but to a finite discontinuity. A more accurate account of the interaction between the electrons in the superconductor should lead to the appearance of a singularity in the specific heat at the transition point [4]. In a bulky superconductor, however, as indicated above, the temperature interval near T_c, where this singularity becomes noticeable, is so small that an experimental investigation of this phenomenon is impossible. The calculation presented shows that for finely-dispersed superconductors this temperature interval increases by many orders of magnitude and can reach values of the order of one degree. An experimental investigation of this phenomenon would contribute to a refinement of our ideas concerning the interaction between electrons in a superconductor.

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[1] We expand Ψ in a Fourier integral, $\Psi = \int \Psi_q \exp(i\vec{q}\cdot\vec{z})d\vec{q}$. The wave vector q corresponds to the pair momentum $\hbar q$. The condition for pair stability is $\hbar q v_0 \leq 2\Delta_0$, where $2\Delta_0$ is the energy gap at $T = 0$ and v_0 is the electron velocity on the Fermi surface. Consequently $q \leq 2\Delta_0/\hbar v_0 \sim \xi_0^{-1}$.

EFFECT OF ELECTRIC FIELD ON TRANSPORT PHENOMENA IN POLAR GASES WITH NONSPHERICAL MOLECULES

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It is known that the viscosity and thermal conductivity of gases with nonspherical molecules changes in a magnetic field [1-6]. The effect is attributed to the fact that precession of the magnetic moments of these molecules in the magnetic field increases the effective cross section for their collision, and consequently decreases the transport coefficients [7-9]. At constant temperature this effect is a single-valued function of the ratio of the magnetic field to the pressure. It would be natural to expect an analogous effect of the electric field and the transport coefficients of polar gases with nonspherical molecules. We have therefore undertaken investigations of the influence of an electric field on the thermal conductivity of gases of this type. It was assumed that in an electric field the effect would qualitatively have the same character as in a magnetic field, provided there were a sufficiently high probability that the molecules of the investigated gas, as in the case of a magnetic field, rotate in such a way that the rotation axis does not make a right angle to the dipole moment. In view of this, special attention was paid by us to investigations in nitrogen trifluoride (NF_3), whose molecules form a trihedral pyramid (angle FNF ~ 102°, dipole moment d ~ 0.24D). In addition, experiments were made with other gases - ethyl chloride (C_2H_5Cl), ethyl alcohol (C_2H_5OH), CO, NO_2, and SO_2. We present here preliminary results of these investigations.

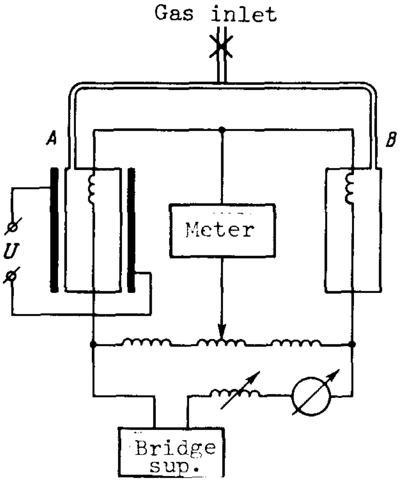

Fig. 1

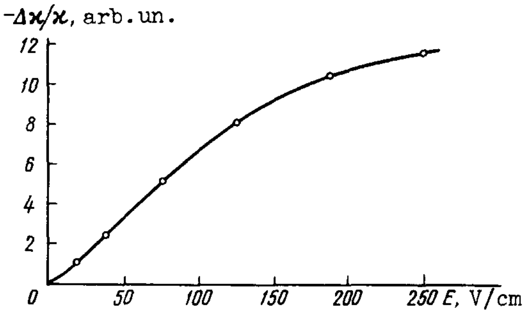

Fig. 2

Figure 1 shows the schematic diagram of the setup. The pickup comprises two interconnected glass chambers (15 mm i.d.) through which electrically heated platinum wires (50 μ diameter) are drawn. The wires are two arms of a Wheatstone bridge. A microvoltmeter sensitive to a pressure change of 10^{-6} is connected in the diagonal of the bridge. The relative change in the thermal conductivity ($\epsilon = -\Delta\kappa/\kappa$) can be judged from the bridge unbalance occurring when an electric field is turned on in one of the chambers. The measurements were made at pressures ~0.06 - 1 mm Hg and in electric fields (E) up to ~1 kV/cm. Figure 1 shows a circuit variant in which one of the chambers (A) is placed in a uniform electric field. In some cases the effect was estimated by producing an inhomogeneous field in chamber B. To this end, a voltage (U) up to several kV was applied between the metallic screen placed over this chamber (not shown in the figure) and the wire in the chamber. Both constant and alternating fields (frequency 50 cps - 20 kcs) were used in the experiments. In all measurement variants, the absence of extraneous effects was confirmed, in particular, by the fact that the effect turned out to be equal to zero in argon, air, and CCl_4 vapor. One of the criteria of the correctness of the results was their independence of the sign and frequency of the field.

Figure 2 shows a plot of ϵ vs. E, obtained for NF_3 at a pressure ~ 0.1 mm Hg by using a homogeneous alternating field. As seen from the figure, ϵ has a tendency to saturate. At maximum E (~ 0.3 kV/cm) ϵ turned out to be of the order of 0.5%, i.e., of the same order as

ϵ_{max} for nonpolar gases, such as O_2 and N_2, placed in a magnetic field (for which ϵ_{max} is approximately 1%). According to preliminary data, ϵ is a function of the ratio E/P.

It must be noted that attempts were already made earlier to investigate the influence of an electric field on the viscosity of certain polar gases. For example, P. Cioara [10] indicates that for a mixture of C_2H_5OH (d ~ 1.7D) and CH_4 (d = 0) the relative change in viscosity at E ~ 35 kV/cm was $-\Delta\eta/\eta \cong 0.2\%$. It is also indicated that $\Delta\eta/\eta \sim B^2$. Unfortunately, there are no concrete data in [10] on the pressure of the gas mixture and on the concentration of the C_2H_5OH vapor, so that we cannot compare the experimental data with other results and gain an idea of the character of the observed effect. Another worker, R. Amme [11] produced a field ~ 12.5 kV/cm in the pickup and obtained $-\Delta\eta/\eta = 0.47 \pm 0.16\%$ for C_2H_5Cl at E/P ~ 32 kV/cm-atm and $-\Delta\eta/\eta = 0.46 \pm 0.16\%$ for OCS (d ~ 0.7D) at E/P ~ 59 kV/cm-atm. Our experimental estimates of the effect in C_2H_5Cl and C_2H_5OH at p ~ 0.5 mm Hg and E ~ 0.2 kV/cm (with E/P approximately 8 times larger than in Amme's experiments) have shown that under these conditions the value of ϵ for these gases is apparently not larger than 0.01% and at any rate much lower than 0.1%. At a C_2H_5Cl vapor pressure ~ 0.1 mm Hg and E ~ 0.3 kV/cm (with E/P larger by approximately two orders of magnitude than in Amme's experiments) ϵ turned out to be less than 0.1% (~ 0.04%). The considerable disparity between our results and Amme's is apparently due to the fact that the viscosity changes observed in his experiments are not connected with the precession of the molecules.

Our investigations of CO (d ~ 0.12D), NO_2 (d ~ 0.17D), and SO_2 (d ~ 1.8D) have shown that for these gases, at p ~ 0.5 mm Hg and E ~ 0.2 kV/cm the value of ϵ is zero, accurate to several thousandths of one per cent.

During the course of writing this paper we learned of Senftleben's recent investigations of the influence of an electric field on the thermal conductivity of chloroform ($CHCl_3$, tetrahedron, d ~ 1D) and ethyl chloride [12] $^{1)}$. These experiments were made essentially with an inhomogeneous field, so that, unfortunately, comparison of his results with others and with the theory is difficult.

We propose to carry out in the future more careful investigations of the effect in the already mentioned gases, and also in other gases.

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CONCERNING TWO-NUCLEON RESONANCES

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Belletini et al. [1] have noted in their experimental paper an anomalous behavior of the differential cross section of the reaction

$$p + d \rightarrow p + x \qquad (1)$$

as a function of the missing mass m_x. In the region of $m_x = (2.33 \pm 0.01)$ GeV there is a clearly pronounced maximum with width $\Gamma = 250$ MeV. Under the experimental conditions the square of the 4-momentum transfer varied in the range $10^{-3} < t(\mathrm{GeV}/c)^2 < 10^{-1}$.

We propose in this note a mechanism for this intensification, based on the notion that the incident proton interacts with one of the nucleons of the deuteron, forming an isobar N* which is subsequently scattered inelastically by another nucleon. It is natural to choose as N* the isobar with mass $m_{N*} = (1.4 \pm 0.01)$ GeV ($\Gamma = 200$ MeV), which was observed by the same group in the reaction $p + p \rightarrow p + x$ and was more pronounced than the remaining isobars.

The amplitude of the reaction (1) in the region of interest to us can be represented as a sum of diagrams (see Fig. 1) which contribute to the amplitude of the reaction (1).

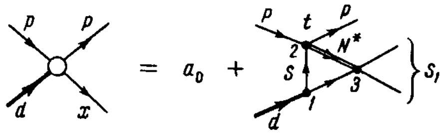

Fig. 1

Here and throughout we use the following notation: S - energy squared in the c.m.s. of the incident proton and deuteron, S_1 - energy squared in the c.m.s. of the particles emitted at the vertex 3. If we denote by $a_\triangle$ the amplitude of the triangular diagram and by a_0 the amplitude corresponding to all other terms, then the differential cross section can be expressed in the form $d\sigma = |a_0 + a_\triangle|^2 d\tau$, where $d\tau$ is the phase volume of the final particles of reaction (1).

In the given experiment (with small t and $m_x = \sqrt{S_1} \simeq m_N + m_{N*}$) we can assume that the