Electron scattering off exotic nuclei

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In recent years, experimental and theoretical investigations of photonuclear reactions involving light, exotic, nuclei have been focused on the nuclear electric dipole (E1) response. The investigations have been stimulated by results of of nuclear resonance fluorescence and Coulomb dissociation experiments which yielded a significant concentration of E1 strength at the particle threshold in stable and non-stable nuclei (for a recent overview we refer to [1] and references therein). Besides the implications for the r-process nucleosynthesis, where the low-lying strength could significantly increase the neutron capture cross-section [2], there are clear indications that the strength is correlated to the neutron-excess [3] and especially prominent in exotic neutron-rich nuclei. Up to now, however, the isospin character and the structure of the dipole excitations are far from being settled and the correlation between the differences in the radial neutron-proton density distribution (neutron skin) and the low-lying E1 strength distribution are still speculative.

Break-up reactions induced by electron scattering on halo nuclei can reach the order of ten millibarns for 10 MeV electrons and increase logarithmically at higher energies [4]. This means, that information about the continuum structure of weakly-bound nuclei (e.g. scattering lengths and effective ranges) are easily accessible in the electron-ion collider mode.

These studies at of utmost relevance for the ELectron-Ion Scattering in a storage ring (eA collider) ELISe experiment which will be part of the installations envisaged at the NESR for FAIR at the GSI facility/Germany. It will offer worldwide unique opportunities to scatter electrons off exotic nuclei [5].

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References

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