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Impact of core excitations in break-up reactions with halo nuclei

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Halo nuclei have been a prolific field of Nuclear Physics since its discovery together with the dawn of radioactive beam facilities. The halo is formed by one or two weakly bound nucleons orbiting around the rest of nucleons that conforms a compact core. Following this picture, halo nuclei are often treated within two- or three-body valence-core models, considering an inert core. However, the development of radioactive beam facilities are discovering new halo nuclei in regions further and further away from the stability valley. Halo nuclei formed in these regions exhibit more complex cores which will be easily excited during a nuclear reaction.

Due to this fact, a great effort has been made to incorporate the effect of core excitations in few-body reaction formalisms, such as a non-recoil extension of the Distorted Waves Born Approximation (NR-DWBA) [1], the Extended Continuum-Discretized Coupled-Channels (XCDCC) [2], and the extension of the Faddeev/AGS equations [3]. Alongside these developments, there has been a revival of models capable to include such excitations in a simple way to allow its inclusion in reaction calculations. That is the case of particle-rotor, particle-vibrator and Nilsson models. However, sometimes there is very little information to fix the corresponding parameters of these models or the structure of the core does not fit into a rotor or a vibrator. To overcome this drawback, we will show how to construct a semi-microscopic folding potential based on core transition densities [4]. This model was tested on 11Be nucleus showing a notable predictive power, which we applied to 19C.

In this contribution we will show how core excitations can contribute and even dominate resonant break-up of halo nuclei like 19C by analyzing 19C(p,p') experimental data from Y. Satou et al. [5,6]. We will also use XCDCC to study Coulomb break-up of 11Be in order to extract information about its Dipole Electric Transition Probability, B(E1). In this case, two different sets of 11Be on 208Pb data [7,8] led to apparently incompatible B(E1) distributions. We will discuss a recently proposed procedure to extract the B(E1) with the help of a modified version of XCDCC which has been able to obtain compatible B(E1) from both data, giving an end to this long-standing discrepancy [9]

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