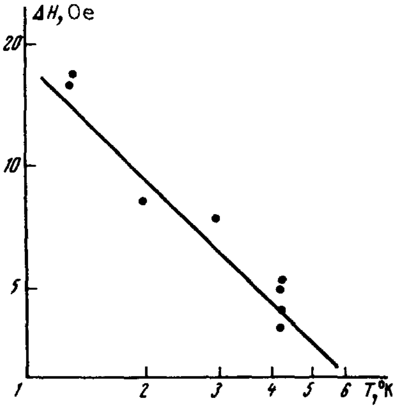

Fig. 3. Temperature dependence of the NMR line shift.

along the chains, since the contribution from the internal electrons of the TCNQ should be much weaker, owing to their large binding energy. The transferred spin density would therefore be distributed over the chain, mainly in accordance with the character of the distribution of the density of the external electron, i.e., uniformly, if the electron is delocalized, and nonuniformly in the opposite case, leading only to a slight modification of the effective field.

On the other hand, if it is assumed that the observed line splitting is nevertheless somewhat connected with the transfer of the spin density of the cation via the internal electrons of the TCNQ molecules, whereas the external electron is delocalized, then one should expect an overall shift of both lines by an amount which is in any case not smaller than the magnitude of the splitting, something not observed in fact.

We can thus conclude that at helium temperatures the extra electrons of the linear conducting chains in the $(DTC)(TCNQ)_2$ complex are localized. If these electrons were delocalized at room temperature, as in the other well-conducting complex TCNQ salts, then we could conclude that when the temperature is lowered there occurs in the investigated complex something similar to a Mott transition. Unfortunately, in view of the low accuracy with which the bond lengths in $(DTC)(TCNQ)_2$ have been determined at room temperature (±0.03 Å) [4], this statement cannot be regarded as final. More accurate x-ray measurements are of great interest in this connection.

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STABILIZATION OF RING-LASER FREQUENCY

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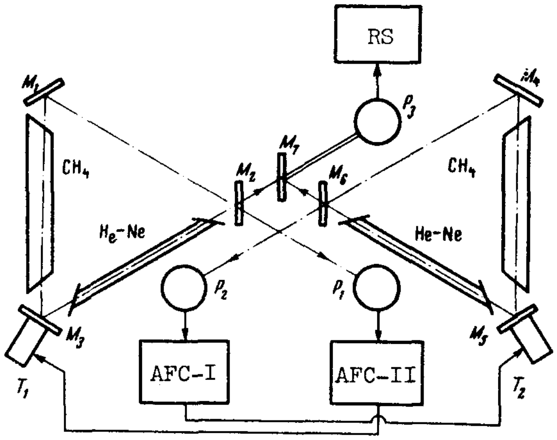
1. We report the results of an experiment on the development of an optical ($\lambda = 3.39\ \mu$) frequency standard with a relative frequency stability $\Delta\nu/\nu = 5 \times 10^{-14}$. The role of the frequency discriminator is assumed by the resonances of the power in the radiation of a ring laser with a nonlinearly-absorbing methane cell inside the resonator [1, 2].

At present, the most effective methods of frequency stabilization in the optical band are based on the use of power resonances of lasers that fix the central frequency of atomic or molecular transitions. Thus, stabilization of the frequency of a single-mode laser using the "Lamb" dip [3, 4] in absorbing low-pressure gases [5 - 7] (width of resonances of the order of the homogeneous line width) leads under ordinary laboratory conditions to a relative stability $\sim 10^{-12}$ at a frequency reproducibility $\sim 10^{-11}$ [8, 9].

Much narrower and more contrasty power resonances are made possible by mode competition of a multimode laser [1, 2, 10, 11]. For example, the effect of interaction of the waves of a ring laser at a generation frequency that coincides with the central frequency of the absorbing gas can lead in principle to arbitrarily narrow power resonances [1, 2]. The effect of wave interaction is indeed the basis of the ring-laser frequency stabilization method reported here.

2. The experimental setup consisted of two identical helium-neon ring lasers with internal methane absorbing cells (see the figure). The length of the discharge gap of the amplifier tube (0.3 cm diameter) was 20 cm. The length of the absorbing cell was 35 cm and its inside diameter 2 cm. At a helium-neon mixture pressure 4.2 Torr and a methane pressure 10 mtorr, the contrast of the laser traveling-wave power peak was close to 50%, and the width at half-height was 60 kHz. The pumping was with a combination of dc and a hf field.



M_1 - M_6 -- mirrors forming the ring resonators, M_7 -- semitransparent mirror, T_1, T_2 -- piezoceramics, P_1, P_2, P_3 -- photoreceivers, RS -- beat recording system, ARC-I, ARC-II -- laser automatic frequency control systems.

The laser emission was registered by photoreceivers P_1 and P_2, the signals from which were fed to the automatic frequency control system of the laser. The receiver P_3 was used as a photo-mixer, the signal from which was fed to the registration system (RS), where the difference frequency was evaluated.

When the lasing frequency deviated from the center of the power peak, the automatic control systems AFC-I and AFC-II generated an error signal which was applied to the piezoceramics T_1 and T_2 to cancel out the shift of the resonator length. The modulation frequencies were 12 and 20 kHz. The time constant of the synchronous detector was 1 sec. The rms drift of the difference frequency at an averaging time of 10 sec amounted to 6 Hz after 30 minutes, corresponding to a relative stability $\sim 5 \times 10^{-14}$.

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TEMPERATURE DEPENDENCE OF NEGATIVE MAGNETORESISTANCE IN COMPENSATED GALLIUM ARSENIDE

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We have established in [1] that in compensated n-GaAs with a total impurity density $N_i \approx 5 \times 10^{17}$ cm^{-3} and an electron density $n \leq 5 \times 10^{16}$ cm^{-3} the electrons become localized at low temperatures in potential wells that distort the bottom of the conduction band.

Since an external magnetic field changes the energy states and the conditions of electron motion, we deemed it of interest to study the influence of the field under these conditions.

The measurements were made on the same samples as in [1], and a decrease of the resistance was observed in magnetic fields up to 50 kOe. The relative changes of the resistance, $\Delta\rho/\rho = [\rho(H) - \rho(0)]/\rho(0)$, turned out to approximately the same in a field H parallel to the current as in a perpendicular one.

Figure 1 shows the measured $\Delta\rho/\rho = f(H)$ at 10 values of the temperature from 0.6 to 27°K, in magnetic fields $H \leq 20$ kOe, in which the positive component of the magnetoresistance could be neglected.

In analogy with the interpretation of the negative magnetoresistance (NM) in ferromagnets and in metals with ferromagnetic impurities, it is assumed that NM in semiconductors is due to the magnetization of the medium [3] and that

$$\frac{\Delta\rho}{\rho} \approx -a^2M^2 = -a^2\chi^2H^2, \qquad (1)$$

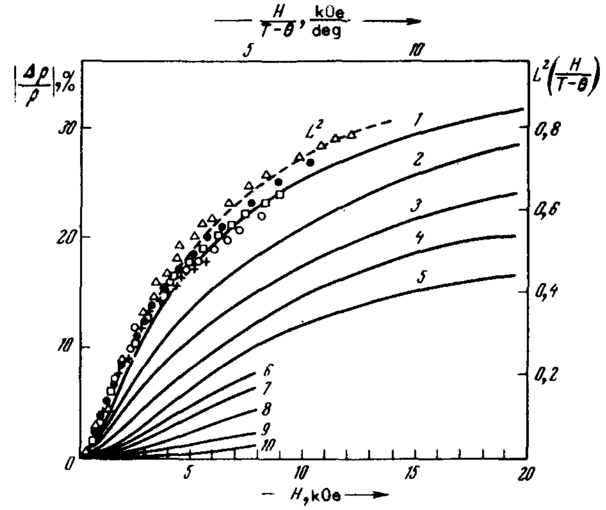

Fig. 1. Dependence of the negative magnetoresistance on the field H and the temperature T: continuous lines - $|\Delta\rho/\rho| = f(H)$ at the following temperatures (°K): 1 - 0.6, 2 - 1.1, 3 - 1.7, 4 - 2.9, 5 - 4.2, 6 - 6.2, 7 - 8.5, 8 - 14.5, 9 - 20.4, 10 - 27. Points: values of $|\Delta\rho/\rho| = f[H/(T - \theta)]$ at the following temperatures: Δ - 0.6, ● - 1.1, □ - 1.7, ○ - 2.3, × - 4.2. The dashed line is a plot of $L^2(x)$, where $L(x)$ is the Langevin function, $x = (\mu H)/k(T - \theta)$, $\mu = 25\ \mu_B$, $\theta_1 = 1.25$ °K, and $\theta_2 = 2$°K.