A variational Monte Carlo approach for the study of medium-mass nuclei\textsuperscript{1} DIEGO LONARDONI, STEVEN C. PIEPER, ROBERT B. WIRINGA, ALESSANDRO LOVATO, Argonne Natl Lab — We report on an accurate variational many-body technique (cluster variational Monte Carlo) suitable for the study of medium-mass nuclei. The employed many-body nuclear Hamiltonian contains realistic two- and three-nucleon interactions and the trial wave function is constructed from pair- and triplet-correlation operators acting on a product of single-particle determinants. As opposed to traditional variational Monte Carlo calculations, that are limited to $A = 12$ nuclei, expectation values are evaluated with a cluster expansion for the non-central correlations. The cluster expansion drastically reduces the computational effort necessary for the study of an $A$-body system, allowing us to extend the calculations in the medium-mass region, currently up to 40 nucleons. We present results for the closed-shell nuclei $^{16}\text{O}$ and $^{40}\text{Ca}$ and prospects for open-shell nuclei like $^{40}\text{Ar}$. Of particular interest is the derivation of the momentum distributions that can be used to constrain the spectral functions of these nuclei. This has a crucial interplay with electron-nucleon and neutrino-nucleon scattering experiments, where Argon is among the typical targets and the scattering data at high momentum transfer can be analyzed by means of the spectral function formalism.\textsuperscript{1}

\textsuperscript{1}This work is supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under the NUCLEI SciDAC grant and Contract No. DE-AC02-06CH11357.

Diego Lonardoni  
Argonne Natl Lab  

Date submitted: 18 Jun 2015  
Electronic form version 1.4