Stanley and Kaplan [4] have shown that a phase transition should be observed in two-dimensional paramagnets. On the other hand, Mermin and Wagner [5] have proven that in such paramagnets there is no spontaneous magnetization at any nonzero temperature. Therefore the phase transition in the two-dimensional Heisenberg model does not lead to establishment of long-range order. At the same time, the presence of even weak anisotropy, which makes any one direction favored, transforms the two-dimensional system into a ferromagnetic state [6]. In real paramagnets, one of the sources of the anisotropy fields is the dipole-dipole interaction of the magnetic ions. In the two-dimensional case such an interaction has axial anisotropy and causes the spin to be located in the plane of the layer. However, the ferromagnetic spin arrangement does not correspond to the minimum of the dipole energy. The formation of a ferromagnetic spiral is more favored energywise. The pitch of the spiral will be determined by the competing influence of the exchange and dipole interactions. The properties of the investigated compounds can apparently be described by means of the two-dimensional Heisenberg model with allowance for the dipole interaction.

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USE OF LIQUID CRYSTALS TO MAKE INFRARED RADIATION VISIBLE

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The use of cholesteric liquid crystals to make electromagnetic radiation visible in based in the property of these substances that they reflect white light selectively, reproducing the entire visible spectrum from red to violet in a definite temperature interval [1 - 3]. Owing to the internal ordering, the chloresteric liquid crystal has a screw-like structure. With changing temperature, the pitch of the structure changes, leading to selective scattering of the light by the substance, in analogy to a multilayered interference mirror. This property is the basis for the operating principle of image receivers reproducing the thermal picture of an absorbed electromagnetic signal [4, 5].

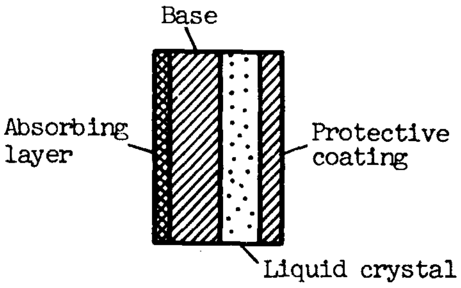

Fig. 1. Diagram of liquid-crystal detector (LCD)

To make near-infrared radiation visible, we constructed a liquid-crystal detector (Fig. 1). The base was a lavsan polyester film having sufficient strength, rigidity, and temperature and chemical stability. The thickness of the base coating was $\sim 30\ \mu$. A layer of finely-dispersed gas lampblack, intended for absorption of the received signal, was deposited on the base. The liquid-crystal material was a mixture of 30% cholesterylpelargonate and 70% cholesteryloleate, with a working temperature range 32 - 36.5°C. The working medium was deposited on the back side of the film base. The thickness of the liquid-crystal layer converting the thermal picture of the received signal into a visible

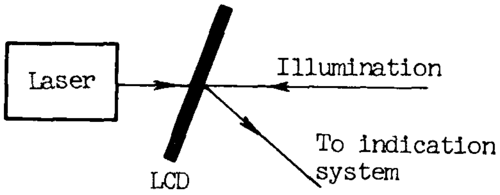

Fig. 2

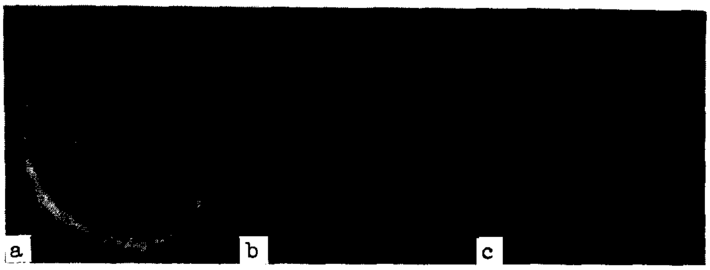

Fig. 3

Fig. 2. Block diagram of experimental setup.

Fig. 3. Image of thermal distribution of laser signal.

picture was 15 - 20 μ. It should be noted that to obtain a contrasty color image it is necessary that the substrate have a black background. In our case, the absorbing lampblack layer, being black, served simultaneously also as the dark background. To protect the system against external action, a lavsan polyester film 10 μ thick was placed over the liquid-crystal layer.

The operating principle of the liquid crystal detector is as follows: the thermal energy released in the absorbing layer upon conversion of the electromagnetic radiation is transferred by heat conduction to the liquid-crystal layer. The latter is heated and when illuminated with white light reproduces a colored image corresponding to the intensity distribution of the input signal. The indicator was used to make the radiation of a neodymium laser visible. The experimental setup is shown in Fig. 2. The Q-switched laser generates a single pulse of duration $\sim 6 \times 10^{-8}$ sec and energy ~ 0.1 J; the beam diameter is 15 mm. The liquid-crystal detector is placed in the path of the laser beam, with the absorbing layer facing the radiation source. The external illumination is by a mercury lamp. When the laser radiation acts on the indicator, the colored image of the thermal distribution is observed visually or is photographed. Figure 3 shows black-and-white photographs illustrating the variation of the thermal distribution following the action of a laser pulse. The light regions correspond to higher temperatures and are colored green and red in succession. The sharp contour framing the colored image corresponds to the boundary of the thermal relief of the pulse reproduced by the given detector. The first photograph was taken immediately after the generation of the pulse, the second 0.2 sec later, and the third 0.4 sec later. On all photographs one can see clearly a diametral line with intensity dips; this line is produced by the edge of the rotating prism used for the Q-switching. The photographs illustrate clearly the capabilities of liquid-crystal films and are of great practical value, if for no other reason, because there are at present no known methods of obtaining readily and simply such photographs in the spectral region where photoelectric converters can no longer be used. The main parameters of the image receiver are as follows: sensitivity in terms of the continuous power $\sim 10^{-2}$ W/cm^2 and in terms of the pulsed energy $\sim 10^{-2}$ J/cm^2, time constant ~ 1 sec, and resolution ~ 2 - 3 lines/mm. Preliminary experiments have shown the liquid-crystal detector to be fully operative with cw helium-neon and CO_2 lasers in the millimeter and submillimeter bands using a metallic absorbing coating. The described image receiver with a liquid crystal can be used to make visible electromagnetic radiation in a wide range of wavelengths, from several microns to several centimeters.

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INVESTIGATION OF METAMAGNETIC TRANSITION IN $FeCl_2$ WITH THE AID OF POLARIZED NEUTRONS

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A metamagnetic transition may produce in $FeCl_2$ regions with nonuniform magnetization distributions; these regions can lead to a strong decrease of the magnetic hysteresis compared with that expected theoretically [1]. Such regions should apparently lead to depolarization of neutrons passing through the sample. A study of the depolarization can yield information both on the magnitude of the critical field H_c^0 and on the process of formation of the saturated phase in the metamagnetic transition.

To investigate the transition with the aid of polarized neutrons, we used a triaxial spectrometer, on the operating stage of which we mounted a helium cyrostat with which it was possible to obtain temperatures 1.3 - 4.2°K in the working volume.

The magnetic field was produced with superconducting solenoids.

Preliminary experiments performed on polycrystals [2] indicated that the metamagnetic transition causes strong depolarization of the neutrons passing

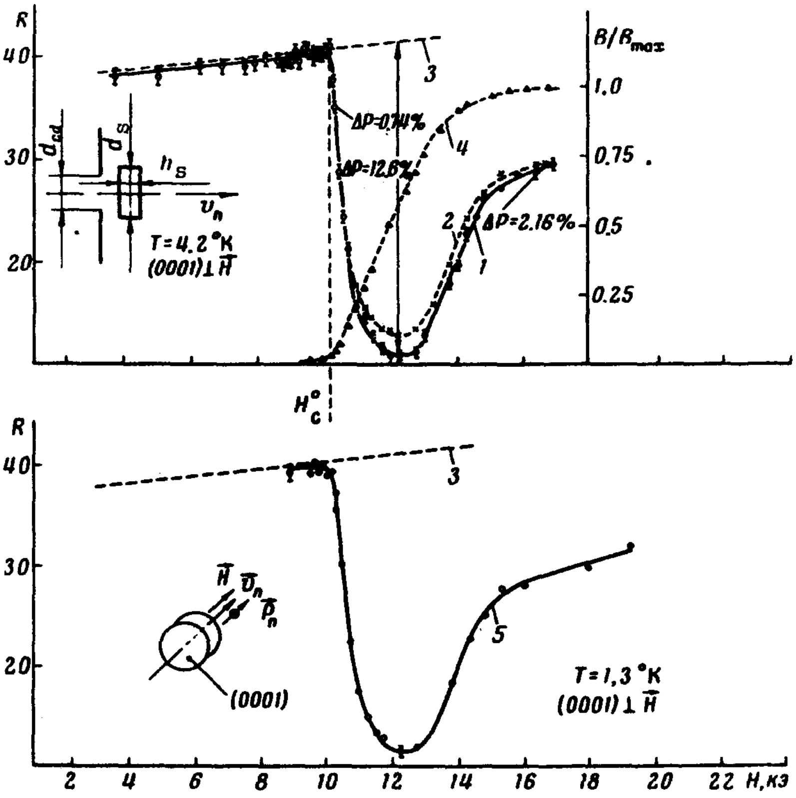

Fig. 1. Dependence of R on the magnetic field H at H ⊥ (0001) for $FeCl_2$. d_{cd} = 0.8 cm - diameter of cadmium diaphragm limiting the neutron beams, h_s = 0.63 cm - sample thickness, d_s = 1.1 cm - sample diameter, v - neutron velocity, P_n - neutron polarization, P - change of polarization.