New developments for knockout reactions at intermediate energies

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ABSTRACT

Direct nuclear reactions, collisions during which very few nuclear degrees of freedom are modified, are commonly used to populate single-particle states and access information on nucleonic shell occupancies through the extraction of spectroscopic factors Sf , defined as the overlap between populated final states and the initial state of the wave function. "Experimental" spectroscopic factors are obtained from the comparison of experiment cross sections to theoretical predictions. Among all direct reactions, "nucleon knockout" in inverse kinematics at intermediate energy has been shown in the last decade to be a very powerful tool to unravel shell effects in exotic nuclei. We will discuss the recent observation of a large discrepancy between experimental cross sections for the removal of deeply-bound nucleons and the corresponding theoretical predictions. Such discrepancy is unexplained. After an overview of the possible origins of this effect, we will detail recent developments on reaction mechanisms that include beyond-the-Glauber-approximation processes. New experimental results for the stripping of deeply-bound nucleons at both the National Superconducting Cyclotron Laboratory (MSU, USA) and the Grand Accélérateur National d'Ions Lourds (France) will be presented. Finally, we will detail a new project, based on the use of nucleon-removal reactions, to investigate the most exotic species, at incident rates lower than one particle per second, at GSI.