Model Independent Identification of C_{2v} Symmetry in ^{236}U Nucleus

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Over the past few years, we can witness and increasing interest in studies on the shape and symmetry of the atomic nucleus, and its significance and consequences on the overall nuclear structure, from both theoretical and experimental points of view. From the theory side, our research work efforts focus in combining the nuclear mean-field with powerful mathematical tools (e.g. group- and group representation theories) to study the properties of nuclear shapes and symmetries.

It turns out that from group theory, one can obtain the spin-parity sequence of (new) rotational bands for specified symmetries, completely nuclear model independent. On the other hand, the nuclear mean-field predicts a whole new set of exotic (molecular) symmetries. Such symmetries have been very well known and studied in the domain of molecular physics and chemistry.

Following the identification criteria of such symmetries from Ref. [1] lead to the discovery of tetrahedral and octahedral symmetries in ^{152}Sm nucleus, cf. Refs [2] and [3]. Pursuing similar steps, we have identified using already existing experimental data signals of C_{2v} symmetry in ^{236}U nucleus, presenting the following sequence

$$\begin{aligned} A_1 \leftrightarrow I^\pi : \quad & 0^+, 1^-, \{2\times 2^+, 2^-\}, \{3^+, 2\times 3^-\}, \\ & \{3\times 4^+, 2\times 4^-\}, \{2\times 5^+, 3\times 5^-\}, \\ & \{4\times 6^+, 3\times 6^-\}, \{3\times 7^+, 4\times 7^-\}, \end{aligned} \tag{1}$$

combining odd and even spins and positive and negative parities, together with unprecedented degeneracies represented by curly brackets. We will present theoretical mathematical details and the corresponding physics discussion.

[1] S. Tagami, *et al.*, Phys. Rev. C **87**, (2013) 054306

[2] J. Dudek *et al.*, Phys. Rev. C **97**, (2018) 021302(R)

[3] S. Basak, *et al.*, Phys. Rev. C **111**, (2025) 034319