that is standard for the BK approximation.

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QUANTUM EFFECTS IN A SINGLY-CONNECTED SUPERCONDUCTING CYLINDER

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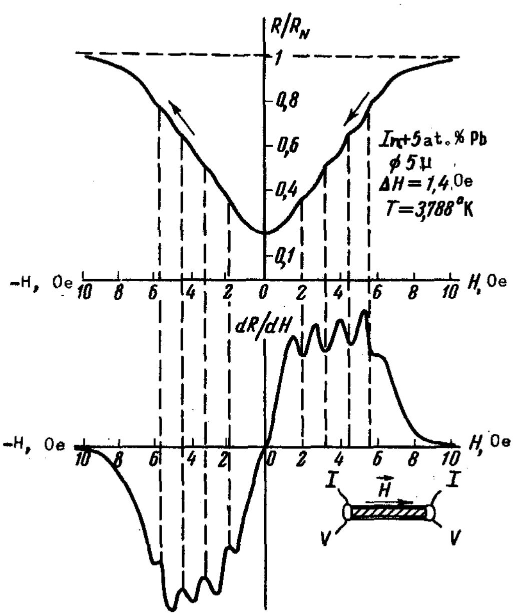
As is well known [1], a superconducting surface-current layer is produced in superconductors with $\kappa \gtrsim 0.4$ in fields $H \leq H_{c3} = 1.69H_c$ parallel to the superconductor surface. Such a superconducting surface layer is analogous to a doubly-connected superconductor that quantizes the magnetic flux. The possibility of quantization by means of surface-superconductivy currents was considered theoretically in a paper by Saint-James [2]. On the basis of his paper, one could expect the existence of an oscillatory dependence of the critical temperature of solid small-diameter cylinders, in analogy with the behavior of hollow thin-wall superconducting cylinders in the experiments of Parks and Little [3].

We investigated the resistance of a wire of indium alloyed with 5 at.% lead [4], with diameters from 1 to 5 μ, as a function of the magnetic field parallel to the wire axis at temperatures near critical. The samples were prepared by drawing a glass capillary with the molten metal. The glass was not removed from the sample. The figure shows a typical R(H) plot obtained for a sample of approximately 5 μ diameter and 4 mm length. The same figure shows a plot of the derivative dR/dH. The amplitude of the field modulation was 0.1 G.



A theoretical calculation of δT_c [5], based on a calculation of the field $H_{c3}(T)$ for bounded samples by a variational method leads to a formula analogous to the case of the Parks-Little effect:

$$\delta T_c = 0{,}14\, T_c \left(\frac{\zeta_0}{a}\right)^2,$$

where a - radius of cylinder. The amplitude of the oscillations of T_c, calculated from the experimental data, turned out to be on the order of 10^{-4} deg in agreement with the presented formula. The period of the oscillations R(H) corresponds to the quantum of the flux in the section of the cylinder. Notice should be taken of certain features of the effect.

1. The oscillation amplitude depends on the direction of change of the field - the amplitude is larger in decreasing fields.

2. The oscillations on the R(H) curve are observed up to its inflection point (maximum of the derivative).

3. Unlike the Parks-Little effect, the oscillation amplitude decreases with decreasing temperature.

4. According to calculations by I. O. Kulik (private communication), the oscillation period decreases with decreasing temperature in the appropriate quantitative ratio.

The preliminary experimental results presented here give grounds for assuming that we are dealing here with the effect predicted in [2]. More detailed quantitative investigations of the effect are now under way.

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MOSSBAUER EFFECT ON IMPURITY NUCLEI IN METALLIC MATRICES

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Until recently, the Mossbauer effect (ME) on impurity nuclei was investigated only in the widely used Mossbauer isotopes Fe^{57}, Sn^{119}, and Au^{197} [1-3].

Such investigations are usually intended to determine two quantities: the isomer shift δ of the resonance line and the ME probability f. An empirical connection is established between these parameters of the Mossbauer spectrum and certain properties of the solid, say the dependence of δ or f on the compressibility of the metallic matrix, the force constants of the coupling, the electronegativity, valence, concentration, etc.

The ME can be investigated by introducing into the matrix stable impurity isotopes or active γ-emitting isotopes. The second method is more convenient for the investigation of the ME on Te^{125} nuclei. The Mossbauer isotope Te^{125}, in analogy with Fe^{57} and Au^{197}, has another parent nucleus, since the Mossbauer level Te^{125} with energy 35.6 keV is obtained by decay of Sn^{125} into Sb^{125}. Therefore, the sources of the resonant γ quanta were made of tin enriched to 90% with Sn^{124}, irradiated by a neutron flux (the Te^{125} is produced in accordance with the scheme $Sn^{124}(n, \gamma)Sn^{125} \rightarrow Sb^{125} \rightarrow Te^{125}$), and introduced by fusing, in amounts 0.5 - 1 wt.%, into gold, silver, copper, palladium, tin, indium, lead, and magnesium of very