High Spin Bands in the A ~ 130 Nuclei: A "Non-chiral" Explanation

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Abstract. Recent experimental investigations of odd-odd nuclei in the A ~ 130 region have resulted in observation of systematic pairs of close-lying, high-spin rotational bands with similar properties, especially in the Z ~ 57 and N ~ 75 region. For moderate quadrupole deformation $\beta_2 \approx 0.2$ the Fermi level for Z ~ 57 is expected to be close to the ½-[550], $h_{11/2}$ and $3/2^-$ [550], $h_{11/2}$ Nilsson configurations while neutron Fermi level for N ~ 75 lies in close proximity to high-*K*, $9/2^-$[514], $h_{11/2}$ configuration. Rotational bands built on these configurations are observed in neighboring odd-Z and odd-N, respectively, nuclei. The rotational levels of bands built on low-*K*, $h_{11/2}$ proton configurations are strongly mixed due to Coriolis interaction, what leads to formation of decoupled rotational bands where favored part has negative signature $\alpha = (-1)^{j-1/2}$ ½ = -1/2 [1]. Coriolis calculations [2] show that due to large negative decoupling parameter a = -5.8 of the ½-[550] configuration, the lowest energy state in favored branch has spin value much greater then *K*, usually $I = 7/2^-$ or $11/2^-$ in this nuclei region, while in the unfavored branch the lowest energy state has $I = 5/2^-$ or $9/2^-$. In the odd-odd nuclei coupling of the $9/2^-$[514] odd neutron to both signatures of the proton configuration results in two band heads with the lowest spin, according to Nordheim weak rule, $I = 8^+$ or 10^+ for the lower band and $I_{lowest}=7^+$ or 9^+ for the higher band. In such way the systematic appearance of two high-spin, ΔI=1 rotational bands with similar properties in this nuclei region acquires natural explanation.

The comparison of sums of several additive experimental variables, such as routhians or alignments in odd-N and odd-Z nuclei (calculated in zero-order approximation where residual n-p interaction is neglected), with values of these variables in pairs of high-spin rotational bands in odd-odd nuclei seems to support the presented above interpretation of structure of these bands. The obtained results will be presented.

In a special case when signature splitting exists in rotational band built on the $9/2^-$[514] neutron hole (e.g. due to triaxial shape of nucleus in this configuration), one may expect even four similar rotational bands in odd-odd nucleus built on two-quasiparticle configurations arising from all four combinations of signatures of proton and neutron bands (++, +-, -+ and --).

REFERENCES

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2. R. Kaczarowski, *Comp.Phys.Comm* **13**, 63 (1977)