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"LIKE-BACKBENDING" EFFECT IN THE ^{66}Zn NUCLEUS

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Presented at the Conference on Physics of medium-light nuclei, Florence, Italy, 7-10 June 1977

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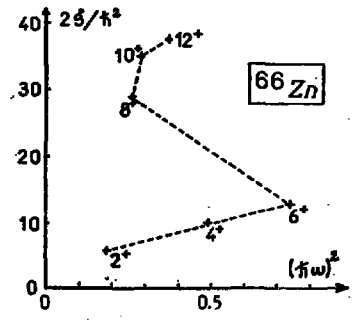
The important role played by the $\nu g_{9/2}$ orbital has been pointed out in the high spin level studies of the even Zn isotopes[1,2]. In this paper we pay particular attention to the Yrast positive parity states. The label "like-backbending" is used referring to the S-curved behaviour of the moment of inertia $2\mathcal{J}/\hbar^2$ plotted versus ω^2 (angular velocity expansion). A sudden change of the moment of inertia occurs in ^{66}Zn for the 8^+_1 state and in ^{68}Zn for the 6^+ state. (In the ^{62}Zn and ^{64}Zn nuclei such an effect has not been observed, but positive parity states of $J > 6$ are unknown at this time). The qualitative explanation we have propounded[1] is that the phenomenon is due to the stretching of two neutrons on the $g_{9/2}$ orbital. To test the hypothesis of a change of nuclear structure associated with the change of the moment of inertia, we have looked at the high spin levels lifetimes in the ^{66}Zn nucleus reached by the ^{64}Ni(α,2nγ) reaction at E_α = 30 MeV. DSAM lifetimes measurements were performed with a ^{64}Ni self-supporting target and a preliminary analysis gives the results reported in the table. The $8^+ \to 6^+$ transition is clearly not enhanced ($|M|^2 \leq 1$) bearing out a change of nuclear structure. Furthermore it will be noted that the $8^+ \to 7^-$ transition (50 % branching ratio) is strongly hindered, that may be understood by assuming a $(\nu g_{9/2})^2 \to (\nu g_{9/2}\, \nu f_{5/2})$ transition (E1 with $\Delta j = 2$). We propose that the 2^+, 4^+ and 6^+ states are collective states involving the $2p_{3/2}$, $1f_{5/2}$ and $2p_{1/2}$ orbitals (near spherical shape) whereas the 8^+, 10^+ and 12^+ states are quasi-rotationnal states also involving the $\nu g_{9/2}$ orbital with a contribution $[(\nu g_{9/2})^2]_{J \neq 0}$ (deformed shape) : the "like-backbending" effect would give an evidence about shape transition in excited states.

1) J.F. Bruandet, Doctorat d'Etat thesis, Grenoble, ISN 76.30. See also : Phys. Rev. C12 (1975) 1739 ; Phys. Rev. C14 (1976) 103 ; Zeit. Phys. A279 (1976) 69

2) G.F. Neal, Z.P. Sawa, F.P. Venezia and P.R. Chagnon, Notre Dame University, USA : "Gamma-ray spectroscopy of ^{66}Zn and ^{67}Zn", to be published



τ_m (10^{-12} s)	$\lvert M\rvert^2$ (W.u)	Yrast levels (E_γ in keV)
2 ± 0.5	≥ 9	12^+ 1225
$2.5^{+1}_{-0.5}$	≃13	10^+ 1086 (828) 9^-
⩾ 20	⩽1	8^+ 1026 (955) 7^-
< 0.5	>6	6^+ 1729
*0.2 ± 0.1	(40!)	4^+ 1411
*2.2 ± 0.1	≃ 20	2^+ 1039
		0^+

* From Nucl. Data Sheets 16 (1975) 383