TALENT Course 6: Theory for exploring nuclear reaction experiments

Outline project proposal

Project name: Neutron Knockout from Cadmium-106
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Project outline and aims:
This project will focus on the analysis of experimental data from a knockout experiment wherein 105Ag, 106Cd, 107In, and 108Sn secondary beams were incident on 9Be target. More specifically, this study will utilize data from the 106Cd beam. Reaction cross sections for 1, 2, and 3 neutron knockout from 106Cd will be determined from data. The single neutron knockout cross section will be compared to theoretical calculations. The angular momentum carried away from the resultant nucleus by the removed neutron will also be calculated and compared with theory.

Methodology:
The 1, 2, and 3 neutron knockout cross sections will be calculated directly from experimental data. The single neutron knockout case will be compared with a theoretical value calculated using the Eikonal model. Knockout reactions probe, mainly, the removal of the most weakly bound nucleons. So, using this simple assumption, we would expect the removed neutron to be from the $1g_{9/2}$ neutron shell ($l = 4$). The residual nucleus (105Cd) has a "memory" of the angular momentum carried away by this neutron. By looking at the momentum distribution of the residual core, we are able to calculate the angular momentum state of the removed neutron.

Key references:

1. A. Gade et al. *Knockout from ^{46}Ar: l=3 neutron removal and deviations from eikonal theory*. Phys. Rev. C **71**, 050301(R) (2005).

2. J. A. Tostevin. *Single-nucleon knockout reactions at fragmentation beam energies*, Nucl. Phys. **A682** (2001) 320c-331c.