TALENT Course 6: Theory for exploring nuclear reaction experiments

Outline project proposal

Project name: Accuracy and efficiency of CDCC and Eikonal methods in elastic scattering of two body composite projectiles
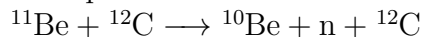
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Project outline and aims:
The project will compute the elastic differential cross section of the $^{11}\text{Be} + {}^{12}\text{C}$ reaction including the effects of the breakup channel:
$$^{11}\text{Be} + {}^{12}\text{C} \longrightarrow {}^{10}\text{Be} + \text{n} + {}^{12}\text{C}$$
in the energy range $(20-100)$ MeV/nucleon using CDCC and Eikonal methods. The aim is to compare the results of the two methods and with the experimental measurements, where available, looking at their accuracy and efficiency in terms of computational resources.

Methodology:
The full coupled channels equations will be solved using CDCC in order to obtain the elastic cross section. The cross section will also be computed based on Eikonal dynamics, using adiabatic approximation. An optical potential model will be used to describe the nuclear force. Coulomb and spin-orbit interactions will be neglected to reduce the number of channels.

Key references:

[1] J. S. Al-Khalili, J. A. Tostevin, and J. M. Brooke, Phys. Rev. C **55**, R1018 (1997).

[2] T. Aumann, A. Navin, D. P. Balamuth, D. Bazin, B. Blank, B. A. Brown, J. E. Bush, J. A. Caggiano, B. Davids, T. Glasmacher, et al., Phys. Rev. Lett. **84**, 35 (2000).