TALENT Course 6: Theory for exploring nuclear reaction experiments
Outline project proposal

Project name: Manifestation of halo size in high energy proton scattering and reactions

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Project outline and aims:
In nuclei which have a strong core-valence structure the mean-field single particle density is expected to be inadequate for certain reactions. We will discuss a simple model to describe the core-valence structure. The results of the single particle density versus the cluster model will be compared to each other and to experimental data where available.

Methodology:
The Glauber theory (in optical limit) will be used to describe high energy proton elastic scattering with a nucleus which is presumed to resemble a core-valence structure. A simple binary cluster model is developed to describe the core-valence structure. In this model the core-valence radii are varied in such a way that they yield the same single particle density. The effect on physical observables for different choices of radii are discussed. If appropriate experimental data is found we can try to fit the predictions of the model to the data as a function of the radii of the core and valence clusters. One would expect that the optimal radii will correspond to physically sensible radii for the core and valence clusters for systems of interest.

Key references:
1. J. A. Tostevin, R. C. Johnson, and J.S. Al-Khalili, Manifestation of halo size in scattering and reactions, Nuclear physics A630 (1998) 340c-351c.