Relativistic Mean-Field Description of Exotic Nuclear Structure

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Models based on the relativistic mean-field approximation provide a microscopically consistent, and yet simple and economical description of the nuclear many-body problem. By adjusting just a few model parameters: coupling constants and effective masses to global properties of simple spherical nuclei, it has been possible to describe many nuclear structure phenomena, not only in nuclei along the valley of β-stability, but also in exotic nuclei with extreme isospin values and close to the particle drip lines.

The relativistic Hartree-Bogoliubov model has been applied in studies of structure phenomena that include: the strong isospin dependence of the effective spin-orbit interaction and the resulting modification of surface properties, the suppression of the spherical $N = 28$ shell gap for neutron-rich nuclei and the related phenomenon of deformation and shape coexistence, the structure of the proton drip line nuclei in the region $31 \leq Z \leq 73$, and ground-state proton radioactivity in nuclei $53 \leq Z \leq 73$. The model has also been used to calculate parity violating elastic electron scattering on neutron-rich nuclei, and neutron density distributions for atomic parity nonconservation experiments. The relativistic random phase approximation, based on effective mean-field Lagrangians with nonlinear meson self-interaction terms, has been used in the analysis of the dynamics of isoscalar dipole modes and of the structure of pygmy resonances.

[1] G.A. Lalazissis, D. Vretenar, W. Pöschl and P. Ring, Nucl. Phys. **A632**, 363 (1998).
[2] G.A. Lalazissis, D. Vretenar, W. Pöschl and P. Ring, Phys. Lett. **B418**, 7 (1998).
[3] G.A. Lalazissis, D. Vretenar, and P. Ring, Nucl. Phys. **A650**, 133 (1999).
[4] D. Vretenar, G.A. Lalazissis, and P. Ring, Phys. Rev. Lett. **82**, 4595 (1999).
[5] D. Vretenar, N. Paar, P. Ring, and G.A. Lalazissis, Phys. Rev. E **60**, 308 (1999).
[6] G.A. Lalazissis, D. Vretenar, and P. Ring, Phys. Rev. C **60**, 051302 (1999).
[7] D. Vretenar, P. Finelli, A. Ventura, G.A. Lalazissis, and P. Ring, Phys. Rev. C **61**, 064307 (2000).
[8] D. Vretenar, G.A. Lalazissis, and P. Ring, Phys. Rev. C **62**, 045502 (2000).
[9] D. Vretenar, A. Wandelt, and P. Ring, Phys. Lett. **B487**, 334 (2000).