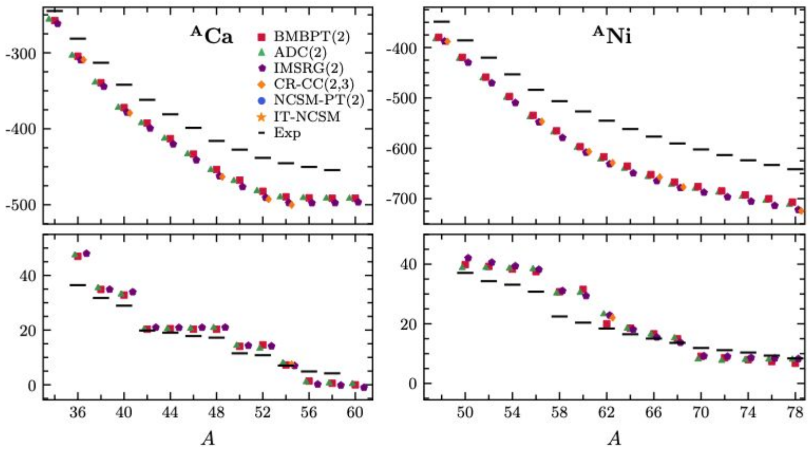
Topic 1: Ab-initio many body framework

Status and achievements

- significant increase in scope of ab initio many-body frameworks

- remarkable agreement between different ab initio many-body methods for the structure of nuclei



PLB 786, 195 (2018)

Key goals and Developments needed

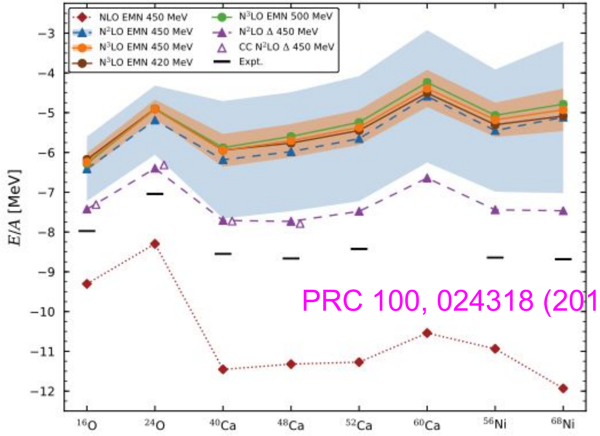
- unified ab-initio calculations of atomic nuclei and reactions based on modern interactions
  - ➔ We need novel computational developments in order to do so (some development NCSM with the continuum, integral relations in QMC, HH,..)
  - ➔ Reactions with light nuclei are important laboratories to study 3NF
- push ab-initio methods of light-nuclei for systems heavier than current capabilities
  - ➔ Use and explore current and novel computational capabilities (GPUs, AI/ML,..)
  - ➔ Relevant to address the role of the many-body forces and correlations
- electroweak observables q different than zero
  - ➔ Extension to nuclei relevant to the accelerator-neutrino program (ex. ^{16}O and ^{40}Ar)
  - ➔ Inclusion relativistic effects, pion-production amplitudes, and the DIS mechanism
  - ➔ Keep developing approaches based on the factorization of the final state (ex. Spectral-function formalism, Short-time approximation,..)
- consistent benchmarks calculations between different ab initio many-body methods for infinite matter and processes involving reactions and coupling to the continuum

Topic 2: Nuclear Interactions and Effective Field Theory

Status and achievements

- tremendous efforts to develop improved NN and 3N interactions based on chiral EFT

- discrepancies to experiment most dominated dominated by deficiencies of present nuclear interactions



PRC 100, 024318 (2019)

- no Hamiltonian exists that describe nuclei and infinite-matter properties at the same time

Key goals and Developments needed

- how can we improve chiral nuclear models?
  - ➔ Improve parametrization of the 3NF
  - ➔ Keep exploring new strategies to constraint the LECs using statistical methods (specifically in the 3N sector and currents)
  - ➔ Identify a set of observables that capture many important features of nuclear forces and are within the control of many-body techniques
  - ➔ Connecting with LQCD
  - ➔ Explore different PCs in many-body calculations
    - ★ Simpler theories like pionless in combination with Bayesian tools may help on this regard
  - ➔ Address the role of delta d.o.f in calculations of observables
  - ➔ Address the role of 4N and higher forces in future calculations

- a deeper and more quantitative understanding of the connection between properties of matter and finite nuclei
  - ➔ Develop effective field theory Hamiltonian capable to describe nuclei and infinite-matter properties
    - ★ Comparison against PREX/CREX data
    - ★ Astrophysical observations (LIGO/Virgo & NICER)