Contribution ID: **303** Type: **Oral**

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

Tuesday 2 July 2024 10:45 (20 minutes)

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 Rs[1,2] and is associated with nucleon-nucleon correlations [3,4]. Rs extracted from knock-out reactions were found to be strongly dependent on the isospin asymmetry (ΔS = Sn- Sp / Sp- Sn for neutron/proton removing reaction) [5,6]. Rs 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, Rs 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 Rs and ΔS of unstable nuclei, a combined experiment with radioactive beams of 15C and 16N 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 15C(p, d)14C, 15C(d, 3He)14B and 16N(p, d) 15N were obtained . By comparing the experimental angular distributions to the DWBA theoretical calculations, the spectroscopic factors and the corresponding Rs with ΔS = -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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Session Classification: Experimental and theoretical studies of nuclear reactions