

quadrupole and magnetic dipole moments, spectroscopic factors etc.), appreciably better than in other models (core-excited model, Kisslinger-Sorensen model, one particle coupled to a vibrator etc.). In addition, there are some experimental effects which are directly connected with a three-particle cluster:

- i) the $I = j - 1$ anomaly for the ground state of $^{51,55}\text{Mn}$ ($5/2^-$) and ^{127}I ($5/2^+$) and for the lowest excited positive parity states in $^{107,109,111}\text{Ag}$ ($7/2^+$)⁵⁾,
- ii) the positive quadrupole moment of the ground state and at the same time large spectroscopic factors of low-lying states in $^{64,67,69}\text{Ga}$ ⁵⁾,
- iii) the explicit appearance of the new negative parity states in $^{107,109}\text{Ag}$ in the region of a two-phonon multiplet⁵⁾,
- iv) the complete breaking of the core-excitation intensity rules in $^{107,109}\text{Ag}$ ⁵⁾, the corrected zeroth-order selection and intensity rules (CZOSIR)⁴⁾ etc.

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3.10. HRP A effects in even-even nuclei (microscopic and phenomenological approach)

G. DUSSEL, CNEA, Buenos Aires, Argentina

R. LIOTTA, The Niels Bohr Institute, University of Copenhagen, Denmark

R. A. BROGLIA, The Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark and Institute for Theoretical Physics, State University of New York at Stony Brook, New York, USA

V. PAAR, The Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark and Institute »Ruder Bošković«, Zagreb, Yugoslavia

In the particle-vibration coupling model¹⁾, the leading order phonon-phonon interaction is given by rectangular and two-triangle diagrams²⁾. The contributions from diagrams which appear in the adiabatic limit are calculated for the quadrupole vibrator. In this way, the strengths of quartic and cubic anharmonicities are expressed in terms of an underlying shell-model structure²⁾.

The leading-order contributions to the static quadrupole moments of the lowest $\mathcal{J}^\pi = 2^+$ states in Ni, Sn and Pb isotopes have been calculated in the framework of a graphical perturbation method³⁾. The microscopic structure of the 2^+ phonons is explicitly taken into account and the Pauli principle is respected up to the order of perturbation in which the quadrupole moments are calculated³⁾.

It was shown that the properties of an anharmonic vibrator follow the behaviour of the leading order processes, and thus are qualitatively simply determined by the coupling strengths of the anharmonic terms⁴⁾. The Bohr collective Hamiltonian was solved analytically in the β - γ representation and compared

with the contributions from the dominant diagrams⁴⁾. The importance of quartic anharmonicities was also stressed, even for the strength of an order of magnitude smaller than for cubic terms. Especially important appear to be the interference terms. The dominant patterns of our analysis for the anharmonic structure of one- and two-phonon states are summarized in a kind of approximate intensity rules.

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