THE ROLE OF THE PARTICLE-VIBRATION COUPLING IN THE NUCLEAR STRUCTURE OF EVEN Zn ISOTOPES

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Energy spectra and electromagnetic properties of even Zn isotopes (Z = 30) have been calculated by coupling two valence protons to quadrupole vibrations of the core. The influence of the anharmonicities and of the parameter variation has been extensively investigated. Table 1 contains the results of a typical particle-vibrator-model calculation, compared with experiment[1] and with the shell-model calculation[2] for ^{64}Zn. Energies of 0., 1.8 and 2.0 MeV are used for $p_{1/2}$, $p_{3/2}$ and $f_{5/2}$ single-proton states, and $\hbar\omega$ = 1.0, G = 0.4 and a = 0.5 MeV are taken as vibrator energy, pairing strength and coupling constant, respectively. Vibration-like features of the lowest-lying states are well reproduced, especially if the experimental $2_2 \to 2_1$ transition rate is corrected for the M1 admixture[3]. For comparison, the shell-model description of ref. 2 fails to reproduce the intensities of $0_2 \to 2_1$, $2_2 \to 2_1$ and $4_2 \to 2_2$ E(2) transitions. Agreement is good also for the quadrupole moment, which is $Q(2_1^+)_{calc}$ = -0.161 eb in comparison with the experimental estimate Q = -0.135 eb /ref. 4/and the shell-model value Q = -0.290 eb[2]. Calculations also show that $g_{9/2}$ may be very important in explaining the properties of the spectra, especially for the levels of high spin.

Table 1

Transition	B(E2) (in eb)		
	Theory pres.calc.	Exp. ref.1	Theory ref.2
$2_1 \to 0_1$	0.0316	0.0316	0.0290
$2_2 \to 0_1$	0.00024	0.00047	0.00029
$0_2 \to 2_1$	0.0308	0.0365	0.0059
$0_2 \to 2_2$	0.0019		0.0510
$2_2 \to 2_1$	0.0444	0.0655	0.0160
$4_1 \to 2_1$	0.0529	0.0330	0.0390
$4_2 \to 2_1$	0.0003	0.00016	0.00001
$4_2 \to 2_2$	0.0274	0.0337	0.0038
$2_2 \to 4_1$	0.0002		0.0001
$4_3 \to 2_1$	0.00047		

References

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2. J.F.A. van Hienen, Nucl. Phys. A269 (1976) 159.
3. F.E. Blumenberg, Thesis, Bonn 1973.
4. J.W. Lightbody, Jr., Phys. Lett. 38B (1972) 475.