

Quenching factor of spectroscopic factors extracted from single-nucleon transfer reactions

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The spectroscopic factors are generally quenched relative to the occupancy numbers predicted by the independent particle model (IPM), which is quantified by the reduction/quenching factor R_s [1,2] and is associated with nucleon-nucleon correlations [3,4]. R_s extracted from knock-out reactions were found to be strongly dependent on the isospin asymmetry ($\Delta S = S_n - S_p / S_p - S_n$ for neutron/proton removing reaction) [5,6]. R_s deduced from the transfer reactions induced by stable nuclei were found to be independent on ΔS [7], while it's controversial from the unstable nuclei with large ΔS . For example, R_s from (d,3He) of neutron-rich Li isotopes decreases significantly as the number of neutrons increases [8], while that from Ar and O isotopes was found weak dependencies [9,10].

In order to more clearly study the dependence between R_s and ΔS of unstable nuclei, a combined experiment with radioactive beams of ^{15}C and ^{16}N was performed at Radioactive Beam Line in Lanzhou (RIBLL) in 2022 [12,13]. The differential cross sections in the mass center system for the single-nucleon transfer reactions of $^{15}\text{C}(p, d)^{14}\text{C}$, $^{15}\text{C}(d, ^3\text{He})^{14}\text{B}$ and $^{16}\text{N}(p, d)^{15}\text{N}$ were obtained. By comparing the experimental angular distributions to the DWBA theoretical calculations, the spectroscopic factors and the corresponding R_s with $\Delta S = -19.12, 8.99$ and 19.86 MeV were extracted. Weak dependencies were found from these single-nucleon transfer reactions induced by weakly bound nuclei, which were performed in one experiment using the same target in order to reduce the systematic errors as much as possible.

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Section

Experimental and theoretical studies of nuclear reactions

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