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The present work is a part of systematic studies of electromagnetic properties of the odd-odd and odd-*A* nuclei belonging to the region of Cs and La nuclei in which chiral bands were found (see ref. [1] and references therein). It is worth noting that the knowledge of the properties of odd-*A* nuclei is essential for understanding the structure of odd-odd nuclei and their chiral bands.

The excited states of the ^{129}La nucleus were populated in the ^{120}Sn (^{14}N, 5*n*) reaction at 77 MeV. The ^{120}Sn target 20 mg/cm^2 thick was bombarded by the beam, provided by the U-200P cyclotron at the Heavy Ion Laboratory of the Warsaw University. The γ-γ coincident events were collected by the OSIRIS II array consisting of ten Compton-suppressed HPGe detectors.

The lifetimes of yrast levels in ^{129}La with spins $I^{\pi} = 23/2^{-} - 39/2^{-}$ were determined by the Doppler Shift Attenuation method [2]. The lifetime analysis carried out by using the COMPA, GAMMA and SHAPE programs is similar to that described in detail in [3]. The preliminary results of lifetimes in the decoupled band built on the $\pi 1h_{11/2}$ configuration are presented in Fig.1 whereas Fig. 2 shows the $B(E2; I \rightarrow I\text{-}2)$ values versus spin I of the initial level. One can see that the transition probability diminishes with increasing spin. A similar behaviour was observed in the decoupled band of ^{131}La [3].

In the present work the experimental data are interpreted in the frame of the Core Quasi-Particle Coupling model (CQPC) [6] where an odd-*A* nucleus is considered as a quasi-particle coupled to the (*A*-1) and (*A*+1) even-even cores. In the case of $^{129}_{57}$La the odd proton-particle is coupled to the neighbouring $^{128}_{56}$Ba nucleus, whereas the proton-hole is coupled to $^{130}_{58}$Ce. Since the properties of these two nuclei are similar in our calculation we used the ^{128}Ba nucleus as both the (A-1) and the (A+1) core. The ^{128}Ba nucleus was chosen instead of ^{130}Ce one, because there is more experimental information available about the former, which can be compared with theory and also applied to obtain the phenomenological core (see text below). The parameters applied in the CQPC model were the same as those used in [3] except for the quadrupole-quadrupole interaction strength that was taken as $\chi = -15.9$ MeV. For that value of χ the state with spin $I=3/2^+$ becomes the ground state of ^{129}La in agreement with the experiment. A similar value ($\chi = -13.8$ MeV) follows from the energy splitting of the $\pi 1h_{11/2}$ multiplet in the Nilsson model at $\beta =$ 0.24 (the method for evaluation of χ was proposed by Starosta in [8]). In the CQPC calculations the following single-proton states were used: $1g_{9/2}$, $2d_{5/2}$, $1g_{7/2}$, $1h_{11/2}$, $3s_{1/2}$, $1d_{3/2}$ and $2f_{7/2}$ with energies such as those applied for ^{125,127}La [7].

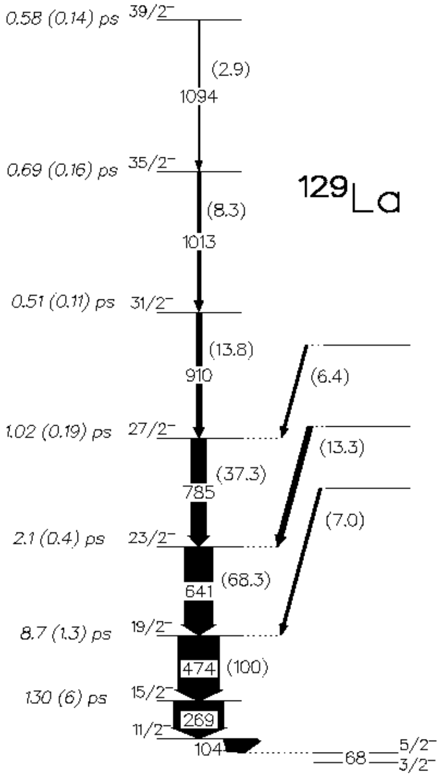

Fig. 1. Partial level scheme of ^{129}La [4]. Lifetimes of the $23/2^- \div 39/2^-$ levels were obtained in the present work, lifetimes of the $19/2^-$ and $15/2^-$ levels are taken from ref. [5]. Numbers in brackets are the relative intensities.

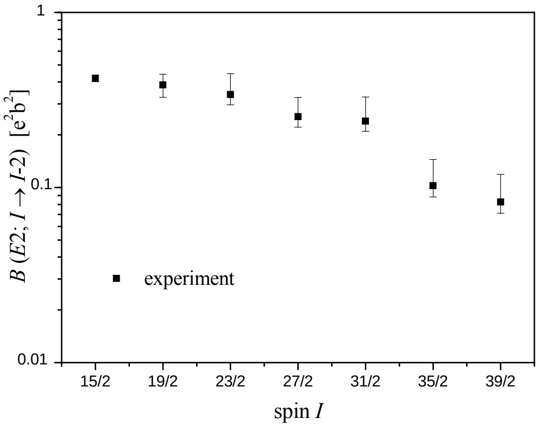

Fig. 2. The experimental $B(E2; I \to I\text{-}2)$ values in ^{129}La. The $B(E2)$ values for spins $15/2^-$ and $19/2^-$ are taken from [5].

The properties of the ^{128}Ba core (spins, excitation energies, the $E2$ matrix elements), which are needed as the input data for the CQPC model calculation, were obtained from the rigid triaxial rotor model of Davydov and Filippov [9]. The ^{128}Ba core was calculated by using the following parameters: $E(2_1^+)$ = 284 keV (value taken from the experiment [10]), $\beta = 0.24$ (based on the experimental value of $B(E2;\ 2_1^+ \to 0_1^+)$ [10]) and $\gamma_{\text{Lund}} = -22°$ (based on the experimental values of ratios $E(2_2^+)/E(2_1^+)$ and $B(E2;\ 2_2^+ \to 2_1^+)/B(E2;\ 2_1^+ \to 0_1^+)$).

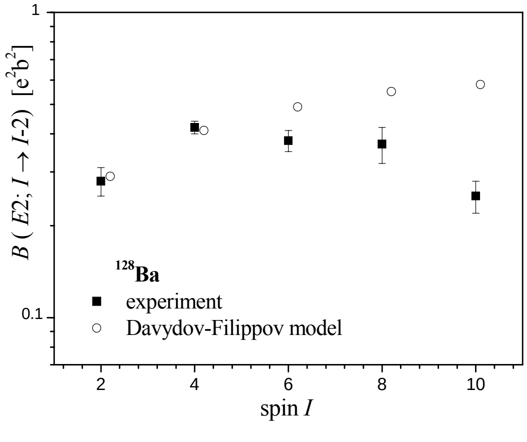

Fig. 3. Comparison of the observed and theoretical $B(E2)$ values versus spin of the initial level in ^{128}Ba. A similar disagreement between the experiment and the Davydov-Filippov model calculations was observed for ^{130}Ba [3].

The comparison of the results of the Davydov-Filippov model with the experimental data for ^{128}Ba indicates that the model is unable to describe excitation energies and transition probabilities of the high spin states in this nucleus. It is seen from Fig. 3 that the calculated

$B(E2)$ values for spin $I \geq 6^+$ differ significantly from the experimental data [10]. This is the reason why the CQPC calculations with the rigid core are unable to reproduce the experimental data for ^{129}La (see Fig. 4, case A). We used, therefore, a more realistic, phenomenological core by putting all experimental values known for ^{128}Ba, i.e. the level energies and $B(E2)$ values for the ground, quasi-γ, two quasi-neutron bands (bands ”1”, ”2”, ”3”, ”4” in ref. [10]). Theoretical values taken from the Davydov-Filippov model were used only when the experimental data were unavailable. The results of the CQPC calculations with such an experimental-theoretical core are shown in Fig. 4, case B. A satisfactory agreement with the observed properties for ^{129}La was obtained for the $E2$ transition probabilities (with the exception of the $39/2^-$ state) and the level energies.

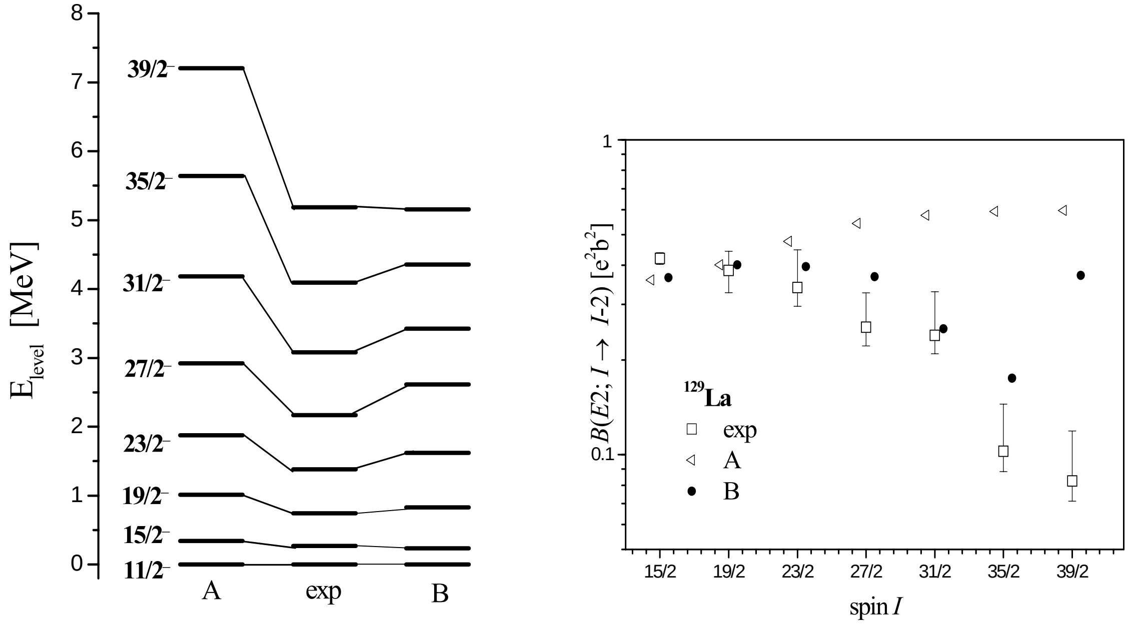

Fig. 4. Comparison of the experimental excitation energies and $B(E2)$ values with the results for the CQPC model calculations: (A) with rigid triaxial ^{128}Ba core (described by the Davydov-Filippov model), (B) with the phenomenological ^{128}Ba core (see text).

One can conclude that the rigid triaxial rotor model does not reproduce the real ^{128}Ba and ^{129}La nuclei. Good agreement of the experimental data concerning the $\pi 1h_{11/2}$ decoupled band in ^{129}La with the CQPC results was achieved only when extensive information (excitation energies and $B(E2)$ values taken from the experiment) about the properties of the real ^{128}Ba was used in the model. This suggests that the 57th proton placed on the $\pi 1h_{11/2}$ orbital does not significantly modify (due to the polarisation effect) the properties of the real ^{128}Ba nucleus when it becomes the core of ^{129}La. It also follows that for reliable calculations of the chiral bands in the frame of the Core-Particle-Hole Coupling model, experimental data on the neighbouring nuclei being the cores for the odd-odd nucleus should be taken into account.

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