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Self-consistent studies of the dipole response in spherical heavy nuclei using realistic potentials

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The dipole response in neutron rich nuclei is investigated within the equations of motion phonon method (EMPM) [1]. The approach is fully self-consistent and makes direct use of the chiral potential, optimized up to-next-to-next leading order so as to minimize the effect of three-body forces [2]. Calculations in Hartree-Fock-Bogoliubov (HFB) plus Tamm-Dancoff (TDA) and random-phase (RPA) approximations have shown that the potential yields more realistic single particle spectra compared to other potentials and improves the description of the dipole response [3]. TDA and RPA, however, were unable to describe the finne structure of the giant and Pygmy resonances. To this purpose a calculation for 132Sn and 208Pb was performed within EMPM using a space which includes up two-phonon basis states. These states induce a strong fragmentation of the dipole strength. At low energy, a large number of weakly excited levels coexist with few strong excitations around the neutron decay threshold. These levels are excited by both isoscalar and isovector probes and, therefore, seem to be the analogue of the spectra detected in (gamma, gamma') and (alpha, alpha') in neutron rich nuclei. The study confirms the crucial role of the two-phonon states in damping GDR and in enhancing the level density of the low-energy region as recent experiments require.

[1] D. Bianco et al., Phys. Rev. C 84, 014313 (2012).
[2] A. Ekstrom et al., Phys. Rev. Lett. 110, 192502 (2013).
[3] D. Bianco et al., J. Phys. G 41, 025109 (2014).

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