

Calculation of the g_K -factors of the odd-mass deformed $^{173-177}\text{Yb}$ nuclei

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In this study the secular equation for the energy shift of unpaired single quasiparticle state of the odd nuclei due to the quasiparticle-phonon interaction is obtained. In addition, analytical expressions for g_K and effective spin g_s^{eff} factors are derived. The phonon states in doubly even nuclei are described in RPA and their structure is conserved in odd-mass nuclei when one takes into account the spin-spin interactions between phonons and quasiparticles [1]. The internal wave function for an odd-mass nucleus in a state with an angular momentum projection K is taken in the form ($K > \frac{1}{2}$)

$$\Phi_K(\tau) = \left\{ N_K(\tau) \alpha_K^+(\tau) + \sum_{\tau'} \sum_v R_i^{Kv}(\tau, \tau') \alpha_v^+(\tau) Q_i^+ \right\} \Psi_0,$$

Here α_K^+ and Q_i^+ are the quasiparticle and phonon creation operators. Isospin index τ and τ' represent neutron and proton. The function Ψ_0 represents the phonon vacuum which corresponds to the even-even core of the nucleus. The quantities $N_K(\tau)$ and R_i^{Kv} determine the contribution of the one quasiparticle and the quasiparticle-phonon component in the wave function, respectively.

Using derived analytical expressions for g_K and effective spin g_s^{eff} factors numerical calculations are performed for the deformed $^{173-177}\text{Yb}$ isotopes. As an example, the dependence of the g_K factor on the (n-n) and (p-p) spin interaction parameters $\chi_{\sigma} = \kappa/A$ MeV and n-p interaction parameter q is demonstrated in figure below for the ^{175}Yb nucleus. The experimental value of $g_K^{\text{exp}} = 0.188(3)$ was computed from observed magnetic moment [2] by using $g_R = 0.328$ value taken from our theoretical calculations. As can be seen from figure, the calculations comparatively well describe the data with $\kappa = 46$ and $q = -1$.

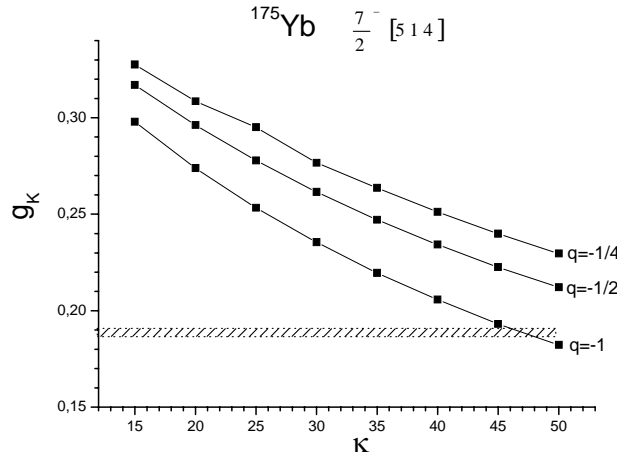


Figure. The g_K factor as a function of the parameters κ and q for the ground state of ^{175}Yb . The shaded region represents the experimental value [2].

References

- [1] Gabrakov S.I., Kuliev A.A., Pyatov N.I., Salamov D.I. and Schulz H., Nuclear Phys. A182, 625-633 (1972).
 [2] Kudryavtsev Y.A., Hyperfine Interactions, Volume: 74, Issue: 1-4, 171-180 (1992).