Abstract Submitted
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The Emergence of Collectivity in Heavy Nuclei in the Shell Model Monte Carlo Method[1] SOHAN VARTAK, YORAM ALHASSID, Center for Theoretical Physics, Sloane Physics Laboratory, Yale University, New Haven, CT 06520, MARCO BONETT-MATIZ, Physics Department, University of Bridgeport, Bridgeport, CT 06604 — Understanding the microscopic origin of collectivity in heavy nuclei has been a long-standing problem in nuclear physics. The configuration-interaction (CI) shell model is one of the basic models for describing the structure of nuclei but its application to heavy nuclei has been severely limited because of the combinatorial increase of the dimensionality of the many-particle model space with the number of valence orbitals and/or number of nucleons. The shell model Monte Carlo (SMMC) method has addressed this problem by enabling calculations in model spaces that are many orders of magnitude larger than those that can be solved by conventional diagonalization techniques. However, SMMC has been mostly limited to the calculation of thermal and ground-state observables, and it has been a challenge to extract spectroscopic information on individual excited states. A method was recently developed to extract a few low-lying excited states for each spin and parity by SMMC calculations of one-body density response matrices in imaginary time [1]. We apply this method to chains of lanthanide isotopes and identify signatures of the crossover from vibrational to rotational collectivity in the spectra of these isotopes.
[1] Y. Alhassid, M. Bonett-Matiz and C.N. Gilbreth, to be published.

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