Q_α = (5064 ± 15) kev, if we take the value $E_{\beta max}$ = (1510 ± 10) kev[3] for Tl^{206}. The total α-decay energy of the long-lived Bi^{210} isomer is Q_α = (5286 ± 15) kev if we take into account the recoil of the nucleus and the energy of the γ quanta. This value of Q_α is 220 kev larger than the above mentioned energy of the α decay of RaE. One must thus assume that RaE with $T_{1/2}$ = 5.01 days is the ground state of Bi^{210} and the state with $T_{1/2} = 2.6 \times 10^6$ yr a metastable one. The partial lifetime of Bi^{210m} relative to an electromagnetic transition T_γ can be estimated from the build up of Po^{210} from the subsequent decay through RaE. It is clear from Table I that the intensity of the α-line of Po^{210} with an energy of 5300 kev is ≤ 0.01%, which corresponds to $T_\gamma \geq 10^{10}$ yr.

The energy levels of Bi^{210} were calculated by Yu. I. Kharitonov on the nuclear shell model basis taking pair interaction and the interaction with the nuclear surface into account. It was shown that the lowest levels of Bi^{210} corresponded to the $(h_{9/2})^1_p(g_{9/2})^1_n$ configuration and that one should assign spins and parities 1^- and 0^- to the ground state and first excited state and 9^- to the isomeric state. Similar calculations for Tl^{206} point to a doublet structure of the levels and lead to spin values corresponding to the configurations $(s_{1/2})^{-1}_p(p_{1/2})^{-1}_n$, $(d_{3/2})^{-1}_p(p_{1/2})^{-1}_n$, $(d_{5/2})^{-1}_p(p_{1/2})^{-1}_n$ or $(s_{1/2})^{-1}_p(f_{5/2})^{-1}_n$ (Fig. 3). For the given values of the spins and parities the α decay to the ground state of Tl^{206} must be forbidden, because of parity, which agrees with the experimental data.

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*EXPERIMENTAL INVESTIGATION OF THE HARMONIC OSCILLATIONS OF A DISK IN ROTATING HELIUM II**

É. L. ANDRONIKASHVILI and D. S. TSAKADZE

Tbilisi State University

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THE problem of the oscillations of a system of circular disks suspended from a torsion fiber in helium II, and participating together with the latter in uniform rotational motion, has been investigated by us[1,2] and by Hall.[3,4] It has been shown that the period of oscillation of such a stack of disks depends upon the ratio of the frequencies Ω (the frequency of the oscillations) and ω (the rotational frequency), as well as upon the spacing of the disks and the condition of their surfaces. These investigations, however, failed completely to take into account the possibility of changes in the damping processes in rotating helium II.

With the object of studying this aspect of the problem, we constructed an apparatus in which a transparent beaker of organic glass 44 mm in diameter filled with liquid helium performed uniform rotational motion at angular velocities of from $\omega = 13 \times 10^{-3}$ sec^{-1} to $\omega = 129 \times 10^{-3}$ sec^{-1}. A single circular disk 1 mm thick and 30 mm in diameter, suspended within the beaker of helium, took part simultaneously in two types of motion: rotation, with the same velocity as the beaker; and harmonic oscillation about an axis perpendicular to its own plane and parallel to that of the beaker. The surface of the disk was alternatively covered with granules with linear dimensions $l \approx 50\,\mu$, or polished. The frequency of the oscillations of the disk was 0.581 sec^{-1} in the case of the rough surface and 0.551 sec^{-1} for the smooth surface case.

The logarithmic damping decrement δ of the oscillations of the disk was determined by noting the time required for a light spot associated with it to traverse a fixed path between two photomultipliers rotating, together with a scale, in synchronism with the beaker. A detailed description of this apparatus, as well as of the theory of the method, has been given in reference 5. Calibration of the system was carried out using classical liquids (water, helium I), for the viscosity coefficients of which good agreement was obtained with tabulated data. In both cases the damping remained constant over the whole velocity range investigated, to within the limits of experimental error.

In the case of helium II, the damping decrement has a clearly-expressed dependence upon the rotational velocity, while the curve showing the dependence of the relative increase in the damping arising as a result of the rotation upon the rotational frequency passes through a maximum (Fig. 1), both in the case of the roughened disk (curve a) and of the smooth disk (curve b). Our attention is drawn to the fact that the ordinate of curve a exceeds that of curve b by a factor of not less than two over the whole range of rotational velocities. The character of the fall of the curve beyond the maximum is quite different for the rough and smooth disks, as is the sign of the curvature.

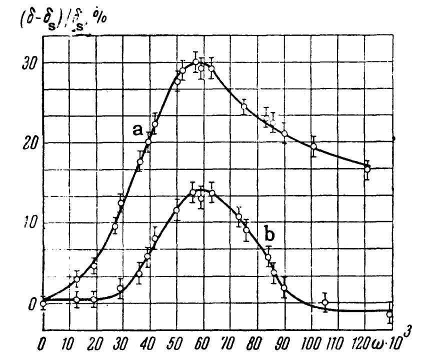


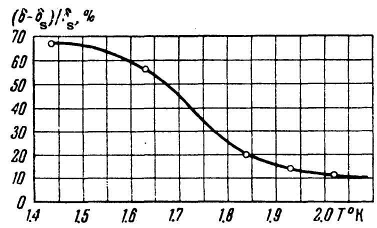
FIG. 1. Relative increase in the disk damping decrement as a function of angular velocity of rotation: a – for disk with roughened surface, b – with smooth surface; δ_s – damping in stationary helium II, δ – damping in rotating helium II; temperature 1.78°K.

In the smooth disk case the curve, near the origin, runs parallel to the x axis, which indicates, evidently, that under these conditions a slippage of the vortices is observed relative to the polished surface (i.e., the vortices are not fixed on the surface).

The temperature dependence of the maximum increase in the relative damping (at $\omega = 55 \times 10^{-3}$ sec^{-1}) for the roughened disk is shown in Fig. 2. It is characteristic that over the whole temperature interval the increase in the damping arising from entrainment of the superfluid component does not exceed 65 – 70% of the damping due to friction with the normal component.

To explain the features of the behavior of the curves presented in Fig. 1, Yu. G. Mamaladze, has suggested that the linear dependence of $(\delta - \delta_S)/\delta_S$ upon ω found at the beginning of the curve gives place to a more complex dependence when the distance between neighboring vortices becomes equal to their effective diameter. On this hypothesis the parameter $\nu = \epsilon/\rho_S\Gamma$ of

FIG. 2. Temperature dependence of the maximum value of the relative increase in the damping of the disk with roughened surface.



Hall and Vinen, where ϵ is the vortex energy per unit length and Γ is the circulation, was computed from the data of the present experiment. It was found that $\nu = 6$ to 8×10^{-4} $\mathrm{cm}^2\ \mathrm{sec}^{-1}$, which agrees well with the value found bý Hall himself.

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LOCALIZATION OF A HIGH-FREQUENCY INDUCTION DISCHARGE

M. D. RAĬZER and S. E. GREBENSHCHIKOV

P. N. Lebedev Physics Institute, Academy of Sciences, U.S.S.R.

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We have investigated a high-frequency induction discharge in an axially symmetric magnetic field in the pressure range 1 – 100 mm Hg in various gases (air, hydrogen, and helium).