$$\text{Re}\,\langle \text{HFB}\,|\,N_n\,N_p\,|\,\text{HFB}\,\rangle = N_n N_p. \tag{9}$$

In describing the excited states by the quasiparticle method based conceptually on ideas of reduced density matrices and transition amplitudes, a very consistent definition of spurious states can be reached which for higher excitations basically differs from the usual one.

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3.5. Investigation of the low energy spectrum in ^{93}Nb*

M. KREGAR, *Institute »Jožef Stefan«, Ljubljana* and G. G. SEAMAN *Kansas State University, Manhattan, Kansas, USA*

3.6. Projection of angular momentum from the generator coordinate wave function

N. MANKOČ-BORŠTNIK and M. V. MIHAILOVIČ, *Institute »Jožef Stefan«, Ljubljana*

3.7. Pairing vibrational states in Pb and Sn isotopes**

D. JUSTIN, M. V. MIHAILOVIČ and M. ROSINA, *Institute »Jožef Stefan«, Ljubljana*

3.8. A formula to calculate particle-hole excited states if the two-body density matrix of the ground state is known

M. ROSINA and M. V. MIHAILOVIČ, *Institute »Jožef Stefan«, Ljubljana*

3.9. Three-particle states in the semimicroscopic model

G. ALAGA and V. PAAR, *Institute »Ruđer Bošković«, Zagreb, Yugoslavia, University of Zagreb, Yugoslavia* and *The Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark*

In nuclei with three particles (holes) away from a single-closed shell or a good subshell, the model of coupling a three-particle (hole) cluster to the quadrupole vibrational field was introduced in order to include the anharmonic structure of the neighbouring even nuclei as well as additional states based on broken and promoted pairs.[1-5] So far this model has been successfully applied to ^{51,53,55}Mn[5], ^{65,67,69}Ga[5], ^{107,109}Ag[5], ^{123,125,127}I[5] and ^{193,195,197,199}Au[1-4]. The success of the model is reflected in reproducing the global structure and the properties of the ground and excited states; this means that the overall agreement with experiment for low lying states is rather good (energy spectra, *B*(E2) and *B*(M1) values, electric

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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 $^{51,55}Mn$ ($5/2^-$) and ^{127}I ($5/2^+$) and for the lowest excited positive parity states in $^{107,109,111}Ag$ ($7/2^+$)[5],

ii) the positive quadrupole moment of the ground state and at the same time large spectroscopic factors of low-lying states in $^{64,67,69}Ga$[5],

iii) the explicit appearance of the new negative parity states in $^{107,109}Ag$ in the region of a two-phonon multiplet[5],

iv) the complete breaking of the core-excitation intensity rules in $^{107,109}Ag$[5], the corrected zeroth-order selection and intensity rules (CZOSIR)[4] etc.

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3.10. HRPA 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 »Ruđer Bošković«, Zagreb, Yugoslavia*

In the particle-vibration coupling model[1], the leading order phonon-phonon interaction is given by rectangular and two-triangle diagrams[2]. 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 structure[2].

The leading-order contributions to the static quadrupole moments of the lowest $J^\pi = 2^+$ states in Ni, Sn and Pb isotopes have been calculated in the framework of a graphical perturbation method[3]. 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 calculated[3].

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 terms[4]. The Bohr collective Hamiltonian was solved analytically in the $\beta - \gamma$ representation and compared