For our measurements, the relation $\omega\tau < 1$ is satisfied only at 3 GHz and at $T > 170°K$. Using the data of [1, 2], we can calculate the temperature dependence of the absorption. It is seen from Fig. 2 that the values of the absorption calculated for $\tilde{\gamma} \approx 6$ are in fully satisfactory agreement with the measured ones.

The experimental results offer evidence that diamond has a lower absorption than any other crystal.

In conclusion, the authors thank N.L. Kenigsberg for help with the work.

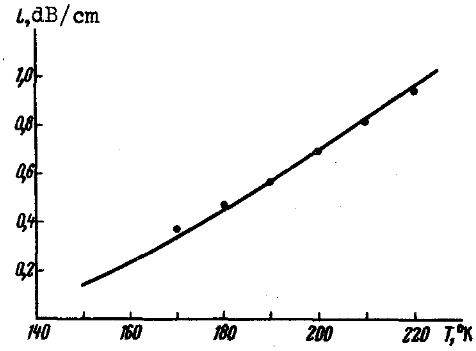

Fig. 2. Comparison of the experimental and calculated values of the damping of longitudinal waves in diamond at 3 GHz. Curve - theory, points - experiment.

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## ANGULAR ANISOTROPY AND SPIN OF THE TARGET NUCLEUS IN (n, f) REACTIONS

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One of the factors determining the angular anisotropy of fission is the alignment of the angular momentum $\mathcal{J}$ of the compound nucleus relative to a preferred direction in space, namely that of the beam of the bombarding particles. A random distribution of the spins of the target nuclei should lead to a decrease of the angular anisotropy of the fission. The effect of the spin depends strongly on the distribution of the K-projection of the total angular momentum $\mathcal{J}$ of the compound nucleus on the symmetry axis [1]. In the case of statistical distribution of K [2]

$$\phi(K) \sim \exp[-K^2/2K_0^2] \qquad (1)$$

the coefficient of the angular anisotropy can be approximately represented by the quasiclassical expression [1, 3]

$$A = \frac{W(0°)}{W(90°)} - 1 \approx \frac{L}{4K_0^2}\left[1 + \frac{L - 2I_0(I_0 + 1)}{18K_0^2}\right], \qquad (2)$$

where $L = \overline{\ell(\ell + 1)}$ is the mean square of the angular momentum transferred to the nucleus, $I$ is the spin of the target nucleus, and $K_0^2 = \overline{K^2}$.

The first attempts to observe the influence of the spin on the angular anisotropy of the outgoing fragments were undertaken for the reactions where $U^{233}(5/2^+)$, $U^{235}(7/2-)$, and $Pu^{239}(1/2^+)$ were fissioned by fast neutrons of several MeV energy [4]. The observed effect turned out to have the opposite sign. This fact was later interpreted [5] as the result of a dependence of the moment of inertia $J_{eff}(K_0^2 \sim J_{eff})$ on $Z^2/A$ of the fissioning nucleus.

Investigations of the fission of identical compound nuclei in the reactions (n, f), (d, f), and (α, f) [6] have shown that the effect of spin at appreciable excitations at the saddle point (5 - 20 MeV) is very small. However, near the fission threshold, in complicated reactions of the (d, pf) type, the spin differences of the aforementioned nuclei are quite clearly pronounced [7 - 10] and are in full agreement with the obvious consequences of the theory: they are stronger the larger $I_0$, and for the same compound nucleus, they are stronger the smaller the angular momentum $\ell$ introduced by the bombarding particle.

The present investigation is a new attempt to observe the effect of the spin in the (n, f) reaction. We investigated the target nuclei $U^{233}$, $U^{235}$, and $Pu^{239}$. The measurements were made with an electrostatic generator predominantly in the region of low neutron energies $E_n$, where, according to [7 - 10], it is possible to expect a more pronounced manifestation of the investigated effect. In addition, at low excitations, $J_{eff}$ is much lower than the rigid-body value, so that we can expect a smaller role of the side effect connected with the dependence of $J_{eff}$ on $Z^2/A$. Glass detectors were used for measurements of the angular distributions of the fragments $W(\theta)$. The measurement procedure and the reduction of the experimental data are described in [11].

The results of measurements of the angular anisotropy of the fission are shown in Fig. 1. From a comparison with the other data [4, 12, 13] it is seen that our results alter greatly the picture of the energy dependence of the angular anisotropy of the fission of the investigated nuclei at low $E_n$. In [4], only one point was measured in the considered range of $E_n$. In [12], where the low-energy section of $E_n$ was investigated in greater detail for all three nuclei, the values of A for $U^{233}$ and $Pu^{239}$ at $E_n \lesssim 0.5$ MeV are apparently underestimated by a factor 1.5 - 2. Favoring this conclusion, which is very important for a discussion of the spin dependence of the angular anisotropy of the fission, are the results of [13] on $Pu^{239}$ (n, f), which are in good agreement with the results of the present experiment.

The behavior of the observed $A(E_n)$ functions seems strange at first glance. On the one hand, the appreciable gap between the data for $U^{235}$ and $Pu^{239}$ at low values of $E_n$ might naturally be connected with the difference between the spins. Then, on the other hand, why do the values of A for $U^{233}$ and $Pu^{239}$, whose spins also differ appreciably, coincide within the limits of relatively small experimental errors?

This seeming disparity, as well as the already noted absence of the spin effect at high excitations [6] and its presence at low ones [7 - 10], can be explained with the aid of expression (2). The term in the brackets, which contains $I_0$, is significant only when $K_0^2$ is large, regardless of the ratio of $\ell$ and $I_0$, i.e., it is significant only at low excitations. Figure 2 shows the plots of A against $K_0^2$, calculated from (2), for three values of the spin, 1/2, 5/2, and 7.2, and for $E_n = 0.2$ MeV (L = 1.66). The character of the $A(K_0^2, I_0, L)$ curves in the range $E_n < 0.7$ MeV (L < 3.5) of interest to us is the same, and all that changes is the scale of the angular anisotropy. Somewhat more accurate modifications of formula (2) are considered in [3, 14]. The small difference between them and (2) is irrelevant from the point of view of the present analysis.

From the curves in Fig. 2 it follows that the spin effect vanishes rapidly with increasing $K_0^2$ and is difficult to observe already at $K_0^2 \gtrsim 5$. The absence of a noticeable difference between the angular anisotropies of $U^{233}$ and $Pu^{239}$

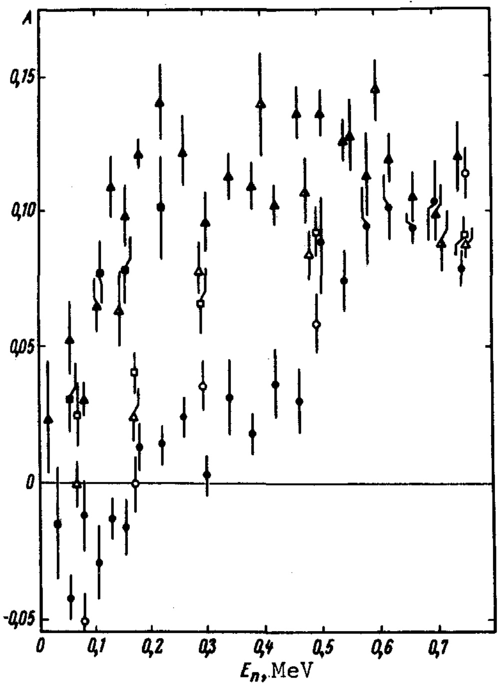

Fig. 1. Angular anisotropy of fission as a function of the neutron energy: squares - $U^{233}$, circles - $U^{235}$, triangles - $Pu^{239}$; light symbols - [12], half-filled - [13], completely filled - present work.

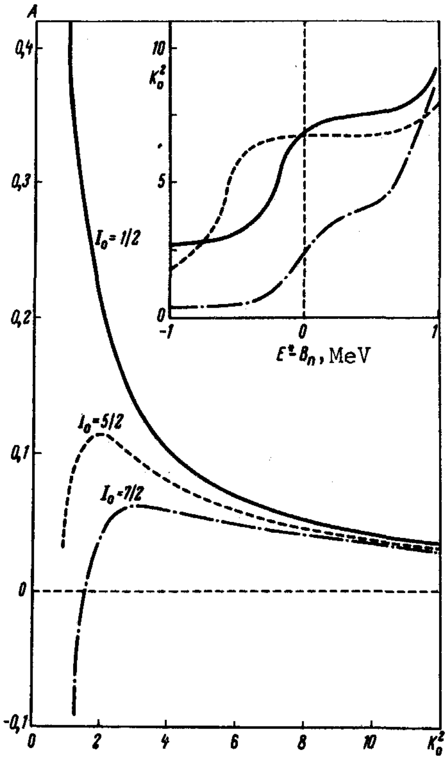

Fig. 2. Dependence of angular anisotropy of the fission on $K_0^2$ and on the spin of the target-nucleus $I_0$. Insert - dedpdence of $K_0^2$ on the excitation energy of the compound nuclei, reckoned from the binding energy of the neutron; dashed curve - $U^{234}$, dash-dot - $U^{236}$, solid - $Pu^{240}$.

makes it therefore necessary to assume that at the considered values of $E_n$ the values of $K_0^2$ of the compound nuclei $U^{234}$ and $Pu^{240}$ are sufficiently large and close to each other. It follows from the experimental data on $K_0^2$, which are known from investigations of the reactions $U^{233}$(d, pf) and $Pu^{239}$(d,pf) [9, 15] and are shown in the insert in Fig. 2, that the values of $K_0^2$ for the compound nuclei $U^{234}$ and $Pu^{240}$ at compound-nucleus excitation energies $E^*$ exceeding the binding energy of the neutrons $B_n$ ($E_n = E^* - B_n > 0$), agree with this assumption. The appreciable deviation of the data for the target nucleus $U^{235}$ at $E_n < 0.6$ MeV shows that in this energy region $K_0^2$ of $U^{236}$ is smaller than that of $U^{234}$ and $Pu^{240}$. From the value of A, which goes through zero at $E_n = 0.1 = 0.2$ MeV, we can estimate that $K_0^2$ lies between 1.5 and 2.5. This estimate is in reasonable agreement with the curve for $U^{236}$ in the insert of Fig. 2, obtained in [9] by studying the reaction $U^{234}$(t, pf). The growth of $K_0^2$ for $U^{236}$ at $E^* - B_n > 0.5$ MeV greatly decreases the role of the spin, a fact manifest in the vanishing of the difference A for $U^{235}$(n, f) and $Pu^{239}$(n, f).

Thus, on the basis of an analysis of the simple relation (2), we can interpret, at last qualitatively, the main features of the observed dependences of the angular anisotropy of fission on the spin of the target nucleus.

On the one hand, this result is somewhat unexpected, since formula (2) has been derived under the assumption that K has a statistical distribution, whereas at the realized excitation, in the transition state ~1.5 MeV, appreciable deviations from (1) might be expected. On the other hand, it is well known [9, 16] that the use of (1) in the analysis of the differential cross sections of the reactions (d, pf) and (t, pf) leads to reasonable agreement with experiment both for the form of W(θ) and for the values of $K_0^2$ (see the insert of Fig. 2) even within the energy gap of even-even fissioning nuclei, down to the lowest transition state $K^\pi = 0^+$. This fact is surprising, but it is difficult to assess its significance to the theory of fission, since, as shown in [9], the existing experimental data can also be described by assuming a reasonable discrete state of intermediate states $K^\pi(\mathcal{J} > K)$. Obviously, this alternative deserves a special study.

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# CONNECTION BETWEEN THE SUPERCONDUCTING PROPERTIES OF THE Ti-Nb-Fe ALLOY AND THE PARAMETERS OF THE NGR SPECTRA

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An investigation of the phase decay of superconducting alloys during its initial stages, when the greatest changes of the superconducting properties takes place, is of considerable interest. The use for this purpose of methods such as x-ray and electron microscopy is frequently ineffective, owing to the large number of segregations and their finely dispersed character [1]. New possibilities of investigating this process are offered by the method of nuclear γ-resonance spectroscopy (NGRS), which has high sensitivity to the change of the local surrounding of the resonant atoms [2]. The purpose of the present study was to establish a connection between the critical current density $J_c$ (the macroscopic parameter most sensitive to the change of the microstructure of the alloy) and the NGR spectrum parameters, which reflect this change directly.