Contribution ID: **159** Type: **not specified**

Shape transition with temperature of the pear-shaped nuclei in covariant density functional theory

Friday, 11 October 2019 10:50 (20 minutes)

The shape evolutions of the pear-shaped nuclei ^{224}Ra, even-even $^{144-154}$Ba, and even-even $^{286-304}$Cm with temperature are investigated by the finite-temperature relativistic mean field theory with the treatment of pairing correlations by the BCS approach. The free energy surfaces as well as the bulk properties including deformations, pairing gaps, excitation energy, and specific heat for the global minimum of the isotopes are studied. For ^{224}Ra, three discontinuities found in the specific heat curve indicate the pairing transition at temperature 0.4 MeV and two shape transitions at temperatures 0.9 and 1.0 MeV, namely one from quadrupole-octupole deformed to quadrupole deformed, and the other from quadrupole deformed to spherical. Furthermore, the gaps at N = 136 and Z = 88 are responsible for stabilizing the octupole-deformed global minimum at low temperatures. Similar pairing transition at T ~ 0.5 MeV and shape transitions at T = 0.5–2.2 MeV are found for even-even $^{144-154}$Ba. A proportional relation between the critical shape transition temperature and the deformation at zero temperature $T_c = 6.6\beta(0)$ or $T_c = 44A^{-1/3}\beta(0)$ where A is the mass number is found for both octupole shape transition and quadrupole shape transition. Through this study, the formation of octupole equilibrium is understood by the contribution coming from the octupole driving pairs with $\Omega[N, n_z, m_l]$ and $\Omega[N+1, n_z \pm 3, m_l]$ for single-particle levels near the Fermi surfaces as it provides a good manifestation of the octupole correlation.

Abstract Type

Talk

Primary author: Dr ZHANG, Wei (Zhengzhou University)

Co-author: NIU, Yifei (L)

Presenter: Dr ZHANG, Wei (Zhengzhou University)

Session Classification: S1: 核结构