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Collective spectra yrast and first non-yrast alternating-parity bands of even-even nuclei

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A model of axial quadrupole-octupole vibrations with effective triaxiality in the rotation motion is applied to yrast and first non-yrast alternating-parity bands in rare-earth and actinide nuclei in the present work. In the energy spectrum with alternating-parity bands the parity shift is determined by the simultaneous contribution of the triaxial K-mixing effect and the angular quadrupole-octupole vibration
modes. In solution the Schr\"{o}dinger equation in polar coordinates involving the radial variable of the effective quadrupole-octupole deformation and angular variable of the relative contributions quadrupole and octupole deformation. The Davidson potential is used to solve the radial part of the vibration-rotational Schr\"{o}dinger equation in polar coordinates. The angular variable was taken as a constant in the moment-of-inertia components of the triaxial quadrupole-octupole shape. The dependence of the contributions of the quadrupole and octupole modes on the contribution of the parameter ε_0 is determined. Depending on the values of this parameter, the energy levels change from rotational to vibrational-rotational. An overall good description was obtained for the energy levels and ΔI=1 staggering patterns in the nuclei ^{154}Sm, ^{162}Er, ^{228,230,232}Th, ^{236,238}U and ^{240}Pu. The values of the quadrupole and octupole asymmetry (triaxiality) parameters in these calculations went beyond the traditional values in the case of purely quadrupole and octupole deformations: $\gamma_{\rm eff}$ ($0 \leq \gamma_{\rm eff} \leq \frac{\pi}{6}$) and $\eta_{\rm eff}$ ($0 \leq \eta_{\rm eff} \leq \frac{\pi}{2}$). It turned out that these deviations are a feature of the case of simultaneous consideration of quadrupole and octupole deformed even-even nuclei with effective triaxiality. The importance of taking into account the collective quadrupole-octupole modes is shown.

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