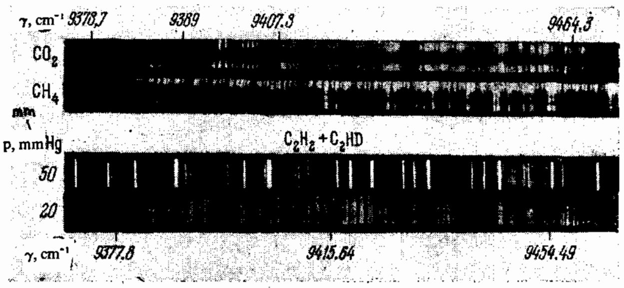

≈ 10^{-8} of the incident energy enter the resonator as a result of diffraction on microscopic inhomogeneities and dust particles or by reflection from the back surfaces.

All selecting elements were eliminated from the resonator, and the mirrors were deposited on bases 3 cm thick with the back surface 10° out of parallel. The Nd^{3+}-glass rod was cut at the Brewster angle, one of its faces forming a window of the cell, whose other window was the resonator exit mirror. When test gases were admitted into the cell, we obtained their absorption spectra in the lasing range of Nd^{3+} (9360–9460 cm^{-1}) with absorption coefficients of 10^{-3} to 10^{-7} cm^{-1}. The figure shows a few absorption spectra as examples.

The high sensitivity of the proposed method makes it possible to work with microscopic amounts of the substances analyzed, an important point for study of isotope-substituted compounds (the figure shows the spectrum of $C_2H_2 + C_2HD$).

The proposed method will be used to model the optical properties of planetary atmospheres and the interstellar gas, to investigate atmospheric pollution, and in the analytical chemistry of gases. The maximum attainable sensitivity is 10^{-11} cm^{-1}, which corresponds to a molecule concentration of ~ 10 cm^{-3}.

The high intensity of the laser radiation makes it possible to obtain the absorption spectra in very short times. The speed of the method is limited by the propagation velocity of light, i.e., the time during which the light covers the effective absorbing-layer thickness $\tau = L_{eff}/c$. Times $\tau \sim 10^{-7}$ to 10^{-3} sec are required to investigate absorption spectra with $\Delta k \sim 10^{-3}$ to 10^{-7} cm^{-1}. This permits the use of the method to study nonstationary processes in chemistry and the intermediate products of chemical reactions: radicals and excited states of molecules.

It is interesting to note the possibility of registering not only weak absorption lines, but also the amplification in excited molecules. Amplification lines of the CH radicals formed on photolysis of the $C_2H_2 + C_2HD$ mixture are clearly visible in the figure.

This method could be extended over practically the entire visible and near infrared region of the spectrum by the use of organic-dye lasers.

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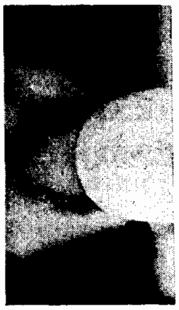

FIG. 1

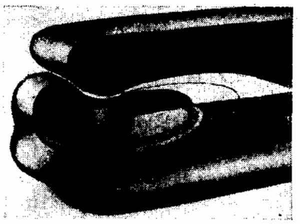

FIG. 2

FIG. 1. Blackening of film placed in the meridional plane on the daytime side. The breakthrough of particles through the polar gaps and the radiation belt are clearly visible.

FIG. 2. Model of magnetosphere.

I. M. Podgornyĭ, É. M. Dubinin, and Yu. N. Potanin. Investigation of Precipitation of Particles and Formation of a Radiation Belt in Terrella Experiments. It was shown earlier[1,2] that, despite the impossibility of reproducing the complete picture of the interaction of the solar wind with the earth's magnetic field in the laboratory, a number of the most important phenomena can be studied in model experiments. The limited-modelling principle was used in selecting the experimental conditions: although the dimensionless parameters determining the course of the phenomenon to be studied differed somewhat from their values in space, this could not produce significant differences. At an artificial solar wind velocity $\bar{v} = 3 \times 10^7$ cm/sec, a concentration $n = 10^{13}$ cm^{-3}, an electron temperature $T_e = 15 - 20$ eV, and a field B = 30 G frozen into the plasma, the interaction of the plasma stream with the magnetic field of the dipole resulted in the formation of a magnetosphere with a magnetic tail and other features characteristic of the earth's magnetosphere. A collisionless shock wave in which the microfluctuation spectrum agreed with that measured in space[2] was registered on the daytime side.

The magnetosphere obtained in the model experiment was used to study the penetration of fast particles into the earth's magnetic field and their precipitation into the upper atmosphere. A small number $(n \cdot 10^{-4})$ of fast electrons were injected into the artificial solar wind; the paths on which they entered the magnetosphere and struck the surface of the terrella were investigated for the most part with x-ray films. The penetration of the plasma in the region of the so-called neutral points on the daytime side was clearly evident on exposure of films placed in the plane of the dipole axis and the velocity of the undisturbed plasma stream. Penetration on the night side occurs at lower latitudes. Measurements showed that the regions of penetration on the day and night sides are interrelated. They form a gap that girdles the terrella and is enclosed between the force lines of the closed magnetosphere and the lines going out into the magnetic tail. There are two of these polar gaps—north and south. The penetration of fast particles into these gaps results in their precipitation onto the surface of the terrella precisely at the point where, according to Brice and Hartz, a high-latitude auroral zone should be observed. Another (low-latitude) precipitation zone is also observed in the model experiment. Its appearance is associated with particles trapped in the magnetic field and drifting around the axis of the terrella. In other words, a radiation belt was observed in the model experiment and it was shown that the escape of particles from it is the mechanism that forms the low-latitude auroral zone (Fig. 1).

Experiments performed with baffles indicated that the filling of the radiation belt occurs on the night side. The lines of force at the boundary of the magnetosphere are entrained by the plasma stream and convect to the night side. The anomalous conductivity that arises from the interaction of the colliding streams apparently enables the force lines to sink into the magnetosphere; here a certain number of fast particles are trapped to feed the radiation belt.

Evidence of the strong interaction that results in convection of the force lines is also found in the formation of an equatorial gap on the daytime side, merging with the plasma layer of the magnetospheric tail on the night side. The magnetosphere model that follows from these laboratory experiments is shown in Fig. 2. The results of the study can be found in[3].

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