Nuclear Octupole Correlations from Multidimensionally-Constrained Covariant Density Functional Theories

Shan-Gui Zhou

Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing 100190, China

Many different shape degrees of freedom play important roles in determining nuclear properties at the ground state and saddle point and in locating the fission path. By breaking both the axial and the spatial reflection symmetries simultaneously, we have developed multidimensionally-constrained covariant density functional theories (MDC-CDFTs) [1–4] in which all shape degrees of freedom $\beta_{\lambda\mu}$ with even μ, such as β_{20}, β_{22}, β_{30}, β_{32}, β_{40}, etc., are included self-consistently.

The MDC-CDFTs have been applied to the study of fission barriers and potential energy surfaces (PES's) of actinide nuclei [1, 2], third minima in PES's of light actinides [5], shapes and PES's of superheavy nuclei [6], non-axial octupole Y_{32} correlations in $N = 150$ isotones [7] and Zr isotopes [4], axial octupole correlations in MχD [8] and in Ba isotopes [9], and shapes of hypernuclei [10, 11]. Based on the PES's from MDC-CDFTs, the dynamics of spontaneous and induced fissions in actinide nuclei has also been studied [12, 13]. In this talk I will introduce MDC-CDFTs and focus on applications on octupole correlations and deformations in nuclei.

References

[1] B.N. Lu, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **85** (2012) 011301(R).

[2] B.N. Lu, J. Zhao, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **89** (2014) 014323.

[3] S.G. Zhou, *Phys. Scr.* **91** (2016) 063008.

[4] J. Zhao, B.N. Lu, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **95** (2017) 014320.

[5] J. Zhao, B.N. Lu, D. Vretenar, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **91** (2015) 014321.

[6] X. Meng and S.G. Zhou, *in preparation*.

[7] J. Zhao, B.N. Lu, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **86** (2012) 057304.

[8] C. Liu, S.Y. Wang, R.A. Bark, et al., *Phys. Rev. Lett.* **116** (2016) 112501.

[9] X.C. Chen, J. Zhao, C. Xu, et al., *Phys. Rev. C* **94** (2016) 021301(R).

[10] B.N. Lu, E.G. Zhao, and S.G. Zhou, *Phys. Rev. C* **84** (2011) 014328.

[11] B.N. Lu, E. Hiyama, H. Sagawa, and S.G. Zhou, *Phys. Rev. C* **89** (2014) 044307.

[12] J. Zhao, B.N. Lu, T. Nikšić, D. Vretenar, and S.G. Zhou, *Phys. Rev. C* **93** (2016) 044315.

[13] J. Zhao, T. Nikšić, D. Vretenar, and S.G. Zhou, *Phys. Rev. C* **99** (2019) 014618.