The \(^{7}\text{Li}^{7}\text{Be}\) charge-exchange reaction in inverse kinematics with rare isotope beams.

Remco Zegers

NSCL/MSU

Nuclear charge-exchange reactions at intermediate energies have long been recognized as an important tool to investigate the spin-isospin response of nuclei. In particular Gamow-Teller (GT) transitions have been the subject of intensive studies. Since GT transition strengths \(B(\text{GT})\) are proportional to the CE cross section at vanishing linear momentum transfer \(q=0\), weak transition strengths can be extracted for excitation energies inaccessible to \(\beta\)-decay. Nuclear structure theory can thus be tested up to high excitation energies in a model-independent manner, which has several important applications, for example in the realm of astrophysics.

Because of these properties and applications, the prospect of using such data to better understand the nuclear structure away from the valley of stability is very attractive. However, the development of CE experiments at intermediate energies in inverse kinematics (i.e. in which the beam containing the rare isotopes of interest is impinged on a target foil holding the probe nuclei) has proven to be a challenge. In this presentation, the first successful extraction of GT strengths through an \((n,p)\)-type CE experiment in inverse kinematics involving a rare isotope beam will be discussed. The probe used was the \((^{7}\text{Li},^{7}\text{Be}+\gamma)\) reaction at 100A MeV and transitions from unstable \(^{34}\text{P}\) to \(^{34}\text{Si}\) were investigated. The extracted Gamow-Teller strength distribution can be used to test theoretical models that are applied to describe the evolution towards the island of inversion.

This work was supported by the US NSF (PHY-0822648 (JINA), PHY-0606007, and PHY-0758099).