Coulomb Breakup as a Spectroscopic Tool for Neutron-Rich Nuclei

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One-neutron-removal reactions have been proven to be very useful in studying the single-particle structure of unstable exotic nuclei [1, 2, 3]. The Coulomb breakup process is an complementary tool to study the ground-state structure of very rare nuclei [4]. In the present work, the electromagnetic breakup of ^{11}Be and odd-mass oxygen isotopes (A=17-23) has been investigated with secondary beams of corresponding projectiles at energies around 500 MeV/nucleon impinging on lead target.

The secondary beams were produced by fragmentation of a primary ^{40}Ar beam delivered by the synchrotron SIS at GSI, and were separated by the fragment separator FRS. Both the incident projectiles and their fragments emerging from the target were uniquely identified and their momenta were measured. Coincident neutrons and γ-rays were detected by the LAND and the 4π- Crystal Ball spectrometer, respectively. The relative energy spectrum of the fragment and the emitted neutron was reconstructed from the measured momenta. These spectra were further differentiated according to the ground state or the excited states of the fragment by observing the γ-rays in the Crystal Ball. By comparing the measured differential cross sections in case of electromagnetic excitation with cross sections calculated on the basis of the direct-breakup model [4], ground-state single-particle configurations and respective spectroscopic amplitudes were deduced for ^{11}Be and ^{17,19,21,23}O. The comparison of the results with those from other methods such as knockout and transfer reactions or electron scattering as far as available , proves that Coulomb breakup allows for a quantitative assessment.

References

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