



# ANNUAL REPORT

## 2023

**Joint Center for Nuclear Physics**  
**青年核物理中心**

# Contents

<b>1. Supporting the CMB cosmic age from nuclear physics</b>	
X. H. Wu and J. Meng	
Science Bulletin <b>68</b> (2023) 539	
.....	1
<b>2. Doubly charmed tetraquark <math>T_{cc}^+</math> from lattice QCD near physical point</b>	
Y. Lyu, S. Aoki, T. Doi, T. Hatsuda, Y. Ikeda, and J. Meng	
Physical Review Letters <b>131</b> (2023) 161901	
.....	4
<b>3. Accurate relativistic density functional for exchange energy of atomic nuclei</b>	
Q. Zhao, Z. X. Ren, P. W. Zhao, and T. S. Park	
Physics Letters B <b>841</b> (2023) 137913	
.....	11
<b>4. Nuclear chiral rotation induced by superfluidity</b>	
Y. P. Wang and J. Meng	
Physics Letters B <b>841</b> (2023) 137923	
.....	16
<b>5. Isospin-dependence of the charge-changing cross-section shaped by the charged-particle evaporation process</b>	
J. W. Zhao, B. H. Sun, I. Tanihata, S. Terashima, A. Prochazka, J. Y. Xu, L. H. Zhu, J. Meng, J. Su, K. Y. Zhang, L. S. Geng, L. C. He, C. Y. Liu, G. S. Li, C. G. Lu, W. J. Lin, W. P. Lin, Z. Liu, P. P. Ren, Z. Y. Sun, F. Wang, J. Wang, M. Wang, S. T. Wang, X. L. Wei, X. D. Xu, J. C. Zhang, M. X. Zhang, and X. H. Zhang	
Physics Letters B <b>847</b> (2023) 138269	
.....	23
<b>6. Examination of machine learning for assessing physical effects: Learning the relativistic continuum mass table with kernel ridge regression</b>	
X. K. Du, P. Guo, X. H. Wu, and S. Q. Zhang	
Chinese Physics C <b>47</b> (2023) 074108	
.....	29

<b>7. Neutron-proton effective mass splitting in neutron-rich matter</b>	
S. B. Wang, H. Tong, Q. Zhao, C. C. Wang, P. Ring, and J. Meng	
Physical Review C <b>108</b> (2023) L031303	
.....	42
<b>8. Possible neutron halo in the triaxial nucleus <math>^{42}\text{Al}</math></b>	
K. Y. Zhang, S. Q. Zhang, and J. Meng	
Physical Review C <b>108</b> (2023) L041301	
.....	49
<b>9. <math>0\nu\beta\beta</math> -decay nuclear matrix elements in self-consistent skyrme quasiparticle random-phase approximation: Uncertainty from pairing interaction</b>	
W. L. Lv, Y. F. Niu, D. L. Fang, J. M. Yao, C. L. Bai, and J. Meng	
Physical Review C <b>108</b> (2023) L051304	
.....	56
<b>10. Fission dynamics, dissipation, and clustering at finite temperature</b>	
B. Li, D. Vretenar, Z. X. Ren, T. Nikšić, J. Zhao, P. W. Zhao, and J. Meng	
Physical Review C <b>107</b> (2023) 014303	
.....	63
<b>11. Possible coexistence of magnetic and antimagnetic rotations in <math>^{61}\text{Ni}</math></b>	
J. Lin, Y. K. Wang, C. Xu, Z. H. Li, H. Hua, S. Q. Zhang, D. W. Luo, H. Y. Wu, J. Meng, X. G. Wu, Y. Zheng, C. B. Li, T. X. Li, Z. Y. Huang, H. Cheng, C. Y. Guo, Z. X. Zhou, Z. Q. Chen, and C. G. Wang	
Physical Review C <b>107</b> (2023) 014307	
.....	75
<b>12. Shape and multiple shape coexistence of nuclei within covariant density functional theory</b>	
Y. L. Yang, P. W. Zhao, and Z. P. Li	
Physical Review C <b>107</b> (2023) 024308	
.....	82

**13. Deep-neural-network approach to solving the *ab initio* nuclear structure problem**

Y. L. Yang and P. W. Zhao

Physical Review C **107** (2023) 034320

.....92

**14. Coexisting single-particle excitations and octupole correlations in the transitional nucleus  $^{217}\text{Ra}$**

Madhu, A. Y. Deo, K. Yadav, D. Sahoo, Y. Y. Wang, Y. K. Wang, J. Meng, S. Suman, S. K. Tandel, A. Sharma, I. Ahmed, K. Katre, K. R. Devi, S. Dutt, S. Kumar, Yashraj, S. Muralithar, and R. P. Singh

Physical Review C **108** (2023) 014309

.....101

**15. Prolate-shape dominance in atomic nuclei within the deformed relativistic Hartree-Bogoliubov theory in continuum**

P. Guo, C. Pan, Y. C. Zhao, X. K. Du, and S. Q. Zhang

Physical Review C **108** (2023) 014319

.....116

**16. Generalized time-dependent generator coordinate method for small- and large-amplitude collective motion**

B. Li, D. Vretenar, T. Nikšić, P. W. Zhao, and J. Meng

Physical Review C **108** (2023) 014321

.....125

**17. Impact of isovector pairing fluctuations on neutrinoless double- $\beta$  decay in multireference covariant density functional theory**

C. R. Ding, X. Zhang, J. M. Yao, P. Ring, and J. Meng

Physical Review C **108** (2023) 054304

.....137

**18. Shell-model-like approach based on covariant density functional theory in 3D lattice space: Evolution of octupole shape in rotating  $^{224}\text{Th}$**

F. F. Xu and Y. P. Wang

International Journal of Modern Physics E <b>32</b> (2023) 2340007 .....	148
<b>19. Octupole deformation and Ra puzzle with covariant density functional theory in three-dimensional lattice space</b>	
D. D. Zhang International Journal of Modern Physics E <b>32</b> (2023) 2340009 .....	160
<b>20. Rotational spectroscopies of reflection-asymmetric nuclei within particle rotor model</b>	
Y. Y. Wang and S. Q. Zhang International Journal of Modern Physics E <b>32</b> (2023) 2340010 .....	170
<b>21. Relativistic density functional theory in nuclear physics</b>	
Y. K. Wang, F. F. Xu, T. X. Huang, and P. W. Zhao Chinese Science Bulletin <b>68</b> (2023) 1074 .....	189
<b>22. Progress on the magnetic rotation in the nuclei of <math>A \sim 60</math> and <math>A \sim 80</math> mass regions</b>	
D. W. Luo, C. Xu, H. Y. Wu, S. Q. Zhang, X. Q. Li, Z. H. Li, and H. Hua Chinese Science Bulletin <b>68</b> (2023) 1082 .....	197
<b>23. Backflow transformation for <math>A=3</math> nuclei with artificial neural networks</b>	
Y. L. Yang and P. W. Zhao Atomic Energy Science and Technology <b>57</b> (2023) 673 .....	205
<b>24. Application of neutron capture reaction rate from kernel ridge regression prediction in s-process simulation</b>	
T. X. Huang and X. H. Wu Atomic Energy Science and Technology <b>57</b> (2023) 743 .....	211