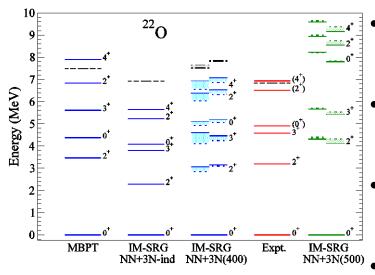# A new ab-initio framework for the nuclear shell model using the In-Medium Similarity Renormalization Group (IM-SRG)

Objectives

- Use the IM-SRG to construct valence shell model Hamiltonians from first principles
- Quantify theoretical uncertainties and benchmark against many-body perturbation theory (MBPT)
- Study chiral 2N and 3N interaction effects in spectroscopy of medium-mass nuclei

Impact

- Ab initio analysis and prediction of spectroscopic properties for isotopic and isotonic chains
- Consistent framework for effective operators (Gamow-Teller quenching, effective charges, and $0\nu\beta\beta$ matrix element)
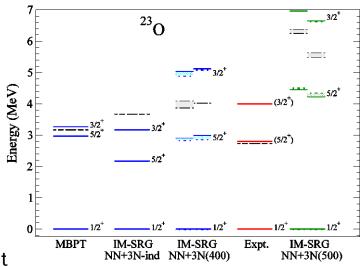- Ab initio structure input for reaction theory and nuclear astrophysics

Accomplishments

- Oxygen chain spectra from chiral 2N and 3N interactions
- Comparable level of accuracy as empirical interactions
- 3N forces essential for agreement with experiment
- Significant improvement over MBPT