Project in nuclear-reaction theory: "Extension of the eikonal description of reactions involving exotic nuclei"

The development of radioactive-ion beams in the mid 80s has enabled nuclear physicists to study the nuclear structure far from stability. This technical breakthrough has led to the discovery of new and unexpected properties of nuclei. Since these exotic nuclei are very short lived, they are mostly studied through nuclear reactions. To infer reliable structure information from experimental cross sections, a good understanding of the reaction mechanism is needed. In this project, we propose to develop such accurate reaction models, and in particular to extend the so-called eikonal approximation. This description of the reaction process is very efficient at high energy. However, it includes some simplifying approximation, which makes it unreliable in some cases. The goal of this research project is to explore a few options to improve the reliability of the eikonal approximation. For example, include the Coulomb distortion of the incoming wave to account for that long-range effect. This would extend the domain of validity of the model to low beam energies. Another option is to extend the existing dynamical code to couple the quasi-elastic channel to the stripping channel. This would provide a more reliable model of knockout reactions, which offer the best tool to study the single-particle structure of exotic nuclei far from stability. A third possibility is to use Bayesian approaches to better constrain nuclear-structure observables from reaction cross sections.

Prerequisites are a good knowledge of non-relativistic quantum mechanics and basic notions of nuclear physics. Knowledge of quantum collision theory is a plus.