



量子物理学・ナノサイエンス第 160 回セミナー

Recent applications and formal developments of heavy-ion and light-ion-induced transfer reactions for nuclear spectroscopy

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概要

Nuclear reactions where a single nucleon is transferred onto a nuclear species are used regularly to help understand and quantify which nucleon single-particle states are active near the *Fermi-surface* of the nucleus. Depending on the mass and energy of the projectile beam, what can be measured in the reaction and the reaction's sensitivity to the quantum numbers of the orbitals of the transferred particle is different. When the aim is to perform spectroscopy on exotic nuclei, single-nucleon pick-up reactions in inverse kinematics on a light target nucleus (such as carbon), combined with modern gamma-ray tracking detectors, can be used to select and characterise (intruder) states with large angular momentum [1] and, used in combination with single-nucleon removal reactions, to examine more fully the spectrum of final states [2].

In nuclear astrophysics, single-neutron transfer reactions such as (d,p) reactions are typically used with the aim of determining absolute cross sections (and spectroscopic factors) [3]. Here, new work will be outlined that investigates the (d,p) reaction combining (a) deuteron breakup, (b) realistic deuteron wave functions (with both S and D-state components), and (c) non-local nucleon optical-model potentials [4]. With these ingredients, the transfer reaction cross section can show significant sensitivity to the nucleon-nucleon interaction model used, through their high-momentum. Early results relevant for the astrophysically interesting $^{26}\text{Al}_{\text{gs}}(\text{d,p})^{27}\text{Al}$ system [3] will be discussed.

[1] A. Gade *et al.* Phys. Rev. C **93**, 031601(R) (2016)

[2] A. Gade *et al.* Phys. Rev. C **93**, 054315 (2016)

[3] V. Margerin, *et al.* Phys. Rev. Lett. **115**, 062701 (2015)

[4] G.W. Bailey, N.K. Timofeyuk, J.A. Tostevin, Phys. Rev. Lett., Submitted

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