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Potentials at the Limits of their Existence: Particle-Vibration Coupling in the Nuclear Many-Body Problem PHILIPPE LEWALLE, University of Rochester, ELENA LITVINOVA, FILOMENA NUNES, LUKE TITUS, Michigan State University – NSCL — We consider the effects of particle-vibration coupling (PVC) in ^{56}Ni, both on the potential (Relativistic Mean-Field, or RMF) which models interactions between nucleons, and the energy level distribution. The theoretical approach employed uses single-particle propagators to obtain a self-energy term describing coupling between particles and phonons in the first-order perturbation theory. This self-energy is transformed into coordinate space, where it is combined with the RMF resulting in a non-local optical potential, which is then implemented to calculate nucleon-nucleus scattering. Our work towards obtaining results comparable to scattering data is still in progress; we anticipate improvements in the agreement with data for the total potential, as compared with the RMF alone. Additionally, we continue previous work done with this formalism on energy level distributions by examining the contributions of individual vibrational (phonon) modes to level fragmentation. Analyses of the relative strengths of the fragments in highly-fragmented states through their spectroscopic factors demonstrate that in many cases, only a few phonon modes cause large amounts of fragmentation, but that the others may alter the relative strengths of the fragments caused by those few modes.

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