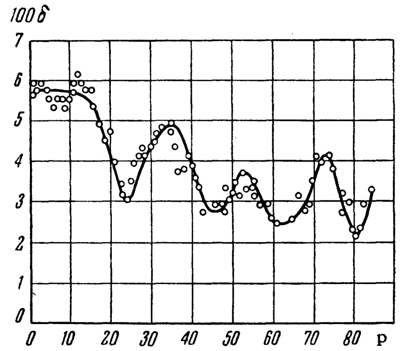

FIG. 1

We show in Fig. 1 the results of our measurement performed using one disc covered on both sides with grains of linear dimensions $l \approx 50\,\mu$ (the number of periods is along the abscissa). The measurement took place at 1.38°K and the rotational frequency was $\omega = 55 \times 10^{-3}$ sec^{-1}. The level of the helium above the surface of the disc changed rapidly thanks to intensive illumination (rate of evaporation 3.6×10^{-2} mm/min). The initial part of the curve corresponds to the induced swinging of the oscillating system. In Fig. 2 we show the results of an experiment performed under the same conditions as the previous one, except for the fact that the rate of change of the liquid level above the disc was much slower in this case (0.5 mm/sec) because the illumination was switched off.

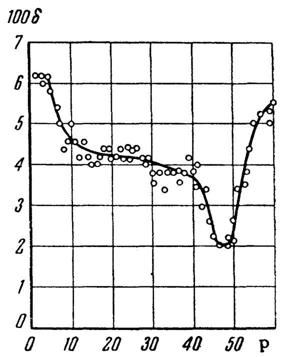

FIG. 2

From the curves obtained it is clear that when the rate of evaporation of the helium above the disc is changed the character of the periodicity of the damping is also changed. This result may be explained by assuming that a standing transverse wave appears in the vortex lines when the disc oscillates. The distance between two adjacent resonances corresponded to a lowering of the level by ~ 0.065 cm.

The authors express their thanks to Yu. G. Mamaladze for his active participation in the discussion of the experimental results in all stages of their development, and to T. M. Shul'ts, K. B. Mesoed, and I. M. Chkheidze for their help in performing the experiment.

*Reported at the Fifth All-Union Conference on Low Temperature Physics at Tbilisi, October 1958.

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THE USE OF A SUPERCONDUCTING RING FOR REGISTERING THE PHASE TRANSITION IN LIQUID HELIUM

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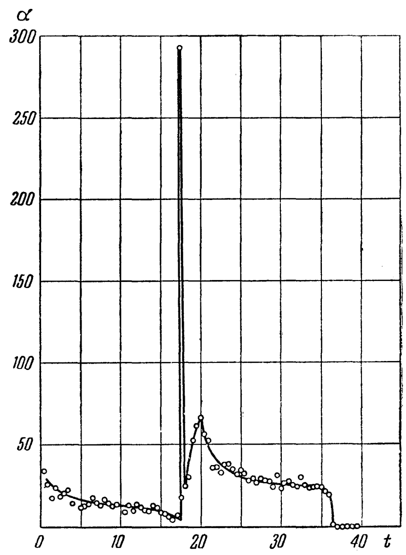
IT is often desirable, when investigating the properties of He^3-He^4 mixtures, especially the properties of rotating helium, to have a thermometer which does not need external leads, is sufficiently sensitive, and dissipates a negligible amount of heat. These requirements are satisfied by a superconducting ring,* in which a current is induced by switching on and off an external magnetic field higher than the critical value.

When the temperature dependence of the current in the ring is known, the determination of the temperature of the liquid helium reduces to a measurement of the magnetic field of the ring by some instrument located outside the apparatus.

In experiments where there is a steady increase in temperature and, consequently, a continuous decrease of current in the ring, a stationary induction coil connected to a galvanometer can be used, and an emf will be induced by the decreasing magnetic field of the ring. The magnitude of the emf depends on the rate of change of current in the ring, i.e., on the rate of temperature rise which, for a constant heat input, is determined by the heat capacity of the system. This makes the use of a superconducting ring especially convenient for registering phase transitions.

We have used this system under conditions of a slow transition from He II to He I. In this experiment the current was induced in a tin ring fixed in a plexiglass vessel containing liquid helium[2] at 1.5° K, after which pumping of the helium vapor was stopped and the vessel was illuminated with a beam of light.



The results are shown in the figure, where the deflection (α) of the mirror of the galvanometer connected to the stationary coil is plotted as a function of the time (t) of warming of the helium (t = 0 corresponds to 1.5° K). Insofar as the heat influx to the system remained practically constant during the course of the experiment, the variation of α(t) determines the temperature dependence of the heat capacity of liquid helium. This explains the decrease in α with increasing temperature from 1.5° K to the λ point (from t = 0 to t = 17.5 min), the sharp increase in α at the λ point corresponding to the specific heat jump at this temperature, and the slow decrease in α in the He I region. At the transition temperature for tin the deflection must, of course, become zero (T = 3.73° K, t = 36.5 min).

We should point out that during the transition through the λ point there is a large and sharp peak superimposed on the variation of α(t) described, probably connected with the appearance of a small temperature difference between the ring and the helium under the conditions described. Such a temperature difference can perhaps be explained by a change in the mechanism of heat transfer in He II and He I. When the helium was heated electrically by a heater in the liquid, instead of by light, the change in α corresponded to the temperature dependence of the heat capacity of helium and the peak was absent. The sharp change in α makes it possible to record the transition through the λ point with great accuracy.

This method will be used to investigate the He II-He I transition in rotating helium and to determine the λ temperature of isotopic mixtures.

In conclusion we would like to thank Professor B. G. Lazarev for discussion of the results.

*A ring of tin was used by Galkin, Kan and Lazarev to study the properties of the superconducting transition[1] and to measure the thermal conductivity of copper.

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NUCLEAR REACTIONS INDUCED BY HEAVY IONS

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PARFANOVICH, Rabin, and Semchinova[1] have studied stars produced in nuclear emulsions by accelerated nitrogen and oxygen ions. Two interesting and unexpected effects were observed, one of which is a strong forward directional effect of protons and α particles in the stars. Secondly, the proton to α particle ratio is much smaller than would be expected according to Le Couteur's theory of evaporation of a compound nucleus. Both effects have been confirmed by qualitative observations in our laboratory at Birmingham.