positive parity, we get $\psi = \psi_+ + F\psi_-$. After passing through the barrier, whose penetrabilities for the states ψ_+ and ψ_- are equal respectively to P_2 and P_1, we form a state

$$\psi = P_2\psi_+ + P_1F\psi_- = P_2\left[\left(1 + \frac{P_1}{P_2}F\right)\psi_1 + \left(1 - \frac{P_1}{P_2}F\right)\psi_2\right],$$

i.e., a state with a pear-shaped deformation which is correlated with the spin. An analogous result is obtained for a nucleus with negative parity.

The estimates given above for the values of P_1/P_2 and F show that the spatial asymmetry can be quite large in certain nuclei. An experiment for observing spatial asymmetry can be carried out with polarized nuclei which have a spin in the ground state and a relatively high probability for spontaneous fission:[10] Bk^{249} ($T_{sp.f.} = 6 \times 10^8$ yr), Cf^{249} ($T_{sp.f.} = 1.5 \times 10^9$ yr), Es^{253} ($T_{sp.f.} = 7 \times 10^5$ yr) and possibly Am^{241} ($T_{sp.f.} \geq 2 \times 10^{14}$ yr).[11]

3) The appearance of longitudinal polarization of secondary neutrons, associated with the fact that the direction of the spin of the fragments formed in fission may be correlated with the direction of motion of the fragments. The observation of longitudinal polarization of neutrons can be carried out with unpolarized nuclei.

4) The occurrence of circular polarization of γ quanta, associated with a possible transition of the mixture of even and odd wave functions in the fission fragment.

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TRANSVERSE POTENTIAL DIFFERENCE THAT IS EVEN WITH RESPECT TO THE MAGNETIC FIELD, OBSERVED IN TIN

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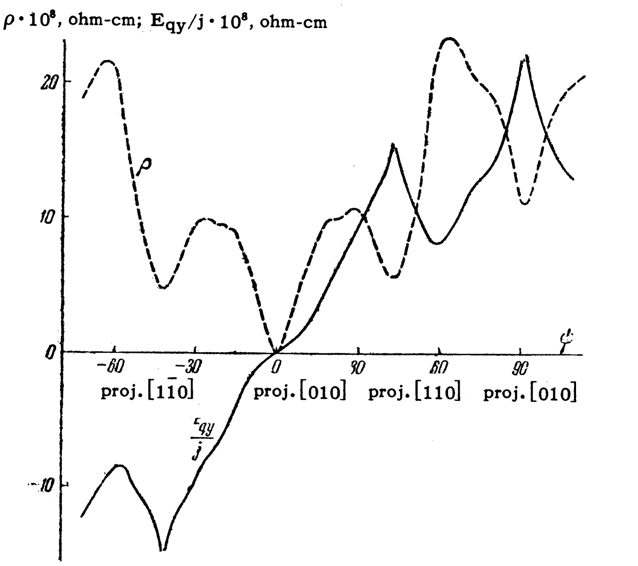
AT the present time there are only three papers dealing with the experimental study, in large magnetic fields, of the even e.m.f. (even relative to the magnetic field direction), which—like the Hall effect—appears in the plane perpendicular to the current; the experiments have been conducted on single crystals of gallium,[1] tin,[2] and copper.[3] In the last case this phenomenon is attributed to the motion of carriers in open trajectories.

We have carried out an investigation, which was described in [2], on cylindrical specimens of pure tin ($\rho_{290°K}/\rho_{4.2°K} = 60\,000$) of various orientations in fields up to 7 koe. The voltage proportional to the resistance due to inaccurate disposition of the contacts amounted to several percent of the measured effect.

The rotation diagram of the even voltage is given in the figure for one of the specimens— Sn-11; for comparison, the rotation diagram of the resistance in the magnetic field is given. (The quantity E_{qy} plotted in the diagram in the projection of the vector of the even electric field $\mathbf{E}_q$ on the y axis; the x and z axes are directed along the current $\mathbf{j}$ and field $\mathbf{H}$, respectively. Since $\mathbf{E}_q \perp \mathbf{H}$, it follows that E_{qy} coincides with $|\mathbf{E}_q|$ except in sign.) For directions leading to open trajectories, the even voltage attains a maximum (as in the case of copper[3]); it does not, however, disappear for intermediate directions of the magnetic field when there are no open trajectories (with the exception of the direction $\mathbf{H} \parallel$ proj.[001]).* A rotation dia-

*The symbol proj. [001] means the direction of the projection of the [001] axis in the plane of rotation of the magnetic field.



Rotation diagram E_{qy}/j (j is the current density) for specimen Sn-11; the specimen axis lies in the (010) plane and makes an angle of 27° with the [001] direction. Magnetic field is 6.9 koe.

gram of this type is characteristic of all the tin specimens, with the exception of those oriented parallel and perpendicular to the [001] axis. In the latter case the even effect is absent.

It seems possible to us that the occurrence of the even voltage can be explained as due to the appearance of closed carrier orbits elongated in one direction, oriented so that the direction of elongation makes with the current direction an angle not equal to 0° or 90°. (Open trajectories can be considered as particular cases with limiting elongation.) From this viewpoint singularities in the behavior of the even voltage can be explained on the basis of a knowledge of the form of the Fermi surface. In the case of tin the Fermi surface is such (see [5]) that elongated orbits passing through several elementary cells in reciprocal space exist for all directions of the magnetic field which are not parallel to the [001] axis and the (001) plane. For all these directions of the magnetic field an even voltage arises (with the exception of the case when **H** ∥ proj.[001] i.e., when the direction of elongation is perpendicular to the current) which attains a maximum when open trajectories appear. In copper the Fermi surface has a more symmetrical form [7] and elongated orbits only occur in directions close to open trajectory directions. Therefore, the even voltage in copper has the form of separate "peaks"; unlike in tin, there is no even voltage between them.[3] To some extent our viewpoint confirms the mention of the presence of an even voltage in bismuth,[6] which has closed Fermi surfaces in the form of strongly elongated ellipsoids.

As Klauder and Kunzler [3] showed, a knowledge of the vector of the even field $\mathbf{E}_q$ and the resistance field allows, when open trajectories appear, the direction of these trajectories in space to be determined. However, concerning the sharpness of the peaks, it is possible that their smearing is caused by the imperfect structure of the crystal (of a growth-structure type), which it is impossible to avoid in practice. This fact reduces the reliability of such a determination. The assertion by these authors that the rotation diagrams of the even voltage and the resistance of one specimen are adequate for the complete disclosure of the Fermi surface topology is true only in the simplest case; this apparently led to the authors making the error of incorrectly describing the particular directions of the magnetic field in copper (cf. [7]). At the same time a study of the even voltage together with the resistance in a series of specimens of various orientations can give more complete information about the Fermi surface than the study of the resistance alone. In particular, whatever the particular directions of the open trajectories the singularities appearing are always maxima in the case of the even transverse voltage, whereas singularities of the resistance can be minima (tin) or maxima (metals of the first group, tin for some orientations).

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