Configuration mixing of angular-momentum projected triaxial relativistic mean-field wave functions

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In recent years several accurate and efficient models and algorithms have been developed that perform the restoration of symmetries broken by the static nuclear mean field and take into account fluctuations around the mean-field minimum. The most effective approach to configuration mixing calculations is the generator coordinate method (GCM). With the simplifying assumption of axial symmetry, GCM configuration mixing of one-dimensional angular-momentum projected (1DAMP) and even particle-number projected (PNP) quadrupole-deformed mean-field states, has become a standard tool in nuclear structure studies with Skyrme energy density functionals [1], the density-dependent Gogny force [2], and relativistic density functionals [3]. Recently, the 1DAMP+GCM framework has been extended to include triaxial shapes. The 3DAMP+GCM models with PNP have been developed, based on the self-consistent Hartree-Fock-Bogoliubov approach with Skyrme forces [4] and the Gogny force [5].

Starting from relativistic energy density functionals, we have implemented a model for configuration mixing of three-dimensional angular-momentum projected relativistic mean-field wave functions, generated by constrained self-consistent calculations for triaxial nuclear shapes [6,7]. This relativistic 3DAMP+GCM model has been applied to the systematic investigation of ground states and low-energy collective states in the even-even magnesium isotopes. The results are compared to data and with previous axial 1DAMP+GCM calculations, both with a relativistic density functional and the non-relativistic Gogny force. The effects of the inclusion of triaxial degrees of freedom on the low-energy spectra and $E2$ transitions of magnesium isotopes are examined.

Furthermore, the relativistic 3DAMP+GCM model has been adopted to study the low-lying states of even-even carbon isotopes. The quenched $B(E2)$ values, combined with the very low $E_x(2_1^+)$ indicate that the decoupled structure of neutron and proton might also exist in $^{18-22}$C besides ^{16}C [8].

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