Colloquium

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Survey of Neutron Spectroscopic Factors & Asymmetry Dependence of Neutron Correlations in Transfer Reactions

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Spectroscopic factors (SF) are fundamental quantities in nuclear physics. They have been extensively used in understanding the single particle properties of nuclear structures and astrophysical network calculations. Knockout reactions suggest that the deficient nucleon species have stronger reduction in measured spectroscopic factors compared to the predictions of shell models than the weakly bound excess species. While the choice of optical-model potentials and geometries of the bound neutron wave function may result in different absolute measured spectroscopic factors, the comprehensive data obtained from transfer reactions do not yield evidence of systematic suppressions of SF with neutron binding energy. To reconcile such different observation in knockout and transfer reactions, (p,d) neutron transfer reactions have been studied using proton rich ^{34}Ar and neutron rich ^{46}Ar beams in inverse kinematics at NSCL with the high resolution silicon array HiRA and the S800 spectrometer. The experimental results show no extra reduction of the ground-state neutron spectroscopic factor of ^{34}Ar compared to that of ^{46}Ar. The results suggest that neutron correlations, which generally reduce such spectroscopic factors, do not depend strongly on the asymmetry of the nucleus. The present results are consistent with results from systematic studies of transfer reactions and from global analyses of $^{40\text{-}49}$Ca scattering data via the dispersive optical model, but inconsistent with the systematic trends of knockout reaction measurements.