now under way.

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SHIFT OF λ POINT OF LIQUID HELIUM IN A ROTATING ANNULAR GAP

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It was shown in [1] that the λ point of liquid helium in a rotating singly-connected loop experiences no shift, accurate to 5×10^{-4} degrees, at a rotation speed $\omega_0 = 0.56$ sec^{-1}. In the present investigation the measurement accuracy was increased by more than one order of magnitude, on the one side, and higher rotation speeds were used, on the other. As before (see [1]), we used a resistance thermometer made of lead-brass wire bifilarly wound on a paper ribbon.

The experiment was performed in the following fashion: He II near the λ point was set in rotation, after which the vacuum pump was disconnected and the rotating He II was converted into He I, and at the same time a thermogram of the heating of the liquid was plotted; the λ-point position was clearly seen on the plot in the form of a characteristic break. Comparison of the position of the break on the thermogram of the rotating liquid with the position of the break on the thermogram of the stationary He makes it possible to determine the shift of the λ point. The thermometer was placed in a Plexiglas cylinder of 38 mm diameter. At a rotation speed $\omega_0 = 9.3$ sec^{-1}, the λ point of the liquid helium showed no shift with accuracy to 3×10^{-5} deg.

It was possible, however, to observe a shift of the phase-transition point in a doubly-connected volume. To perform this experiment, the wire-wound thermometer was placed in a gap between two coaxial cylinders rotating at the same angular velocity. The inside diameter of the outer cylinder was 44 mm, and the outside diameter of the inner cylinder was 40 mm. The shift of the λ point of the liquid helium placed in such an annular gap is $\Delta T_\lambda = (1.2 \pm 0.4) \times 10^{-4}$ deg at a speed $\omega_0 = 6.5$ sec^{-1}. ΔT_λ increases with increasing rotation speed.

We have thus shown that rotation shifts the λ point towards lower temperatures only in an annular gap.

The fact that we were unable to observe the shift of the λ point in a singly-connected loop is the consequence of the effect of quantum closeness. When the linear velocity near the rotation axis is not large enough to disrupt the superfluidity, the ψ function of the Bose condensate penetrates also into those regions in which the linear velocity is in general sufficient to transform the He II into the normal state. The internal cylinder makes it impossible for the ψ function of the s-component to exert any influence on the state of the liquid He in the gap, and consequently makes it possible for the λ point to shift.

Thus, we attained in this experiment a critical velocity ω_{c_2} at which the superfluidity vanishes at a lower temperature than for stationary helium. The presence of a second critical velocity ω_{c_2}, which greatly exceeds the first critical velocity ω_{c_1} at which the first vortex is produced in the superfluid component, allows us to establish a new far reaching analogy between the behavior of rotating superfluid liquids and the behavior of superconductors of the second kind.

As is well known, for such superconductors there exist two critical magnetic fields H_{c_1} and H_{c_2}, corresponding to the occurrence of the first Abrikosov vortex [2] and to the destruction of superconductivity.

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PLASMA RESONANCE ON NONEQUILIBRIUM CARRIERS IN SEMICONDUCTORS

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Observation of plasma resonance on nonequilibrium carriers produced in a semiconductor at exciting-light intensities on the order of 10^{25} quanta/cm^{2}sec under conditions when there is still no damage to the surface of the sample would make it possible to estimate the density Δn of nonequilibrium carriers and the relaxation (scattering) time τ of the carriers from the position and depth of the minimum of the reflection coefficient R; such a minimum is characteristic of plasma resonance. As shown by us in [1], the density of such carriers reaches only about $(3 - 7) \times 10^{19}$ cm^{-3} in Si and GaAs, and accordingly the plasma resonance and the increase of R should be observed in the wavelength region $\lambda = 5 - 10\ \mu$.

We have investigated the change of the reflection coefficient ΔR at a wavelength $\lambda = 10.6\ \mu$ as a function of the intensity of the exciting light for Ge, Si, and GaAs. The experimental setup is shown in Fig. 1. The use of a Q-switched ruby laser ($t_{\text{pulse}} \approx 4 \times 10^{-8}$ sec) to produce non-equilibrium carriers called for the use of a low-inertia infrared receiver (photoresistor of Ge doped with gold) and of a powerful source of probing radiation (CO_2