# MICROSCOPIC DESCRIPTION OF PYGMY AND GIANT DIPOLE RESONANCES IN $^{48,50}$Ca AND $^{68,70}$Ni

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The structure of exotic neutron-rich nuclei is one of the main science drivers in contemporary nuclear physics research. An attention has been devoted to effects of varying the ratio between the proton $Z$ and neutron $N$ numbers on different nuclear structure characteristics of nuclei deviated from their valley of beta-stability. One of the phenomena associated with the change in $N/Z$ ratios is the pygmy dipole resonance (PDR) [1]. One of the successful tools for describing the PDR is the quasiparticle random phase approximation (QRPA) with the self-consistent mean-field derived from Skyrme energy density functionals (EDF) [2]. Such an approach can describe the properties of the low-lying states reasonably well by using existing Skyrme interactions. Due to the unharmonicity of the vibrations there is a coupling between one-phonon and more complex states [3]. The main difficulty is that the complexity of calculations beyond standard QRPA increases rapidly with the size of the configuration space, and one has to work within limited spaces. Using a finite rank separable approximation for the residual particle-hole interaction derived from the Skyrme forces one can overcome this numerical problem [4–6].

In the present report, we analyze the effects of phonon-phonon coupling (PPC) on the E1 strength distributions of neutron-rich calcium and nickel isotopes. Using the same set of the EDF parameters we describe available experimental data for $^{48}$Ca, $^{68}$Ni and give prediction for $^{50}$Ca, $^{70}$Ni. The inclusion of the PPC results in the formation of low-energy $1^-$ states of $^{48}$Ca. There is an impact of the PPC effect on low-energy E1 strength of $^{48}$Ca [7]. The effect of the low-energy E1 strength on the electric dipole polarizability is discussed. We predict a strong increase of the summed E1 strength below 10 MeV (12 MeV), with increasing neutron number from $^{48}$Ca ($^{68}$Ni) till $^{50}$Ca ($^{70}$Ni) [8].

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