Researchers obtain new results on knockout reactions at HIRFL-CSR

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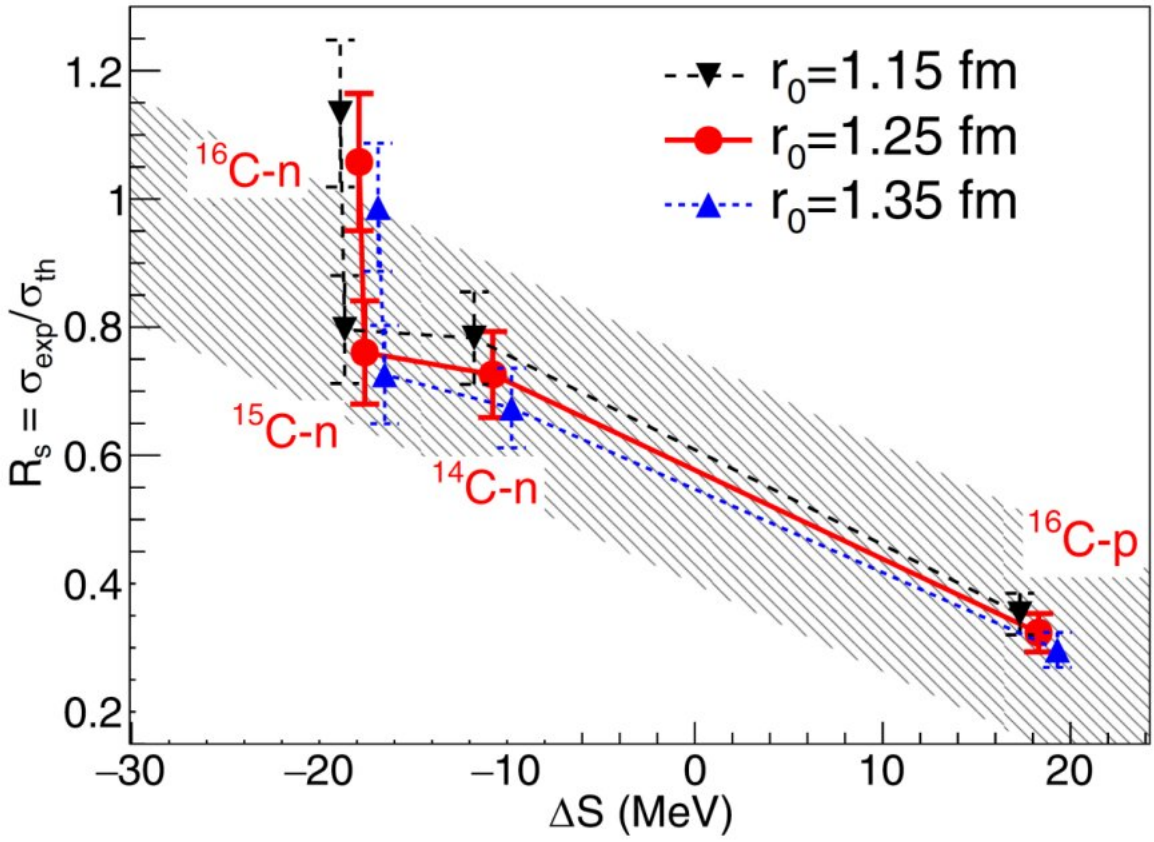

Isospin asymmetry dependence of the ratio of experimental to theoretical single-nucleon knockout cross sections. The hatched area denotes the systematics from experiments of intermediate energy (Physical Review C

Researchers from the Institute of Modern Physics (IMP) of the Chinese Academy of Sciences (CAS) and their collaborators have systematically measured the knockout cross sections of neutron-rich carbon isotopes at the intermediate- to high-energy region by using the External Target Facility (ETF) of the Cooler Storage Ring (CSR) at the Heavy Ion Research Facility in Lanzhou (HIRFL).

Knockout reactions induced by light nuclear targets have been demonstrated to be a powerful tool for probing the single-particle structure of rare isotopes away from the stability line. Spectroscopic factors for unstable isotopes have been studied by using knockout reactions at intermediate energies below 100 MeV/u. It is found that the measured spectroscopic factors for strongly-bound nucleon knockout are far less than thosecalculated by the reaction model.

The high energy of the beam is crucial for the applicability of the reaction model that uses the sudden and eikonal approximations. Therefore, it would be of important value to study these reactions at higher beam energies.

The radioactive ion beam line RIBLL2 at HIRFL-CSR is one of the few facilities around the world that can provide radioactive ion beams at intermediate- to high-energy (200-1000 MeV/u). In this work, neutron-rich 14-16C beams near ~240 MeV/u were produced by RIBLL2.

The researchers studied knockout reactions induced by these neutron-rich isotopes with the large-acceptance magnetic spectrometer ETF. The beam-energy dependence of the reduction on the extracted spectroscopic strength was also studied.

The one-nucleon knockout results indicate that the extracted spectroscopic factors do not have evident dependence on beam energy and imply that the deduced spectroscopic factors are robust to changes in

beam energy at the intermediate energy region. This adds further confidence to the application of the eikonal model in knockout reactions at beam energies of near or above 100 MeV/u.

The result was published in *Physical Review C*.

More information: Y. Z. Sun et al, Single-neutron removal from C14,15,16 near 240 MeV/nucleon, *Physical Review C* (2021). DOI: 10.1103/PhysRevC.104.014310

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