drop temperature T_e calculated from (4), using the values $\phi = 1.5$ meV [4, 5] and $t_c = 3.5$ μsec at 4.2°K (Fig. 1a). It is seen from Fig. 2 that the drop temperature T_e increases approximately in proportion to the pressure gradient and reaches ∿6°K. Naturally, at such a high temperature the electron-hole drops in the germanium evaporate almost completely and there is no more recombination radiation from the condensed phase of non-equilibrium carriers.

The authors thank S. V. Poteshin for help with the experiment.

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EPR OF FREE RADICAL DPPH AT INFRALOW TEMPERATURES

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The study of the magnetic properties of organic paramagnets of the free-radical type at very low temperatures is of undisputed interest, since simple magnetic-system models that lend themselves to a rigorous theoretical analysis, are frequently realized in such paramagnets. One of the most thoroughly studied representatives of this class of substances is the free radical αα-diphenyl-β-picrylhydrazyl (DPPH).

Vanishing of the resonance signal at temperatures $T_{cr} = 0.2 - 0.3$°K in DPPH samples crystallized from benzene was first observed at low frequencies in [1] by the EPR method. This fact was interpreted as the result of a phase transition into an antiferromagnetic state, and the absence of such a transition at high freqeuncies [2] was attributed in [1] to destruction of the antiferromagnetic order by the constant magnetic field necessary to satisfy the resonance conditions.

We report here observation of a phase transition in two types of DPPH samples at temperatures below 1°K, using an EPR method at intermediate frequencies (300 MHz). The specimens were finely crystallized powders of the radical, crystallized from two solvents, benzene and chloroform.

The EPR signal was detected with a superheterodyne spectrometer at a working power level on the order of 10^{-7} W to exclude spin saturation and high-frequency heating of the sample. Temperatures below 1°K were produced by adiabatic demagnetization of a block of paramagnetic iron ammonium alum salt, with which the sample was in contact through a copper cold finger. Demagnetizing fields on the order of 20 kG were obtained with a small superconducting solenoid.

The results are listed in the table:

Sample type	t_m, °C	δH(4,2°K), G	δH(1,8°K), G	T_{cr}, °K
DPPH(I) (from benzene)	106	5,3	5,9	0,25 ±0,15
DPPH(II) (from chloroform)	120	3,1	3,8	0,9 ±0,1

where t_m is the melting temperature of the sample, δH is the peak EPR line width at the corresponding temperature, and T_{cr} is the temperature at which the EPR signal vanishes.

The value of T_{cr} obtained for the benzene sample agrees well with the results of [1], in spite of the fact that hour measurements were made at large values of the constant magnetic field. This means that in measurements up to 300 MHz the exchange energy still exceeds the Zeeman energy appreciably.

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The properties of DPPH, as is well known [3], depend strongly on the method by which it is prepared. The values of t_m and δH given in the table agree with the published data. It can be stated that the exchange integral, and hence the temperature T_{cr} in the sample DPPH (I) will be higher. Indeed, in our experiments the EPR signal of the sample DPPH(II) vanished at a higher temperature. The obtained temperature difference for the two samples turned out, however, to be unexpectedly large (by 3 - 4 times).

The magnetic properties of the radical DPPH can be satisfactorily described by the one-dimensional Ising model with allowance for a weak interaction between the chains; it is this interaction which leads to the existence of the phase transition (see, e.g., [4, 5]). In our case it can be shown that the possible difference in the solvent-molecule concentration is insufficient to account fully for the observed difference in T_{cr}. It must apparently be assumed that the exchange integrals within the chains are also different in the samples DPPH (I) and DPPH (2).

We note in conclusion that measurements of the phase-transition temperatures, at different frequencies, of DPPH samples crystallized from different solvents, in conjunction with x-ray structure data, make it possible in principle to investigate experimentally the dependence of the exchange interaction on the distance.

The authors thank N. E. Alekseevskii for consultations on the technique of obtaining very low temperatures, M. M. Zaripov for a discussion of the work, and F. G. Valitova for preparing the samples.

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GASDYNAMIC LASER USING HYDROCARBON-AIR MIXTURE COMBUSTION PRODUCTS

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Submitted 26 April 1973
ZhETF Pis. Red. 17, No. 12, 651 - 654 (20 June 1973)

The purpose of this study was to ascertain the feasibility of using the combustion products of hydrocarbon-air mixtures as laser media for the development of high-power gasdynamic lasers (GDL).

The ideas underlying the production of GDL were developed in [1, 2]. The use of a $CO_2 + N_2$ mixture for GDL was first proposed in [3, 4]. Various types of GDL were subsequently developed on the basis of these ideas [5 - 10]. Particular interest attaches to the use of the combustion products of hydrocarbon fuels to obtain laser media.

The laser described in the present paper is a quasicontinuous GDL operating on hydrocarbon-air mixture combustion products. The fuel in the first experiments was acetylene, which has a high reaction rate and whose combustion products have the minimum water-vapor content relative to the number of produced CO_2 molecules.

A schematic diagram of the experimental setup is shown in Fig. 1. It consists of a combustion chamber 1, an expansion chamber 2, a double planar supersonic nozzle 3, a multipass resonator cavity 4, and a vacuum chamber 5. Prior to the experiment, the entrance into the nozzle from the combustion-chamber side was covered with membrane 6, making it possible to evacuate the nozzle, the resonator, and the vacuum chamber to the required pressure. The combustion chamber, a channel of 70 mm diameter and 1.5 mm length, was then filled with an acetylene-air mixture of definite composition. The mixture was ignited with a spark plug 7, and the combustion process was registered with a piezoelectric pressure pickup 8.

In the combustion process, the pressure in the combustion chamber increased, the membrane was broken, and the combustion products entered the expansion chamber. The main purpose of the expansion chamber was to increase appreciably the stream cross section, by widening it to 50 cm,