Contribution ID: **49** Type: **Oral**

Ab initio investigation of the 12C(n,p)12B charge-exchange reaction

Monday, 8 July 2024 17:30 (15 minutes)

Neutron-induced charged-particle reactions are ubiquitous in nature and their understanding is needed for a variety of applications, ranging from fundamental Nuclear Physics to energy production and medical applications. Motivated by recent measurements at CERN n-TOF facility, we have performed calculations of the charge-exchange 12C(n,p)12B reaction within the ab initio no-core shell model with continuum (NCSMC).

The NCSMC method [1,2] can describe both bound and unbound states in light nuclei in a unified way. With chiral two- and three-nucleon interactions as the only input, we can predict structure and dynamics of light nuclei and, by comparing to available experimental data, test the quality of chiral nuclear forces.

After correcting the ab initio NCSMC calculations for experimental thresholds and energies of known resonances, we obtain a quite satisfactory description of the neutron-12C total, elastic and inelastic cross sections and predict the 12C(n,p)12B cross section where limited data are available. We calculate integrated and differential cross sections for the ground state and excited states of 12B, and for neutron energies up to 20 MeV, where high level densities in the compound 13C nucleus are reached. Our calculations demonstrate NCSMC capability in a regime where statistical compound nuclear reaction methods are typically applied.

Supported by the NSERC Grant No. SAPIN-2022-00019 and by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under Work Proposals No. SCW1158 and No. SCW0498. TRIUMF receives federal funding via a contribution agreement with the National Research Council of Canada. This work was prepared in part by LLNL under Contract No. DE-AC52-07NA27344. Computing support came from an INCITE Award on the Summit supercomputer of the Oak Ridge Leadership Computing Facility (OLCF) at ORNL and from the Digital Research Alliance of Canada

[1] S. Baroni, P. Navratil, and S. Quaglioni, Phys. Rev. Lett. 110, 022505 (2013); Phys. Rev. C 87, 034326 (2013).
[2] P. Navratil, S. Quaglioni, G. Hupin, C. Romero-Redondo, A. Calci, Physica Scripta 91, 053002 (2016).

Primary authors: NAVRATIL, Petr (TRIUMF); Prof. VORABBI, Matteo (University of Surrey); Dr QUAGLIONI, Sofia (LLNL); Dr HUPIN, Guillaume (Université Paris-Saclay)

Presenter: NAVRATIL, Petr (TRIUMF)

Session Classification: Facilities I

Track Classification: Nuclear Reaction Mechanisms (direct, compound, preequilibrium)