

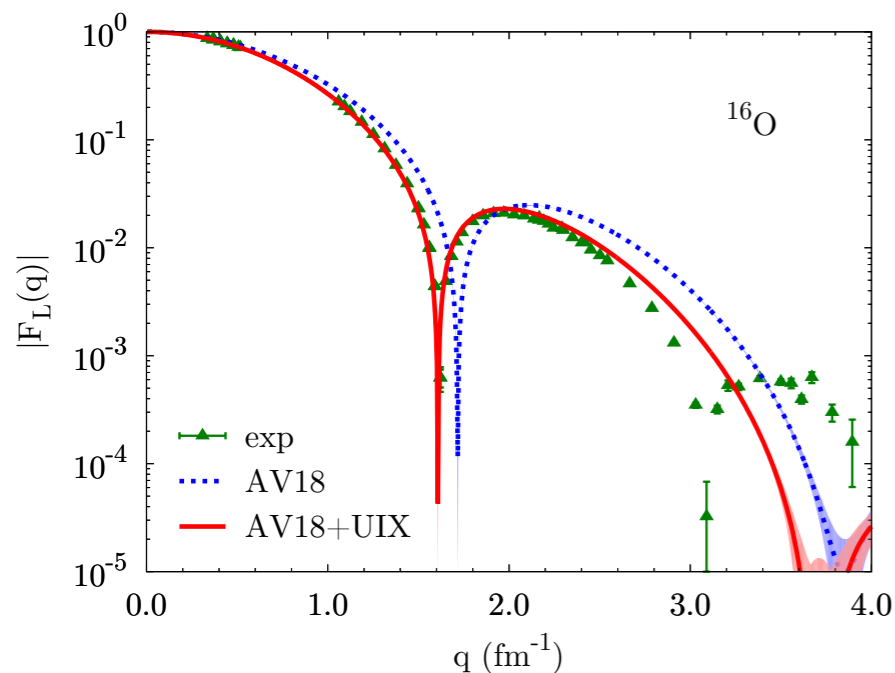
Variational calculation of closed-shell nuclei up to $A = 40$

Objectives

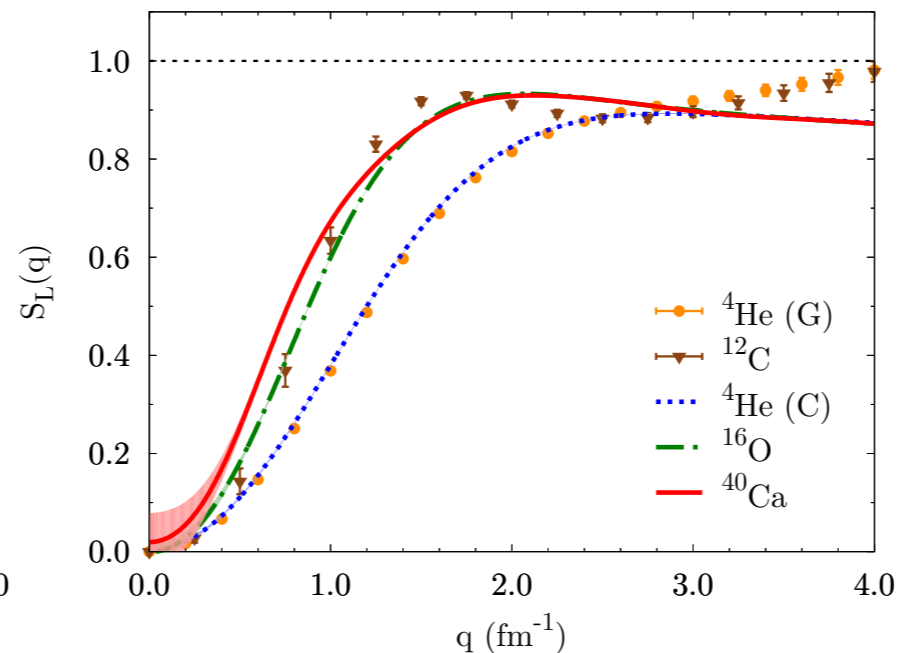
- Compute ground state properties of closed-shell nuclei up to $A = 40$ with quantum Monte Carlo.
- Analyze the behavior of phenomenological Hamiltonians in medium-heavy nuclei.
- Study the high-momentum components of the nuclear wave function and potential in-medium modifications of the nucleon form factors.

Impact

- Observe a change in the behavior of the UIX 3-body force — from attractive to repulsive — already in relatively small nuclear systems, such as ^{16}O .
- Confirm the universality of the tail of the momentum distribution for a given class of Hamiltonians.
- Show very little A dependence of the Coulomb sum rule for $A \geq 12$: no evidence of in-medium modification of the nucleon form factor.



Longitudinal elastic form factor in ^{16}O for different phenomenological Hamiltonians. The UIX 3-body force combined with the AV18 potential provides a good description of the structure of the nucleus.



Coulomb sum rules for $A \leq 40$. Symbols with error bars show GFMC calculations employing the AV18+IL7 potential. The curves show CVMC results for AV18+UIX.

Accomplishments

- Development of a cluster variational Monte Carlo approach (CVMC) to study the properties of medium-heavy nuclei employing realistic nuclear interactions.
- Analysis of binding energies, charge radii, one- and two-body densities, one-body momentum distributions, charge form factors, and Coulomb sum rules for $A = 4, 16, 40$.

