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Probing exotic nuclei with Coulomb breakup

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Coulomb breakup of nuclei away from the valley of stability have been one of the most successful probes to unravel their structure. However, it is only recently that one is venturing into medium mass nuclei like 23O [1] and 31Ne. This is a very new and exciting development which has expanded the field of light exotic nuclei to the deformed medium mass region.

In this contribution we report a very recent extension of theory of Coulomb breakup within the post-form finite range distorted wave Born approximation to include deformation of the projectile [2]. The electromagnetic interaction between the fragments and the target nucleus is included to all orders and the breakup contributions from the entire non-resonant continuum corresponding to all the multipoles and the relative orbital angular momenta between the fragments are taken into account. Only the full ground state wave function of the projectile, of any orbital angular momentum configuration, enters in this theory as input, thereby making it free from the uncertainties associated with the multipole strength distributions that may exist in many of the other theories.

We shall identify reaction observables, which are 'prone' to deformation effects of the projectile by studying the breakup of 31Ne on Pb and Au at 234 MeV/u, and compare our results with the available data. New results on the breakup of 37Mg - a possible halo candidate- will also be presented.

Finally we shall outline our efforts in the construction of a breakup theory, under the post-form reaction theory formalism, where one includes the continuum to all orders. We shall also consider including relativistic effects, which are bound to appear for incident beam energies ranging from 200-1000 MeV/u - a range very relevant for GSI, RIKEN and other facilities.

References
[1] R. Chatterjee, R. Shyam, K. Tsushima, A. W. Thomas, Nucl. Phys. A (vol. 913), 116 (2013).
[2] Shubhchintak and R. Chatterjee, Nucl. Phys. A (vol 922), 99 (2014).

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