EFFECTS OF PHONON-PHONON COUPLING ON PROPERTIES OF PYGMY RESONANCES IN NEUTRON-RICH Ca ISOTOPES

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In many nuclear physics laboratories around the world, there has recently been an increased interest in experiments with short-lived radioactive nuclei. Pioneering experiments with exotic calcium isotopes gave an evidence for strong shell effects [1,2]. The low-energy E1 strength, which is often called pygmy dipole resonance (PDR), is sensitive to the shell structure [3]. For this reason, the properties of the PDR in neutron-rich Ca isotopes provide valuable information for modeling of astrophysical r-process. This stimulates developments of the nuclear models. 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 effective interactions [4]. Such an approach can describe the properties of the low-lying states reasonably well by using existing Skyrme interactions. Due to the anharmonicity of vibrations there is a coupling between one-phonon and more complex states. 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 [5-7]. In my report the signatures of the neutron magicity in low-energy spectrum of dipole excitations in ^{52}Ca are discussed. We study the properties of the low-lying dipole states in the neutron-rich Ca isotopes [8]. Effects of the shell structure and of the neutron skin are studied in a systematic way. This reveals a number of characteristic features of the low-energy E1 modes. In particular, we find the effects of the shell closure on the low-energy E1 strength distribution.

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