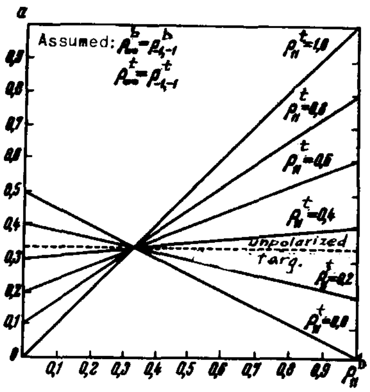
the target. This can serve as a basis for a new method of detecting polarization of slow charged particles. Since the procedure for obtaining polarized targets is being continuously perfected and there are now already twenty different methods for accomplishing this [2], the proposed method can find application in a large group of experiments, including measurement of polarization of slow protons [3] and of nuclei of light and medium elements, which is of particular importance in connection with the ever increasing use of multiply-charged ions in nuclear physics.



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ANISOTROPY OF THE MOSSBAUER EFFECT IN SINGLE CRYSTALS OF TIN AT LOW TEMPERATURES

N. E. Alekseevskii, A. P. Kir'yanov, V. I. Nizhankovskii, and Yu. A. Samarskii
Institute of Physics Problems, USSR Academy of Sciences

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We report here the results of measurements of resonant absorption of recoilless 23.8-keV γ rays produced by the decay of Sn^{119m} in single crystals of tin, in the temperature interval 4.2 - 280°K.

The measurements were made with a setup in which the absorber was caused to move at constant speed relative to the source, using a specially shaped eccentric. Figure 1 shows an over-all view of the installation without the radio apparatus: 1 - eccentric cam, 2 - bellows, 3 - cap, 4 - mounting stand, 5 - helium Dewar, 6 - foamed-plastic container for liquid nitrogen, 7 - lead screen, 8 - thermostat of radiation detector, 9 - NaI(Tl) crystal, 10 - FEU-13 photomultiplier, 11 - commu-

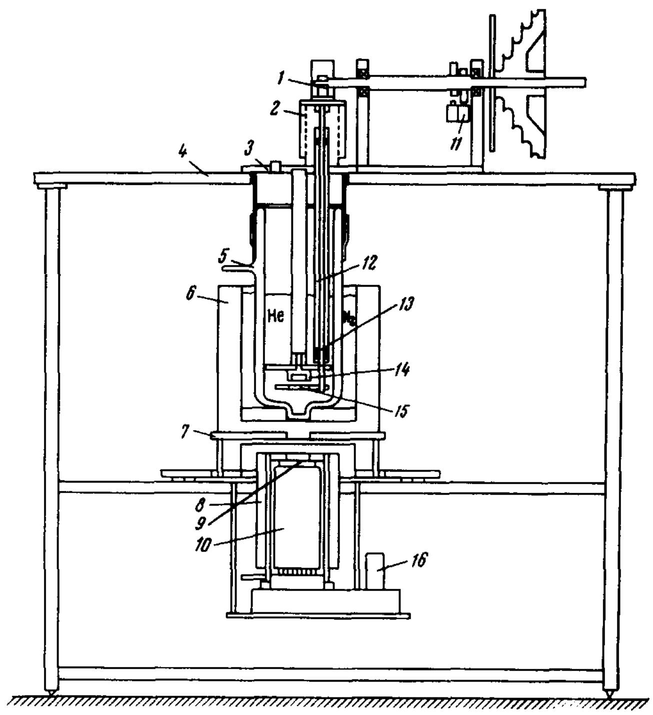

Fig. 1. Over-all view of the installation

tator, 12 - stainless steel stem, 13 - graphite stuffing boxes, 14 - radiation source, 15 - absorber, 16 - high-voltage supply to multiplier and cathode follower.

The γ-ray source was an SnO_2 compound ~30 mg/cm^2 thick; the collimator diameter was 7 mm. The x-radiation was applied through a filter of palladium foil 60 μ thick. During measurements the source was always kept at $\leq$ 77°K.

Absorbers in the form of plates with orientations [001] and [100] were cut by the electric-spark method from a single-crystal block of metallic tin enriched with Sn^{120} and containing 1.7% Sn^{119}. The surface layer of the sample, which was deformed by the electric-spark treatment, was removed electrolytically. The thickness of the absorbers was determined from the magnitude of the nonresonance absorption. The coefficient of absorption of 23.8-keV gamma rays in the metallic tin was (0.0080 ± 0.0002) μ^{-1}, and the density of the tin was assumed to be (7.28 ± 0.02) g/cm^3. The cryostat, which made possible measurements at T $\lesssim$ 20°K, consisted of a glass Dewar, in which two small vessels with flat bottoms 0.3 mm thick were sealed. The Dewar was installed in the glued foamed-plastic liquid-nitrogen container. The attenuation of the gamma-quantum beam due to nonresonant absorption did not exceed 30% in such a system.

The radiation detector consisted of a FEU-13 photomultiplier and a NaI(Tl) crystal 1 mm thick and 24 mm in diameter. The detector was in a thermostat directly under the foamed-plastic container. The detector temperature was usually 10 ± 1°C. The high-voltage for the photomultiplier was obtained from BAS-80 batteries connected to the appropriate pair of diodes. The pulses from the photomultiplier were fed through a cathode follower to the input of an AADO-1 pulse-height analyzer and were accumulated in the counting channel of a PST-100 scaler.

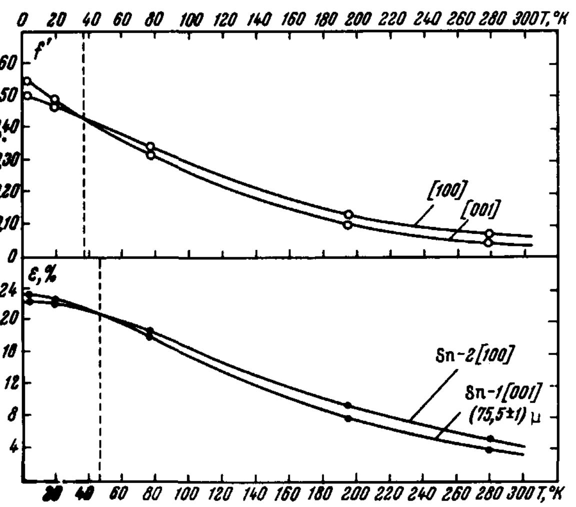

Fig. 2. Resonance-absorption curves for single-crystal tin at T = 4.2°K.

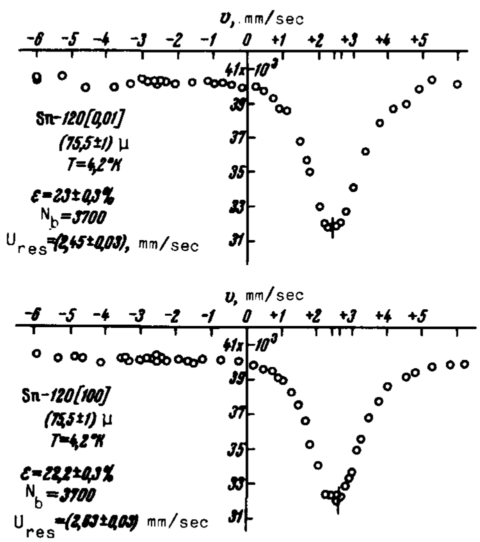

Fig. 3. Temperature dependence of the amplitude and absorption probability in single-crystal tin.

Typical resonance-absorption curves for absorbers with orientations [001] and [100] at 4.2°K are shown in Fig. 2. The absorption curves are not symmetrical. The maxima of the absorption curves for different orientations do not coincide and the displacement amounts to (0.18 ± 0.04) mm/sec. The facts noted above are the consequence of the quadrupole splitting of the excited level of Sn^{119} in the electric field of the tin lattice [1].

Figure 3 shows the temperature dependence of the amplitude of the maximum absorption in single-crystal absorbers (75.5 ± 1.0) μ thick.

The statistics corresponding to each experimental point were ~300,000 pulses and were accumulated by means of multiple measurements made on a single sample, the complete absorption curve being plotted each time.

In the reduction of the experimental data we used the procedure described in [2]. To determine the probability f' of recoilless absorption we used both the areas under the absorption curves and their amplitudes. In the calculation, the value of the quadrupole splitting was assumed to be independent of the direction in the tin lattice and equal to (0.25 ± 0.03) mm/sec at 300°K and (0.33 ± 0.03) mm/sec at $T \leq 77$°K. The fraction of the contribution of the resonance quanta to the total counting rate was assumed equal to (0.40 ± 0.02), and the effective width of the source line was (1.40 ± 0.02) $\Gamma/2$, where $\Gamma/2$ is the half-width of the absorption line (0.155 mm/sec) and the resonant cross section is assumed equal to (1.4 ± 0.04) x 10^{-18} cm^2.

The temperature dependence of the factor f' is listed in the table and shown in Fig. 3 for the [001] and [100] directions.

By increasing the statistics (compared with [3]) through the use of a stronger source, better instrumental geometry, and single-crystal samples, we were able to establish the presence of anisotropy of the Mossbauer effect at 4.2°K.

T^0 K	4.2	20	77	195	280
$f'_{[001]}$	0.54±0.02	0.48± ±0.02	0.31±0.02	0.09±0.02	0.04± 0.01
$f'_{[100]}$	0.50±0.02	0,46±0.02	0.34±0.02	0.12±0.02	0.06± 0.01
$f'_{[001]} : f'_{[100]}$	1.08±0.02	1.03±0.02	0.92±0.02	0.75±0.04	0.67±0.04

Remark. The error in the determination of f' in the table is given without account of the systematic error, which in our measurements amounted to 10% of f'.

Thus, the magnitude of the anisotropy, defined as the ratio $f'_{001} : f'_{100}$, was found to be (1.08 ± 0.02), within the limits of experimental accuracy. The anisotropy of the Mossbauer effect goes through an inversion in the region T = (40 ± 5)°K.

The temperature dependence of the Mossbauer-effect anisotropy can probably be attributed to an overlap of the optical and acoustical branches of the phonon spectrum of tin [4,5].

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INSTABILITY OF AN INHOMOGENEOUS PLASMA

M. A. Vlasov
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1. It has been shown theoretically [1] that oscillations can build up in an inhomogeneous plasma with phase velocities on the order of the velocities of the Larmor drift of the particles in a magnetic field. The resultant instability is called drift (universal) instability. In spite of the appreciable progress made in the theory, experimentally this form of instability has been little investigated. The purpose of this study was to investigate an inhomogeneous plasma produced in a low-pressure arc discharge with incandescent cathodes[2]. The first series of investigations [3] have been devoted to the behavior of such a discharge at low pressures (from 5×10^{-6} to 10^{-4} torr). It has been shown that a negative charge column is formed in this case and becomes unstable under certain conditions. This is manifest in the appearance of a torch which rotates in stationary fashion on the electron side, and breaks away from the region of the primary beam. The instability has a drift character, and the appearance of the torch is a result of the polarization of the plasma in the beam of primary electrons in the presence of azimuthal inhomogeneity in the density and of a difference in the drift velocities of the ions and electrons. In the present communication we describe briefly the main experimental results obtained at higher pressures (4×10^{-4} - 10^{-2} torr).

2. The plasma was produced in an equipotential volume of 76 mm diameter and 400 mm long, the cathode diameter being 10 mm. The working gas was for the most part hydrogen, and in some cases He, N_2, Ne, and Ar. The magnetic field ranged from 100 to 3000 Oe. A stationary discharge was produced in the chamber with U_a from 100 to 400 V and I_a up to 600 mA. The measurement of the plasma parameters, and of the oscillations that accompany the instability was by means of Langmuir probes, but in some cases a plasmoscope [2] was used.

3. The investigation of the plasma instability has shown that there are two characteristic regions. In the first there are no plasma oscillations and the diffusion has a classical character. In the second, oscillations are observed with a spectrum that depends on the plasma parameters, and the diffusion has both classical and anomalous behavior features. The conditions for the occurrence of the plasma instability, and the character of the instability, depend strongly on the initial transverse gradients of density, potential, and temperature. To determine these quantities, experiments were set up under the conditions