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Spectral Signatures of Collectivity in Heavy Nuclei Using the Shell Model Monte Carlo Approach[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 — The microscopic description of nuclear collectivity in heavy nuclei within the framework of the configuration-interaction shell model is a major challenge due to the combinatorial increase of the model space dimension with the number of valence nucleons and/or orbitals. The shell model Monte Carlo (SMMC) method is a powerful technique for overcoming this limitation, allowing the calculation of thermal and ground-state properties of nuclei in model spaces that are many orders of magnitude larger than those that can be treated by conventional shell model methods. Previous SMMC calculations have provided only indirect evidence of collectivity in heavy nuclei. Recently, a method has been developed to extract the energies of several excited states for each spin and parity through the calculation of imaginary-time response matrices of one-body densities [1]. We apply this method to chains of lanthanide isotopes and obtain direct spectral signatures of the crossover from vibrational to rotational collectivity.
[1] Y. Alhassid, M. Bonett-Matiz and C.N. Gilbreth, to be published.

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