Contribution ID: **398** Type: **Oral**

Analysis of the properties of low-lying states in N=44 isotopes from ^{70}Fe to ^{80}Kr

Wednesday 2 July 2025 15:10 (20 minutes)

The occurrence of collective excitations is one of the key and noticeable spectroscopic characteristics of the atomic nucleus. Although the measurement of the B(E2;$2_1 \to 0_1$) transition probabilities is very useful for studying the evolution of collectivity along isotopic or isotonic chains, a deeper understanding of the collective behavior of a given nucleus can be gained by measuring the lifetimes of higher-lying/high-spin states. The reduced probabilities of B(E2) in an even-even nucleus generally increase with increasing angular momentum within the main rotational or vibrational bands [1]. However, different ratios of the reduced probabilities of E2 transitions between the ground state and collective excitations indicate different types of rotational or vibrational excitations. For example, in the case of a harmonic vibrator, the ratio B(E2;$4_1 \to 2_1$)/B(E2;$2_1 \to 0_1$), B42, is expected to be equal to 2.0, while for a symmetric rotator it is 1.43 [2]. The exception is nuclei located near closed shells, where this ratio may be less than unity. Very few cases of nuclei far from closed shells with an anomalously low B42 ratio have been found in the literature [3]. Modern experimental studies have expanded the region of nuclei with an anomalously low B42 ratio. In particular, in the vicinity of the magic isotopes ^{68}Ni and ^{78}Ni, such anomaly is observed in the N=44 isotones (for the ^{74}Zn isotope, the B42 ratio is 0.33) [4]. On the other hand, the study of structural features occurring in nuclei along isotopic or isotonic chains in the shell filling region is also of considerable interest, since different shape evolutions occur here [5, 6].
In the present work, a systematic analysis of the properties of low-lying states in N=44 isotopes from ^{70}Fe to ^{80}Kr is presented. This study is a continuation of our analysis of low-lying states in even isotopes $^{70-88}$Ge [7], performed within the framework of the collective quadrupole Hamiltonian [Bohr1975]. However, the inertia parameters and the potential energy surface are calculated based on the relativistic energy density functional (EDF) [8]. Our analysis showed that the calculations performed using the PC-PK1 and NL3 EDFs give very similar results. Using a single set of parameters, it is possible to describe with good accuracy the available experimental data both in Ge isotopes and in isotones with N=44.

[1] A. Bohr and B. Mottelson, Nuclear Structure, Vol. II (W. A. Benjamin, New York, 1975).
[2] A. Davydov and G. Filippov, Nucl. Phys. 8, 237 (1958).
[3] R. B. Cakirli, R. F. Casten, J. Jolie, and N. Warr, Phys. Rev. C 70, 047302 (2004).
[4] C. Louchart et al., Phys. Rev. C. 87, 054302 (2013)
[5] K. Heyde, and J. L. Wood, Rev. Mod. Phys. 83, 1467 (2011).
[6] P. E. Garrett, M. Zielińska, and E. Clément, Prog. Part. Nucl. Phys. 124, 103931 (2022).
[7] N. N. Arsenyev, E. V. Mardyban, and T. M. Shneidman Int. J. Mod. Phys. E 33, 2441021 (2024); Phys. Atom. Nucl. 88, 24 (2025).
[8] E. V. Mardyban, E. A. Kolganova, T. M. Shneidman, and R. V. Jolos, Phys. Rev. C 105, 024321 (2022).

Primary authors: SEVERYUKHIN, Alexey (Joint Institute for Nuclear Research, Dubną Russian Federation); MARDYBAN, Evgenii (Joint Institute for Nuclear Research, Dubną Russian Federation); ARSENYEV, Nikolay (Joint Institute for Nuclear Research, Dubną Russian Federation); SHNEIDMAN, Timur (Joint Institute for Nuclear Research, Dubną Russian Federation)

Presenter: MARDYBAN, Evgenii (Joint Institute for Nuclear Research, Dubną Russian Federation)

Session Classification: 1. Experimental and theoretical studies of nuclei

Track Classification: Section 1. Experimental and theoretical studies of nuclei.