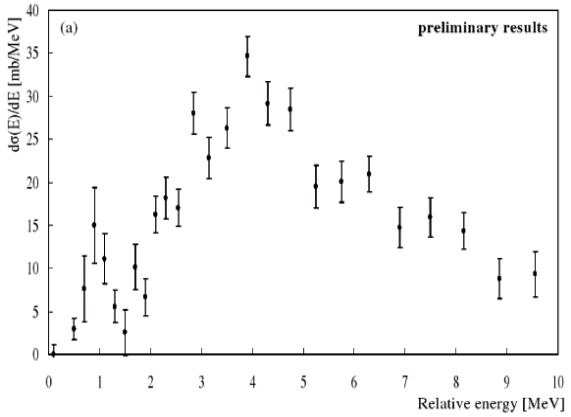

Figure 1: The preliminary differential Coulomb dissociation cross section.

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