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Title: **High-Spin Nuclear Properties within the Dirac Mean-field Approach with a Woods-Saxon Potential**

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It was found in recent years that Relativistic Mean Field theory (RMF) leads to a very efficient description of ground state properties of nuclei as well as those of selected rotational bands. So far, many interesting results were obtained when solving the RMF equations (Dirac equation with "vector" and "scalar" potentials originating from the exchange mechanisms of vector and scalar mesons respectively, coupled self-consistently to the corresponding Klein-Gordon equations)[1].

We adopted a non self-consistent method, in which the low-energy limit of the Dirac equation was studied by parametrising the potentials and the effective-mass with the help of Woods-Saxon functions. The main purpose of this study was to find the best parameter fit that could next give the message about an overall limitation of the possible maximum quality of the Dirac mean-field in nuclei in terms of the single-particle description. In this approach, the main difficulty consisted in finding a suitable set of parameters for the nuclear potentials. For that purpose, we selected a certain number of criteria that gave us a measure of the agreement between theory and experiment. We automatized the research of the best set of parameters via a minimisation process. This procedure was successfully applied to several doubly magic nuclei and enabled us to reproduce many of the ground state properties such as the experimental single particle spectra, the r.m.s. radii and the nucleonic binding energies with an accuracy comparable to or better than that of the best approaches known in the literature. Calculations performed for deformed nuclei also reproduced well the spin and parity band-head assignments. A presentation of the method has been given elsewhere [2].

The results obtained for the ground states of nuclei beeing very satisfactory, we applied the method to the study of rotational bands. As an intermediate step, microscopic-macroscopic calculations of the nuclear equilibrium deformations were performed, and will be briefly presented. Several quantities like the moments of inertia or the effective alignment for various bands have been calculated using the Dirac cranked mean-field and show a very good agreement with experiment.

References

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