Nucleon momentum distributions for local chiral interactions

Objectives

- We use quantum Monte Carlo methods to calculate single- and two-nucleon momentum distributions in $^4$He, $^{12}$C, and $^{16}$O.
- We use correlated many-body wave functions optimized for local chiral interactions up to next-to-next-to-leading order (N$^2$LO).

Impact

- A collection of momentum distributions for p-shell nuclei has been produced for local chiral interactions at N$^2$LO. This largely extends the momentum distribution database, previously available for phenomenological potentials only, and it provides the possibility of examining the scheme and scale dependence of various properties of interest.
- The description of the momentum distributions at low and moderate momenta is similar to that provided by phenomenological potentials, while higher momentum components are typically reduced, consistent with the lower-energy regime of chiral interactions.
- The results for back-to-back pairs confirm the large pn to pp pairs ratio in the regime $q \approx 1.5 - 2.5$ fm$^{-1}$ up to $^{16}$O, which appears to be nearly independent of the employed interaction scheme.
- The pp to pn ratio for local chiral interactions at N$^2$LO is compatible with available experimental data extracted from electron scattering experiments in the range $q \approx 2.5 - 4.0$ fm$^{-1}$ up to $A = 16$.

Accomplishments