Photoprotons from A^{40}

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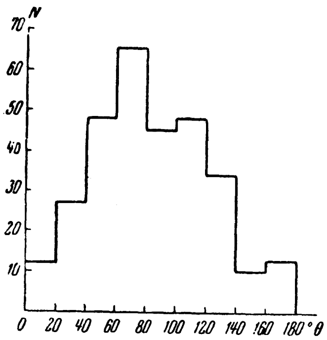
THE angular distribution of photoprotons from A^{40} has been examined. They were obtained by irradiating the A^{40} with the γ-beam from a synchrotron of maximum energy 90 mev.

Photoprotons with energy of 2-10 mev were registered in a Wilson cloud chamber filled with argon at a pressure of 1.4 atmos and mixed with the vapor of ethyl alcohol and water. The Wilson chamber, 30 cm in diameter and 7 cm deep, worked on a compression cycle of period 10-15 sec. The argon in the chamber was irradiated with a collimated γ-beam of diameter 1.6 cm, admitted to the chamber through an aluminum window (100μ) in the side wall. Proton tracks resulting from the (γ, p)-reaction were photographed stereoscopically



Angular distribution of photoprotons from A^{40}. N – number of proton tracks; θ – angle between the γ-beam and direction of ejected proton.

We examined 302 proton tracks. The angles were measured to an accuracy of 1-2% by a reprojection system. The histogram in the Figure was constructed by combining the tracks in 20° intervals. One clearly sees the forward directionality with a maximum at approximately 70°. The shape of the photoproton angular distribution obtained in this work is in satisfactory agreement with that obtained by Spicer[1], using nuclear emulsions and a maximum γ-beam energy of 22.5 mev.

From the character of the angular distribution of the photoprotons it follows that electric dipole absorption is occurring in the argon nuclei. The asymmetry is probably due to a direct photoeffect or quadrupole absorption of γ-rays.

[1] B. M. Spicer, Phys. Rev. 100, 791 (1955).

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108

The Effect of Uniform Compression upon the Magnetic Properties of Bismuth at Low Temperatures

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SEVERAL papers have recently been published dealing with investigations of the influence of uniform compression upon the various properties of metals at low temperatures. Thus, Alekseevskii and his co-workers[1] have studied the effect of uniform compression upon the galvanomagnetic properties of bismuth and its alloys, and Overton and Berlincourt[2] have instituted an investigation into the effect of uniform pressure upon the oscillations of the Hall coefficient and the variation of the magnetoresistance of bismuth in a magnetic field.

In view of the fact that uniform compression of a crystal in all probability alters the structure, the degree of filling, and the possible overlapping of the electronic energy zones which govern the de Haas-van Alphen effect, an experimental study of the effect of uniform compression upon the oscillations of the magnetic susceptibility seems to be called for.

Bismuth was selected as the first subject of such investigation. The required pressures were produced by means of the method previously developed by one of the present authors in conjunction with Kan[3].

A bismuth monocrystal was fixed with a predetermined orientation into a special holder, and was placed within a cylindrical high-pressure bomb of beryllium copper, the latter being prepared in the laboratory from pure copper and beryllium. The bomb was filled with water and

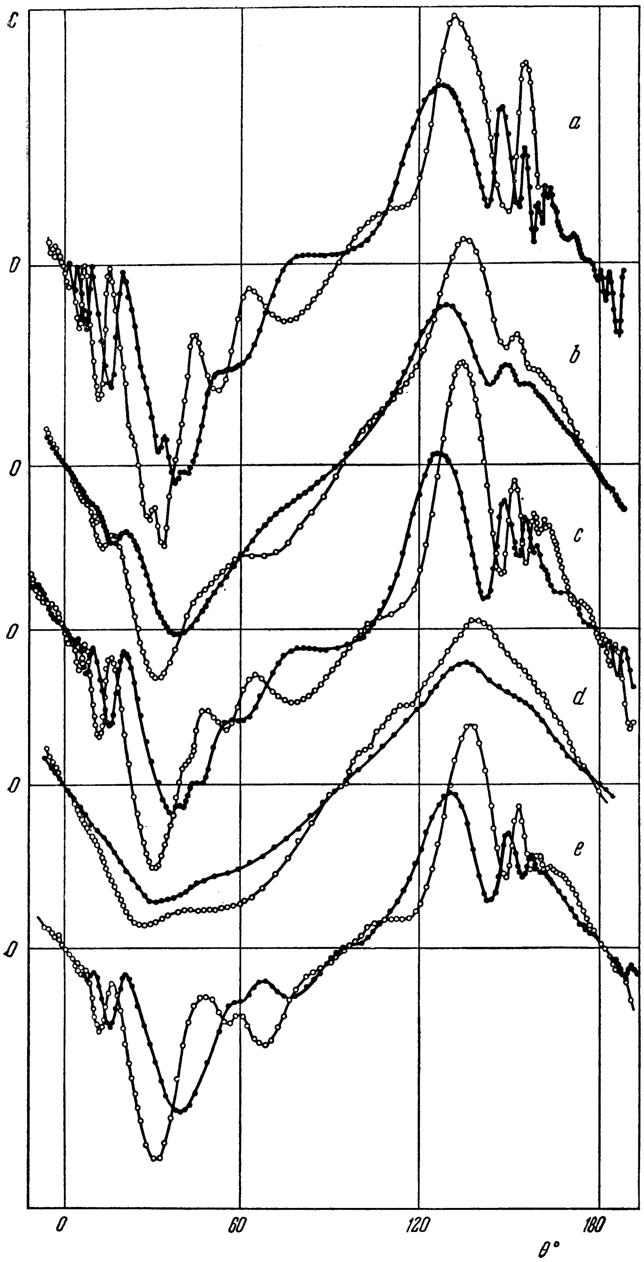

FIG. 1. Dependence of the force couple acting on a bismuth monocrystal in a homogeneous magnetic field upon the angle between the field vector and the trigonal axis of the crystal; $T = 4.2°$ K, ●—H = 15,560 oersteds, O—H = 17,960 oersteds. Curve a — uncompressed specimen; b — under pressure ~ 1500 kg/cm^2; c — pressure removed; d — pressure ~ 1500 kg/cm^2 reapplied; e — second pressure removed.

attached to the quartz rod of the suspension system used for studying the de Haas-van Alphen effect[4]. Measurements were then made of the force couple acting upon the small bismuth monocrystal in a homogeneous magnetic field, within the massive, but magnetically isotropic, high-pressure bomb.

The bismuth monocrystal was so oriented that its binary axis lay parallel to the axis of the bomb, and hence, to the axis of the suspension; the trigonal axis and the field vector lay in the horizontal plane, making various angles θ with each other. The angular dependence of the force couple (the rotation diagram) acting upon the bismuth monocrystal was investigated at $T = 4.2^\circ$ K for two constant values of the field.

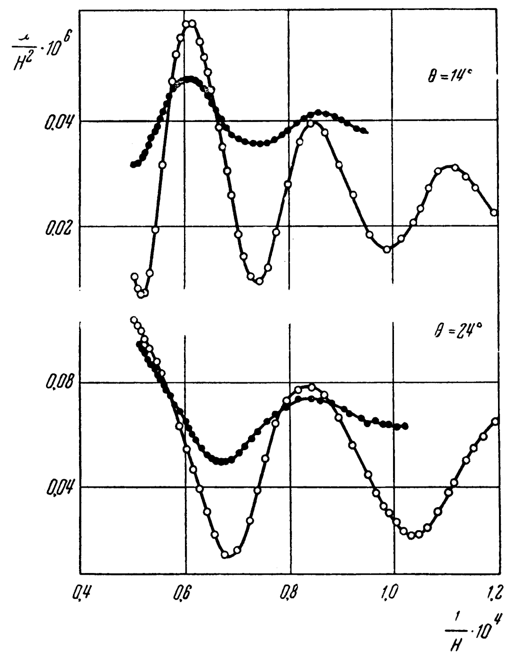

FIG. 2. Dependence of the difference between the components of the susceptibility of a bismuth monocrystal upon the intensity of the applied magnetic field at $T = 4.2^\circ$ K; ●—under pressure ~ 1500 kg/cm^2; O—pressure removed.

Curves a, c and e of Fig. 1 represent the rotation diagrams for the bismuth monocrystal determined in the absence of pressure; curve b is the rotation diagram for the same plane, but with a pressure ~ 1500 kg/cm^2, while d is the rotation diagram for the same plane obtained upon removal and reapplication of a pressure on the order of 1500 kg/cm^2. It is evident that uniform compression of the bismuth monocrystal leads to a substantial reduction (by several times) in the amplitude of the oscillations. Removal of the pressure (curves c and e of Fig. 1) leads to almost complete restoration of the original form of the rotation diagram. The slight incompleteness of this restoration (actually a small pressure effect) is in all probability associated with deformation of the sample. It should be mentioned that a similar type of hysteresis is observed when the effect of pressure upon the galvanomagnetic properties of metals is investigated[1,2].

The dependence of the difference between the two components of the susceptibility of the bismuth monocrystal upon the field intensity was investigated for various values of θ. Two curves of this sort are presented in Fig. 2. It is evident that uniform compression of the bismuth monocrystal leads to a substantial reduction in the amplitude of the oscillations with field strength, to an increase in the constant component of the susceptibility difference (the median line about which the oscillations take place), and also to a change in the period of the oscillations. Analysis of the curves showing the dependence of the difference in the components of the susceptibility upon the field strength for θ = const shows that for θ in the vicinity of 0 and 180° the period of the oscillations increases under pressure, while for θ near 90° it decreases. The change in the period of the oscillations of the susceptibility of bismuth monocrystals under pressure on the order of 1500 kg/cm^2 is inconsiderable (it does not exceed a few percent).

[1] N. E. Alekseevskii and N. B. Brandt, J. Exptl. Theoret. Phys. (U.S.S.R.) 28, 379 (1955); Soviet Phys. JETP 1, 382 (1955).

[2] W. Overton and T. Berlincourt, Phys. Rev. 99, 1165 (1955).

[3] B. G. Lazarev and L. C. Kan, J. Exptl. Theoret. Phys. (U.S.S.R.) 14, 470 (1944).

[4] B. I. Verkin and I. F. Mikhailov, J. Exptl. Theoret. Phys. (U.S.S.R.) 25, 471 (1953).

Translated by S. D. Elliott
114

On $K_{\mu 3}$-Decay

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AT the present time there have been definitely established five different decay schemes for K-mesons with masses ~ 965 m_e. The decay products are known for three of these ($K_{\pi 2}$, $K_{\mu 2}$, $K_{\pi 3}$).

It has recently been established[1,2] that one of