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Abstract for an Invited Paper for the HAW05 Meeting of the American Physical Society

Regularities in Nuclear Spectra and Simple Signatures RICHARD CASTEN, Yale University

Nuclei are complex quantum many-body systems, composed of two kinds of interacting fermions. Yet they display astonishing simplicities and regularities. Key challenges of nuclear physics are to identify such regularities, to use them as phenomenological signatures of structure and to understand their microscopic origins. This talk will focus on the first two of these challenges. The first involves the development of dynamical and structural symmetries and the discovery of approximate manifestations of them in real nuclei. These simple paradigms often lead to new signatures of structure. A number of examples of regularities in nuclear properties and their applications to nuclei far from stability will be discussed. These include empirical extractions of valence proton-neutron interactions, and their relation to shell structure; new signatures for phase transitional behavior in the equilibrium structure; evidence for ordered and chaotic behavior in nuclei, with a very simple signature for ordered spectra; and the evolution of collectivity in particle-particle compared to particle-hole regions. Work supported by the US DOE under Grant No. DE-FG02-91ER-40609.