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New perspectives on spectroscopic factor quenching from reactions

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Systematic studies of nuclei along isotopic chains have revealed unexpected trends that challenge our understanding of nuclear structure. For two decades, nuclear physicists have grappled with the asymmetry dependence of the ratio R between the spectroscopic factors extracted experiments and that predicted by the nuclear shell model. Surprisingly, the strong asymmetry dependence of these strengths and their extreme values for highly asymmetric nuclei inferred from knockout reaction measurements on a target nucleus are not consistent with what is extracted from electron-induced, transfer, and quasi-free reaction data [1]. In this talk, I will present the first consistent analysis of one-nucleon transfer and one-nucleon knockout data, in which theoretical uncertainties associated with the nucleon-nucleus effective interactions considered in the reaction models are quantified using a Bayesian analysis [2]. Our results demonstrate that, taking into account these uncertainties, (i) transfer and knockout reactions lead to a consistent picture for the removal of a loosely-bound nucleon and (ii) there is still some tension between the strengths extracted from transfer and knockout data on deeply-bound nuclei. The uncertainties obtained in this work represent a lower bound and are already significantly larger than the original estimates.

[1] Aumann et al. Prog. Part. Nucl. Phys. 118, 103847 (2021)
[2] Hebborn, Nunes, and Lovell, Phys. Rev. Lett. 131, 212503 (2023).

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Collaboration

Primary authors: HEBBORN, Chloe (Facility for Rare Isotope Beams, Michigan State University); Prof. NUNES, Filomena (Facility for Rare Isotope Beams, Michigan State University); Dr LOVELL, Amy (Los Alamos National Laboratory)

Presenter: HEBBORN, Chloe (Facility for Rare Isotope Beams, Michigan State University)

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