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NUCLEAR *g*-FACTORS OF ISOMERIC STATES IN ^{117}Te, ^{119}Te, ^{121}Te, AND ^{126}Te AND CALCULATIONS WITHIN THE QUASIPARTICLE-PHONON MODEL

The nuclear g-factors of the $5/2^+$ state at 274.4 keV in ^{117}Te, of the $7/2^+$ state, at 443.1 keV in ^{121}Te, and the 10^+ state at 2875 keV in ^{126}Te have been obtained as –0.306(9), –0.221(3), and –0.152(9), respectively, using the TDPAD method. Nuclear g-factor of the $5/2^+$ state at 320.4 keV in ^{119}Te has been found as –0.35(8) by the same method. These experimental data are analyzed using the quasiparticle-phonon model.

K e y w o r d s: *g*-factors, Te-isotops, quasiparticle-phonon model.

1. Introduction

It is known that the magnetic moments of the odd nuclei do not coincide with their single-particle values. The discrepancy between the experimental magnetic moments and single-particle ones is caused by the difference of the nuclear magnetic moment operator from the one-particle operator and by the difference between the wave function of the nucleus and that of the nuclear wave function from the wave function in the independent particle model. The difference in these wave functions is due to the residual interaction, which mixes the excitation of the core with the single-particle states.

The largest contribution to the magnetic moment, which leads to the difference between the experimental values and the single-particle ones, is associated with $\sigma\sigma$-forces that lead to the virtual excitation of spin-orbit doublet near the Fermi surface (spin polarisation of the core). Corrections to the magnetic moment operator are related to meson exchange currents and the difference of the internal magnetic moments of nucleons from the vacuum ones. Quantitative estimations of the spin polarization of the core require a knowledge of the particle-hole interaction. A theory for the spin polarization of the core was proposed in Refs. [1, 2]. The partial-hole interaction in these works was parametrized or different realistic forces were used for it.

At the same time, the spin polarization of the core can be taken into account in the framework of the quasiparticle-phonon model [3] by introducing 1^+-phonons, since their structure is identical to that of spin-orbit doublets. Experimental information on the localization and strength of $M1$-resonances in even-even nuclei allows one to determine the parameters of the particle-hole interaction. In addition, the wave function in this model involves the quadrupole and octupole excitations of the core. It leads to a collective contribution to the magnetic moment. Effects beyond the quasiparticle-phonon model (spin-orbit forces, the contribution of meson exchange currents, $2p - 2h$ excitation, *etc.*) are compensated to some extent by the introduction of the effective spin g_s and orbital g_l factors (see below). Such an approach for odd spherical nuclei was proposed and realized in Refs. [4, 5].

In the present work, the quasiparticle-phonon model calculations are tested by comparing the theoretical g-factors with their experimental values for the excited isomeric states in several tellurium isotopes. The experimental g-factors of the $5/2^+$ state in ^{117}Te with the energy of 274.4 keV and half-life of 16.8 ns, the $7/2^+$ state in ^{121}Te with the energy of 443.1 keV and half-life of 78.8 ns, and the 10^+ state in ^{126}Te with the energy of 2975 keV and half-life of 10.6 ns were measured by the time-differential per-

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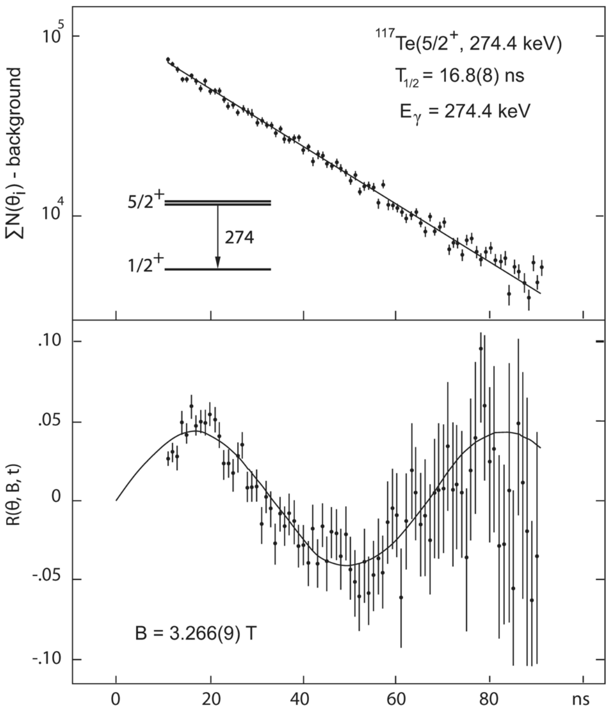

Fig. 1. Sum of the time spectra corrected for background (see text) and time-differential spin precession $R(t)$ for the 274 keV transition de-exciting the $5/2^+$ state in ^{117}Te. The solid line represents the result of a fit according to Eq. (3)

turbed angular distribution of γ-rays method (TDPAD). The magnetic moment of the $5/2^+$ state in ^{119}Te with an energy of 320.4 keV and a very short half-life of 2.2 ns was obtained by the integrated perturbed angular distribution of γ-rays method (IPAD).

2. Details of Experiments and Measurement Results

Excited states in Te nuclei were populated in the reaction $(\alpha, 2n)$ using a pulsed beam of α-particles with energy of 27 MeV of the U-120 cyclotron with a repetition time of $\approx$90 ns and a pulse width of $\approx$4 ns. The target in such an experiment is located in a magnetic field perpendicular to the beam direction. This leads to the precession of the magnetic dipole of the isomeric state with a Larmor frequency

$$\omega_L = -g\mu_N B/\hbar, \tag{1}$$

where g is the g-factor of the nuclear state, μ_N is the nuclear magneton, and B is the magnetic field in Tesla units.

As a result, the experimental time spectra of gamma rays emitted by the isomer state and following the isomer transitions exhibit besides of the exponential decay, the modulation with the Larmor frequency

$$N_\gamma(t, \theta, B) = N_0 \exp(-t/\tau) W(\theta - \omega_L t), \tag{2}$$

where τ is lifetime with $\tau \ln 2 = T_{1/2}$, and $W(\theta)$ is the angular distribution.

In the TDPAD method, the time spectra of γ-rays were recorded with a reference to the cyclotron frequency by using two detectors NaJ(Tl) at angles of $\pm 1135°$ with respect to the beam direction. The Larmor frequency was determined by fitting the experimental points by analytical expression

$$R(t_\gamma \theta_\gamma B) = \frac{N_\gamma(t, \theta, B) - N_\gamma(t, \theta + \pi/2, B)}{N_\gamma(t, \theta, B) + N_\gamma(t, \theta + \pi/2, B)} = $$
$$= \frac{3A_2}{4 + A_2} \cos(\theta - \omega_L t), \tag{3}$$

where $N_\gamma(t, \theta, B)$ are the experimental time spectra corrected for background, and A_2 is the angular distribution coefficient. We account for the difference in detector efficiency by performing measurements in two identical exposures in which the detectors were swapped.

The time spectra of the background were measured for the part of the γ-spectrum, which does not contain the delayed component, simultaneously with the time spectra of γ-rays emitted by the isomeric state. The following procedure was used to correctly account for the background. From the sum of time γ-spectra for isomeric transitions $N_\gamma^i(t)$ obtained by both detectors in two exposures, the same sum of background spectra $N_{bg}^i(t)$ multiplied by a factor k is subtracted

$$T(t) = \sum_i^4 N_\gamma^i(t) - k \sum_i^4 N_{bg}^i(t) = N_0 \exp(-t/\tau). \tag{4}$$

The sum $T(t)$ of the experimental background-corrected time spectra are no longer modulated by the Larmor frequency. Variation of the factor k allows us to obtain an exponential time dependence of the sum $T(t)$, fit of which allows us to obtain the lifetime of the isomer states. Results are shown in the top panel of Figs. 1, 3, and 4. The factor k thus determined is used to correctly account for the background.

The magnetic field magnitude measured at the center of the target location was $B = 3.266(9)$ T. We need to account accurately for the angle of the beam deflection. It is especially important, when only a part of the precession period can be observed (as in one of our experiments), because the obtained value of ω_L depends notably on the choice of the initial phase of the approximating function (3), when fitting it to the experimental data. The angle of the beam deflection was calculated using the measured field topography. The field magnitude and the beam deflection were verified in an independent experiment for the 197 keV state in ^{19}F, whose g-factor is known with high accuracy [6].

Metal targets made of tin isotopes used in the experiments have a non-cubic lattice structure. Tin at room temperature has a mixture of cubic and tetragonal centered lattices. But since the lifetimes of the isomers are small, as well as the quadrupole moments in this mass region, relaxation phenomena were expected to be negligibly small. This is confirmed by the absence of damping of the function $R(t_\gamma \theta_\gamma B)$ for the $7/2^+$ state in ^{121}Te with a long lifetime (see below).

^{117}Te, $5/2^+$, 274.4 keV. Time dependence of the intensity of γ-rays with energy 274.4 keV was measured by the TDPAD method in an external magnetic field. The spin rotation pattern and decay curve are shown in Fig. 1. The following results are obtained from the fitting to the experimental data by the decay function (4) and spin rotation function (3): $T_{1/2} = 16.8$ ns and $g = -0.306(9)$. The magnetic moment of this isomer was also measured by the Rossendorf group in Ref. [7] by the TDPAD method with two planar Ge(Li) detectors. The reaction $(\alpha, 2n)$ was used on a molten target in an external magnetic field $B = 2.539$ T. Because of lower magnetic field the time differential pattern exhibited even not a full oscillation period. Therefore, the result has a lower accuracy: $g = -0.30(2)$.

^{119}Te, $5/2^+$, 320.4 keV. The excited state $5/2^+$, 320.4 keV was identified as an isomer with half-life $T_{1/2} = 2.2(2)$ ns in [8]. The IPAD method with two Ge(Li) detectors at angles $\pm\theta$ to the beam direction was applied to measure the g-factor of this isomer. The measurements were carried out in two exposures with opposite directions of the magnetic field. To determine $\omega_L \tau$, a procedure that does not require strict equality of exposures was applied. The following ratio is formed

$$\xi = \frac{N(\theta, B\uparrow)}{N(\theta, B\downarrow)} \frac{N(-\theta, B\uparrow)}{N(-\theta, B\downarrow)}, \tag{5}$$

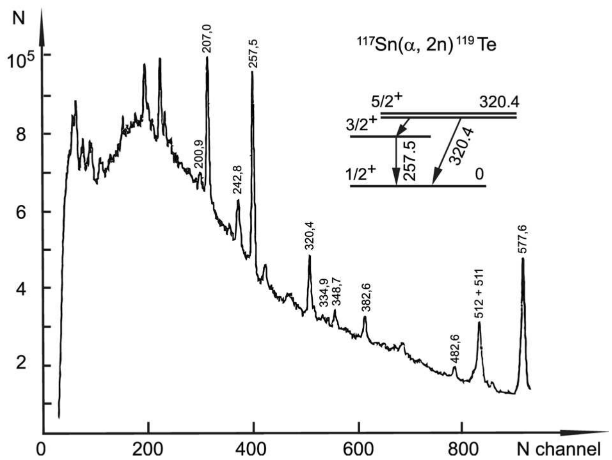

Fig. 2. γ-spectrum from the ^{117}Sn$(\alpha, 2n)^{119}$Te reaction on a thick isotope tin target

where $N(\theta, B\uparrow)$ and $N(\theta, B\downarrow)$ are the counts in the experimental spectra for selected γ-lines corrected for background and for the field direction up and down. From this relation, one obtains a function R similar to that used in the TDPAD method

$$R = \frac{(\sqrt{\xi} - 1)}{(\sqrt{\xi} + 1)} = \frac{1}{W} \frac{dW}{d\theta} (\Delta\theta_L + \Delta\theta_B), \tag{6}$$

where $\Delta\theta_L = \omega_L \tau$ is the precession angle and $\Delta\theta_B$ is the beam deflection angle in the scattered magnetic field before colliding with the target. The angle θ was chosen to be $\pm 135°$ from the condition of the maximum value of the logarithmic derivative $dW/d\theta$ of the angular distribution of γ-rays.

The γ-ray spectrum measured by Ge(Li) detector is shown in Fig. 2. The precession angle $\Delta\theta_L$ is determined for the γ-transition 320.4 keV. Another isomer transition 257.5 keV has a small anisotropy, therefore uninformative. To determine the angle $\Delta\theta_B$ of the beam deflection, another lines in spectrum 242.8, 348.7, 382.6, 482.9 and 577.8 keV, corresponding to the fast transitions, were used. Its value averaged over all fast transitions $\Delta\theta_B = 11.1(8)$ mrad has to be subtracted from the total angle $\Delta\theta = 20.9(10)$ mrad for the isomer transition 320.4 keV. Thus, the precession angle for the isomer is equal to $\Delta\theta_L = 9.8(19)$ mrad. The g-factor found from $\Delta\theta_L$ and using values $B = 3.266(9)$ T and $\tau = 3.17(29)$ ns is equal to $g = -0.35(8)$.

^{121}Te, $7/2^+$, 443.1 keV. Measurements for this state were made using a "flashing" system [9], which

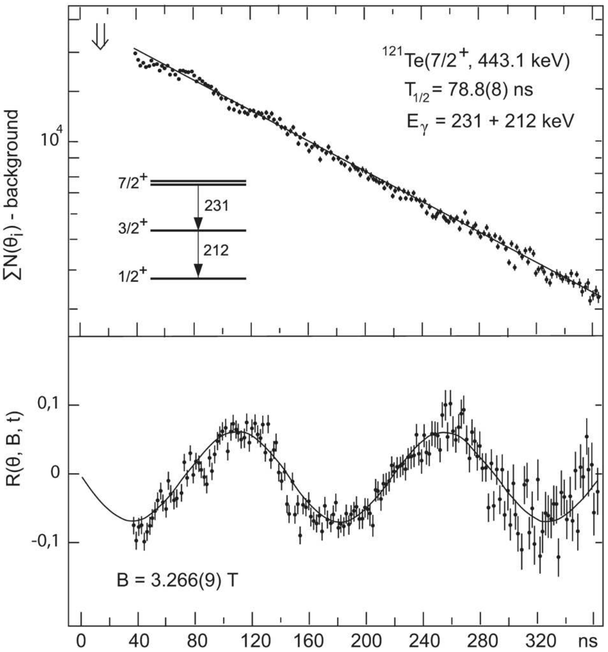

Fig. 3. Sum of the time spectra corrected for background and time-differential spin precession $R(t)$ for the 212 and 231 keV transitions de-exciting the $7/2^+$ state in ^{121}Te. The solid line represents the result of a fit according to Eq. (3)

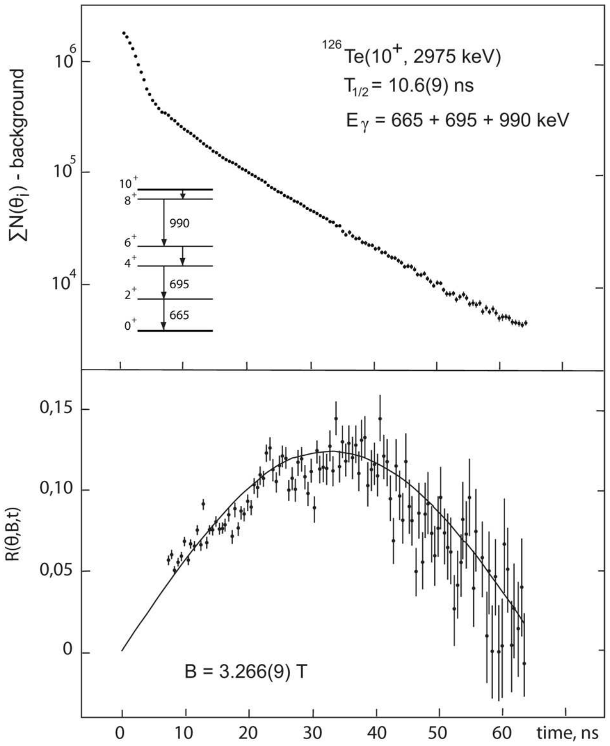

Fig. 4. Sum of the time spectra corrected for background and time-differential spin precession $R(t)$ for the 666, 695 and 990 keV transitions de-exciting the 10^+ state in ^{126}Te. The solid line represents the result of a fit according to Eq.(3)

allowed an increase in the repetition period of the beam pulses on the target by a few times, in this case, by a factor of four. This made it possible to observe the spin rotation for a longer time of ~360 ns, and also allows us to make sure that there is no attenuation of the function (3) in the metallic tin target. The time distributions of the intensity of γ-rays with energies of 212.2 and 230.9 keV were recorded. By fitting the functions (4) and (3) to experimental data, the following results were obtained: $T_{1/2} = 78.8(5)$ ns, $\omega_L = 34.5(5)$ MHz, and $g = +0.221(3)$. The result of the Rossendorf group [7] is $g = +0.18(2)$. The lower accuracy of g-factor is explained by the fact that, due to the weaker magnetic field and the use of a single beam repetition period (four periods in present study), less than half of the picture rotation period was observed.

^{126}Te, 10^+, 2975 keV. In the transition region nuclei, a number of multiparticle high-energy states are observed. Various experimental information has been obtained for them, and information about g-factors is very useful for understanding their structure, at least whether these states are proton or neutron ones. The measurements for these states have the peculiarity that only a part of the precession period can be observed. Therefore, the angle of deflection of the beam in the scattered magnetic field must be precisely determined, and the detectors must be set exactly at the angles of $\pm 135°$ to the beam direction, with regard for the beam deflection. The phase of the approximating function, Eq. (3), is accepted to be zero under such conditions. The beam deflection angle was calculated from the measured magnetic field topography and was determined independently from the TDPAD experiment for 197 keV state in ^{19}F with a known exact g-factor [6]. The experimental results are presented in Fig. 4. Time spectra were measured for the sum of the fast transitions following the isomer transition. The spin rotation pattern was approximated by the function $a + b_2 \sin(2\omega_L t + \Delta\theta)$. The correction of the experimental spectra for the background was satisfactory if both a and $\Delta\theta$ are close to zero. The results of the approximation are given by the follow-

Contributions of different components to the g-factors: results of calculations with the quasiparticle-phonon model and comparison with experimental data

Nucleus	J^π	C_J^2	$g_{\rm SP}^{\rm ef1}$	$g_{\rm SP}^{\rm ef2}$	g_1	g_2	g_T	$g_T^{\rm ef1}$	$g_T^{\rm ef2}$	$g_{\rm exp}$
^{117}Te	$5/2^+$	0.805	–0.673	–0.695	–0.050	0.282	–0.429	–0.355	–0.367	–0.306(9)
^{119}Te	$5/2^+$	0.809	–0.673	–0.695	–0.053	0.266	–0.445	–0.370	–0.383	–0.35(8)
^{121}Te	$7/2^+$	0.868	0.374	0.343	0.048	–0.188	0.247	0.203	0.180	0.221(3)
^{125}Te	$11/2^-$	0.942	–0.306	–0.331	–0.014	0.101	–0.246	–0.206	–0.221	–0.179(1)
^{126}Te	10^+	0.942	–0.306	–0.331	–0.014	0.101	–0.246	–0.206	–0.221	–0.152(9)

N o t e: Here, J^π is the spin and parity of states; C_J^2 is the square of the coefficients of the wave function (7); $g_{\rm SP}^{\rm ef1}$ and $g_{\rm SP}^{\rm ef2}$ are the single-particle g-factors calculated with effective g_s-factors and effective g_s- plus g_l-factors, respectively; g_1 is the total collective contribution; g_2 is contributions to the g-factor of the spin polarization of the nucleus; g_T is the total g-factor calculated with vacuum values of g_s; $g_T^{\rm ef1}$ and $g_T^{\rm ef2}$ are the total g-factors calculated with $g_{\rm SP}^{\rm ef1}$ and $g_{\rm SP}^{\rm ef2}$, respectively; $g_{\rm exp}$ are experimental values of g-factors.

ing: $T_{1/2} = 10.6(10)$ ns, $\omega_L = 23.6(13)$ MHz, and $g = -0.152(9)$.

3. The Quasiparticle-Phonon Model Calculations

The wave function of an odd spherical nucleus in the calculations of magnetic moments in the framework of the quasiparticle-phonon model can be written in the following form:

$$\psi_\nu(JM) = \\ = C_J^\nu \Big\{ \alpha^+_{JM} + \sum_\lambda D_j^{\lambda i}(J\nu)[\alpha^+_{jm} Q^+_{\lambda\mu i}]_{JM} \Big\} \psi_0, \qquad (7)$$

where ψ_0 is the phonon vacuum. Expressions for $[\alpha^+_{jm} Q^+_{\lambda\mu i}]_{JM}$, the coefficients C_J^ν and $D_j^{\lambda i}(J\nu)$ can be found in [3], and the details of the magnetic moment calculations are presented in Ref. [5].

As one can see, the quadrupole 2^+ and octupole 3^- excitations of the even-even core are taken into account, as well as 1^+-excitations with $\lambda = 0$ and $L = 1$. They describe the spin polarization of the even-even core in the random phase approximation. Only one-phonon excitations are considered. The final expression for the g-factor of the state $\psi_\nu(JM)$ can be written as

$$g_J = C_J^2[g_{\rm SP} + g_1 + g_2], \qquad (8)$$

where $g_{\rm SP}$ is the single-particle g-factor and g_1 and g_2 are quadratic and linear in coefficients $D_J^{\lambda i}$ terms. Expressions for the magnetic moment operator in the quasiparticle-phonon model and that for g_1 and g_2 can be found in Ref. [5]. Thus, there is a single-particle contribution $g_{\rm SP}$ to the g-factor, the contribution related to the 1^+-excitations of the core and the collective contribution g_1 arising from impurities of states of the quasiparticle-phonon type (2^+ and 3^-) in the wave function (7), ($g_1 = g_1^{(2)} + g_1^{(3)}$). Contribution of the 1^+-excitations of the core allows us to account the spin polarization of the core.

The spin-multipole interaction constants were determined by the position of $M1$-resonances [10–12]

$$\chi_1^{(01)} = -28/A \text{ (MeV)}, \quad \chi_0^{(01)} \simeq 0.8\chi_1^{(01)}, \qquad (9)$$

where A is the particle number. The uncertainty in the value of the isovector constant $\chi_1^{(01)}$ obtained from the analysis of experimental data in different models is small, $\chi_1^{(01)} \sim (23 \div 28)/A$ (MeV). The isoscalar constant $\chi_0^{(01)}$ is determined somewhat worse [13], but its variation caused insignificant changes in the magnetic moments.

It is known that there is a weakening of the probabilities of $B(M1)$ transitions, Gamow–Teller transitions, and magnetic moments, which cannot be explained only by the polarization of the core. It is related to the excitation of non-nucleonic degrees of freedom by $\sigma\sigma$ forces (ΔN^{-1}-excitations), which transfer to the region of high energies (∼300 MeV) a part of the transition force, as well as to the presence of excitations more complex than $1p-1h$ ($2p-2h$ and more complex), with spin-orbit forces and meson contributions. These effects can, to some extent, be accounted for phenomenologically by introducing effective g_s- and g_l-factors. Calculations in [5] were carried out with the vacuum g_s and effective $g_s^{\rm ef1}$ values of the g_s-factors. The effective g_s-factors $g_s^{\rm ef}(n) = 0.88 g_s(n)$ and $g_s^{\rm ef}(p) = 0.91 g_s(p)$ were determined by the condition that the evaluated in the quasiparticle-phonon model and the experimental values of the g-factors

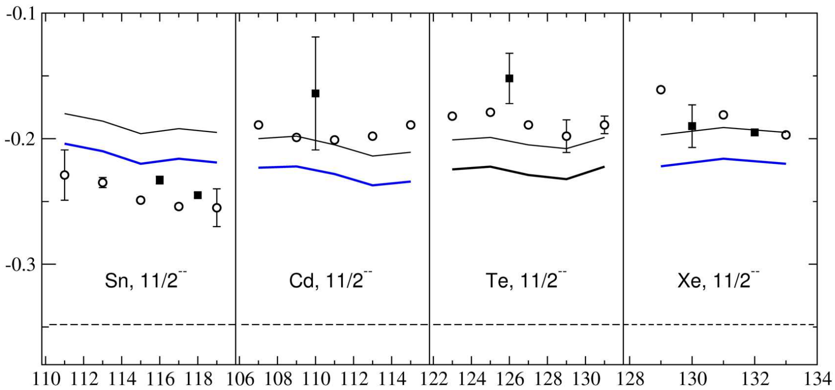

Fig. 5. g-factors of $11/2^-$ and 10^+ states in isotopes of Sn, Cd, Te Xe nuclei. Dashed line – single-particle values $g_{\rm SP}$, thin solid line – values $g_T^{\rm ef1}$. thick solid line – values $g_T^{\rm ef2}$, open circles – experimental g-factors of $11/2^-$ states, solid squares – g-factors of 10^+ states

of the $s_{1/2}$-states of the $^{119}_{50}$Sn and $^{197}_{51}$Tl nuclei coincide. These states are chosen, because they lack the corrections associated with spin-orbit interaction and meson corrections to the orbital g_l-factor, but there remain effects related to the damping of the g_s-factors.

The discrepancy between the calculated and experimental values was usually 15–20%. It was noted that the quasiparticle-phonon model accounts for the main effects, giving contributions to the g-factors. But some states, for example, in Cd and Te, indicate that there are factors which are not taken into account in calculations, but they play an essential role in these cases. Spin polarization of the core of the second (2-particle-2-hole excitations or excitations up to energies of $2\hbar\omega$) and higher orders lead to the re-normalization of both g_s- and g_l-factors. The renormalization of the orbital g_l-factor is dominated by a meson exchange. The resulting contribution is positive for protons and negative for neutrons. Anomalous g_l-factors were found using the experimental g-factors of specific two-particle states in which the spin contributions to the magnetic moment cancel each other out, and orbital g_l-factor contributions add up [14, 15]. For neutrons, such analysis was performed in the work [16]. From the g factors of the 10^- states in ^{190}Pt and ^{192}Pt, which have the configuration $\nu 9/2^-[505] \otimes \nu 11/2^+[615]$, the anomalous g_l-factor for neutrons has been obtained as $\delta g_l = -0.028(6)$.

The results of the calculations are presented in the Table. The values for the collective contribution from quadrupole $g_1^{(2)}$ and octupole $g_1^{(3)}$ phonons $g_1 = g_1^{(2)} + g_1^{(3)}$ are given, as well as the contribution from $M1$ phonons g_2. The Table presents these values and the total g-factor $g_T^{\rm ef1}$ calculated with the effective values of g_s factors and $g_T^{\rm ef2}$ calculated with the effective spin g_s- and anomalous orbital g_l-factors. The total g-factor g_T, calculated with vacuum values of g_s-factors is presented too. In general, the g-factors are fairly well described in this model, with the deviation of both $g_T^{\rm ef1}$ and $g_T^{\rm ef2}$ from $g_{\rm exp}$ being within 10–20%. The values of $g_T^{\rm ef1}$ are closer to the experimental values than $g_T^{\rm ef2}$. Apparently, the contributions from meson exchange, second-order spin polarization, and excitation of Δ-isobar are mutually compensated. It should be noted that high-spin states are described better than low-spin states. In this respect, the discrepancy between the experimental g-factors of the states $11/2^-$ in ^{125}Te and 10^+ in ^{126}Te looks remarkable. The rule of additivity of g-factors is violated.

Therefore it is interesting to see the situation with the g-factors of the states $11/2^-$ in other neighboring nuclei. They are presented in Fig. 5 for the nuclei Sn, Cd, Te, and Xe. Again, the agreement of calculated values with the experiment is good enough. The agreement with the experiment is improved in the case when using effective g-factors in contrast to that when using single-particle values. For Cd, Te, and Xe nuclei, corrections related to the orbital g_l-factor are not necessary for good agreement with the experiment. At the same time, to improve the description of $11/2^-$ states of Sn nuclei, this correction should be taken into account. The contribution of spin polarisation of the core turns out to be overestimated for the Sn isotopes.

Values of g-factors of 10^+ states in some Sn, Cd isotopes also turn out to be much smaller than those for $11/2^-$ states, violating the additivity rule (violations within the error is absent for Xe isotopes). The admixture of collective states is too small to explain the violation of the additivity rule. A small impurity of state $(\nu h_{11/2}\nu h_{9/2})10^+$ (the contribution of non-diagonal elements) may quite strongly change the value of the g-factor. The admixture $\alpha^2 = 0.04$ of such a state is sufficient to explain the difference in the g-factors 10^+ and $11/2^-$ states for Te isotopes. This value is slightly larger than for other nuclei.

4. Conclusions

The nuclear g-factors of the $5/2^+$ state, 274.4 keV in ^{117}Te, the $5/2^+$ state, 320.4 keV in ^{119}Te, the $7/2^+$ state, 443.1 keV in ^{121}Te, and the 10^+ state, 2875 keV in ^{126}Te have been measured. The experimental data obtained have been analyzed within the framework of the quasiparticle-phonon model. For all measured g-factors, it is sufficient to consider the contribution of spin polarization of the core and collective phonons with the effective g_s-factor of the neutron to obtain sufficiently good agreement with the experimental values. Due to the violation of the additivity rule for the g-factor of the 10^+ state in the ^{126}Te nucleus, the g-factors of even and odd isotopes of neighboring nuclei Sn, Cd, Te, and Xe were also analyzed. The additivity rule for the g-factors of the 10^+ state in Sn, Cd, and Te is explained by the admixture of $(\nu h_{11/2}\nu h_{9/2})10^+$ states. It also turned out that the contribution of the anomalous orbital g-factor of neutrons δg_l is necessary for $11/2^-$ states of the odd Sn isotopes to improve the agreement with experimental data. Such contribution is not required for the isotopes of Cd, Te, and Xe.

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ЯДЕРНІ g-ФАКТОРИ ІЗОМЕРНИХ СТАНІВ ІЗОТОПІВ ^{117}Te, ^{119}Te, ^{121}Te ТА ^{126}Te: ПОРІВНЯННЯ З РОЗРАХУНКАМИ В РАМКАХ КВАЗИЧАСТИНКОВО-ФОНОННОЇ МОДЕЛІ

За допомогою методу TDPAD отримані такі значення g-факторів ізотопів телуру: –0,306(9) для $5/2^+$ стану ^{117}Te при 274,4 кеВ, –0,221(3) для $7/2^+$ стану ^{121}Te при 443,1 кеВ, та –0,152(9) для 10^+ стану ^{126}Te при 2875 кеВ. Значення –0,35(8) для $5/2^+$ стану ^{119}Te при 320,4 кеВ було отримано методом IPAD. Одержані експериментальні значення порівнюються з розрахунками в рамках квазичастинково-фононної моделі.

Ключові слова: ядерні g-фактори, ізотопи Te, квазичастинково-фононна модель.