Relativistic Mean Field Theory in Finite Nuclei

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Recent applications of relativistic mean field theory for finite nuclei are reviewed. We discuss the description of ground states of nuclei and their properties like nuclear radii as well as deformation parameters and their energy surfaces. In particular we concentrate on the description of exotic nuclei far from the line of beta-stability. A field theoretical theory for pairing correlations is presented and new results for realistic pairing interactions are discussed. High-spin states and superdeformed bands are investigated within the framework of a relativistic extension of the cranking theory. Finally we review applications of time-dependent relativistic mean field theory for the description of oscillations with small amplitudes as well as large amplitude collective motion in connection with relativistic Coulomb excitations.

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Superdeformed Rotational Bands in the $A \sim 140 - 150$ Mass Region: Cranked Relativistic Mean Field Description

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Cranking relativistic mean field approach is applied for systematic investigation of superdeformed rotational bands observed in the $A \sim 140 - 150$ mass region. Present investigation covers yrast and in some cases also excited superdeformed bands of all nuclei of this mass region in which they have been observed. Using the parameter set NL1 adjusted to a few spherical nuclei, reasonable agreement with experimental data is obtained throughout mass region under investigation. It is shown that the calculated properties of superdeformed rotational bands such as the dependence of dynamic moment of inertia $J^{(2)}$ from the rotational frequency and the absolute values of charge quadrupole moment Q_0 depends sensitevely from the number of occupied high-N intruder orbitals. This is in agreement both with previous investigations within the cranked Nilsson+Strutinsky and the cranked Woods-Saxon + Strutinsky approaches and available experimental data.

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Relativistic Hartree-Bogoliubov Description of the Neutron Halo in ^{11}Li

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Relativistic Hartree-Bogoliubov theory in coordinate space is used to describe the chain of Lithium isotopes reaching from ^{6}Li to ^{11}Li. Pairing correlations are taken into account by a density dependent force of zero range. In contrast to earlier investigations within a relativistic mean field theory and a density dependent Hartree Fock theory, where the halo in ^{11}Li could only be reproduced by an artificial shift of the $1p_{1/2}$ level close to the continuum limit, the halo is now reproduced in a self-consistent way without further modifications using the scattering of Cooper pairs to the $2s_{1/2}$ level in the continuum. Excellent agreement with recent experimental data is observed.

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