Abstract Submitted
for the APR06 Meeting of
The American Physical Society

Structure of p-shell Nuclei with Interactions Derived from Chiral Effective-Field Theory[1] W. E. ORMAND, V. G. GUEORGUIEV, P. NAVRATIL, Lawrence Livermore National Laboratory, J. P. VARY, Iowa State University —
Traditional realistic nucleon-nucleon (NN) interactions based on precision fits to 2-body data have not produced high-quality descriptions of light nuclei. Effective-Field theories (EFT) based on chiral-perturbation theory provide a natural scheme to derive inter-nucleon interactions and predict a three-nucleon interaction at next-to-next-to-leading order (N2LO). A key feature of these EFT potentials is a set of parameters; some of which are determined by the EFT NN couplings, while others are chosen to reproduce the binding energies of A=3 and 4 nuclei. We have developed the tools to utilize EFT-based potentials, including the NNN terms, in the ab initio no-core shell model (NCSM). We have also improved our shell-model codes to increase the scope of our calculations with three-nucleon interactions to the point where model spaces up to $6\hbar\Omega$ are accessible for all p-shell nuclei. We will show results of large-basis NCSM calculations for light p-shell nuclei, especially masses $A = 10, 11, 12, 13$ and highlight the impact the N2LO TNI and its parameters on their structure. Support from LDRD contract No. 04-ERD-058 and DOE grant SCW0498 is acknowledged.

[1]This work was performed in part under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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Date submitted: 13 Jan 2006 Electronic form version 1.4