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Interplay of Nuclear Structure and Nuclear Reactions for exotic nuclei

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The study of the structure of normal, well bound nuclei, can be carried out by populating discrete excited states in a reaction, and studying their gamma decay. Here, the nuclear reaction is just a mechanism to populate excited states, whose properties such as energy and decay probabilities are independent of the reaction that produced it. Exotic nuclei, weakly bound, have few (if any) discrete excited states. The role of excited states is played by structures in the continuum (resonances and virtual states), which decay in fragments in a short time scale, comparable to the collision time. The properties of these continuum structures, such as the energy and angular distribution of the fragments, depend strongly on the nuclear interactions and the reaction mechanisms present in the nuclear reaction.
A key aspect of these nuclear reactions is the collision time. The properties of the exotic nucleus, inferred from its production of break-up in a nuclear reaction, will depend on whether the collision is fast or slow compared to the internal time. This dependence can be explored experimentally by reactions involving short time scales (relativistic beams, with short range interactions), and long time scales (few MeV per nucleon beams, in Coulomb dominated regimes). Both experiments are complementary. In this presentation, recent experimental measurements with their corresponding theoretical analysis will be presented. On one side, coulomb break-up of 11Li and 11Be on heavy targets at low energies will be analyzed, to extract the B(E1) distributions. On the other side, (p,pN) reactions at high energies will be discussed to obtain spectroscopic factors.

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