LEVEL STRUCTURE OF DOUBLY ODD NUCLEI IN A≈ 120—140 REGION

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Investigations of doubly odd nuclei produced in the $(n,\gamma$ reaction at the WWR-M reactor of LNPI in Gatchina and at the tandem accelerator of the Universitat and Technische Universitat Munchen at Garching resulted in construction decay schemes of ^{104}Rh, ^{108,110}Ag, ^{114,116}Sb, $^{128.130}$I, ^{134}Cs and ^{142}Pr up to excitation energies of about 1 *MeV* (see, e.g., ref. [1,2]). The main feature of these level schemes is that almost all the levels excited in the (n, γ) reaction are also seen in the one nucleon transfer reactions, which permits to interpret these levels as members of p-n multiplets based on low-lying proton and neutron states. Correspondingly, the level schemes are divided into the levels schemes of positive and negative parities connected by few E1 transitions with retardation factors $F^W \approx 10^5 - 10^6$. Intense intramultiplet transitions of M1 type proceed inside each level scheme, with the fastest of them having $F^W < 10$. Branching ratios calculated for some multiplets of negative parity confirm the (d,p) and (d,t) reaction data about slight fragmentation of multiplet states. Calculations of energy splitting of the multiplets by residual interactions taken as a combination of short-range Wigner, singlet and tensor forces show an agreement with the experiment within 30—40 *keV* and permit to draw a conclusion that the parameters of interaction of Wigner and singlet forces for various nuclei are about constant.

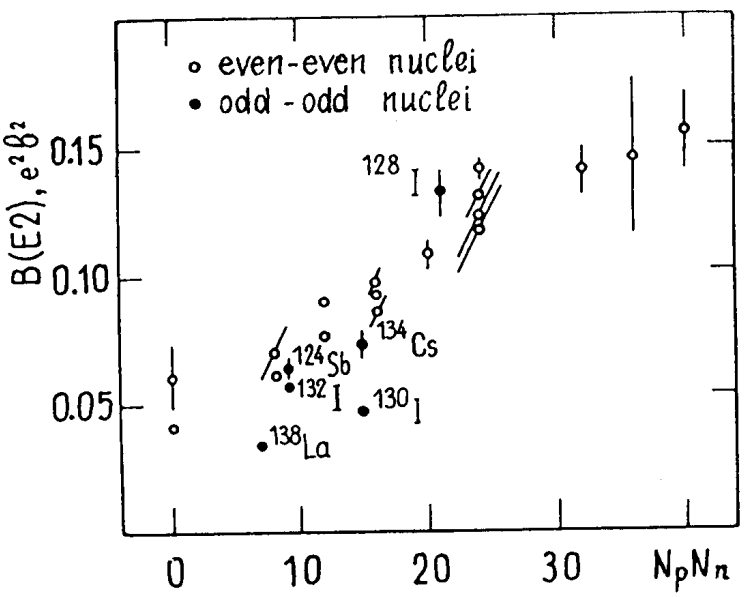

Fig.Systematics of B(E2: $2_1^+ \rightarrow 0_1^+$) values for doubly even nuclei and B(E2) valued for doubly odd nuclei in A=120—140 region

As noted above, the most transitions in the odd-odd nuclei studied are of M1 (sometimes E1) type. However nine transitions of E2 type were found, with seven of them being enhanced ($F^W \approx 10—20$). The half-lives of these enhanced transitions, calculated with the same oscillator wave functions which were used in the calculation of the energy splitting of the multiplets, are about twice as much as the Weisskopf estimates. It is evident that the experimental half-lives cannot be reproduced in the framework of two-quasipartical multiplets. However the fact that B(E2) values of the enhanced transitions are about equal to B(E2:$2_1^+ \to 0_1^+$) values in neighbouring doubly odd nuclei (see fig.) shows that the collective mode of excitation in the A = 120—140 *region* is as important in doubly odd nuclei as in doubly even nuclei. The B(E2) values are displayed in fig. in terms of the parameter $N_p N_n$, where N_p and N_n are the numbers of valence protons and neutrons, respectively, in the $Z,N = 50 \to 82$ shell. For example for $^{134}_{55}Cs_{79}$ $N_p N_n = (55—50)(82—79) = 15$. Such a parameterization is chosen because the systematics of the B(E2: $2_1^+ \to 0_1^+$) values for doubly even nuclei follows a smooth curve in the $N_p N_n$ plot [3].

References

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3. *Casten R.F. //Nucl.Phys., 1985. V.A443. P.1.*