there appears the recombination-radiation line ascribed in [8, 11] to drops of an electron-hole "liquid," pure germanium begins to absorb in the far infrared region, where heretofore it was perfectly transparent. This absorption has, as a function of the wavelength λ, a distinct maximum in the region $\lambda \sim 100\ \mu$, which was interpreted as plasma resonance in the absorption (or scattering) by metallic drops whose linear dimensions are much larger than the wavelength λ. From the position of this resonance it is possible to estimate directly the concentration n_0 of the particles in the drop. It also turned out to be $\approx 2 \times 10^{17}$ cm^{-3}.

Thus, at the present time there is an entire series of facts that agree satisfactorily with the hypothesis that a condensed electron-hole phase exists in semiconductors. Some of these facts can be explained just as well as being due to the fact that at low temperatures the excitons become bound into "molecules" (biexcitons).[9] However, within the framework of the biexciton picture, there is still no satisfactory explanation of such facts as the absorption in the infrared region, the anomalous behavior of the radiation under uniaxial deformations, and the vanishing of the absorption line of the direct exciton. Therefore the existence of condensed-phase drops seems to be quite likely, but only further experiments can prove it (or refute it) conclusively. Such convincing experiments might be, for example, direct observation of the motion of the drops over a macroscopic distance, or scattering of light by these drops.

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V. N. Lugovoĭ and A. M. Prokhorov. Self-focusing of Intense Light Beams.

The phenomenon of self focusing[1] of intense light beams occurs in media whose refractive index depends on the intensity of the light. The dependence of the refractive index on the light intensity can be connected with different physical processes in a material medium. The largest attention was immediately attracted by the so-called Kerr self focusing,[2-15] in which the dependence of the refractive index on the amplitude $|\mathbf{E}|$ of the oscillations of the electric field is due to the Kerr effect: $n = n_0(1 + \frac{1}{2} n_2 |\mathbf{E}|^2)$, $n_2 > 0$. The self focusing phenomenon itself begins with the fact that the beam produces in the initial layer of the medium a distributed lens, which then focuses this beam if its initial power P exceeds a certain critical value P_{cr}.[2, 8] In 1964, Chiao, Garmire, and Townes[2] proposed that a stationary (in time) regime of waveguide propagation of the beam is produced behind the focusing point, in the form of thin filaments with large energy density (self-focusing filaments). Then in [3] and in later papers[4-7, 13-15] it was reported that self-focusing filaments were observed. After this, the concept of stationary waveguide propagation of a laser beam in a nonlinear medium became universally accepted in spite of its partly postulative character (from the theoretical point of view).

For a theoretical solution of this problem, without using any arbitrary assumptions concerning the behavior of the beam behind the focusing point, it is obviously necessary to investigate in sufficient detail the evolution of the light beam propagating in the interior of a nonlinear medium at a specified distribution in the initial plane (z = 0), corresponding to the real conditions. If the distribution in the initial plane is assumed to be stationary, then the field in the medium will also be stationary. Then the equation for a slowly varying (in space) complex amplitude $\mathbf{E}$ of the oscillations of the electric field in an axially-symmetrical beam can be written in the form[2, 8-12]

$$\frac{\partial^2 \mathbf{E}}{\partial r^2} + \frac{1}{r}\frac{\partial \mathbf{E}}{\partial r} + 2ik\frac{\partial \mathbf{E}}{\partial z} + k^2 n_2 |\mathbf{E}|^2 \mathbf{E} = 0 \qquad (1)$$

($k = \omega n_0/c$). A correct analytic solution of this equation was obtained in [12]. However, it is valid only near the boundary of the medium in a narrow interval of values of the initial power of the light beam. In view of the complexity of the analytic solution, the authors of the present paper, in conjunction with A. L. Lyshko of the Computation Center of the U.S.S.R. Academy of Sciences, using in 1967 a computer for a numerical solution.[16] It should be noted that a numerical solution of Eq. (1) was obtained already by Kelley.[8] The calculations have shown that the intensity on the beam axis on approaching the focus increases strongly. However, the question of what takes place in the light beam behind the focus was not considered. Our calculations[16] obtained without a limitation on z, have led to the following picture of the phenomenon. When $P > P_{\mathrm{cr}}$, in the process of propagation in the nonlinear medium, the beam breaks up, as it were, into annular zones and successive focusing of these zones takes place at different points on the beam axis. These points (focal points) constitute regions of small dimensions and large energy concentration. Their number is finite and is determined by the excess of the initial power over the critical value. At large excesses of the initial power above the critical value, the focal points lie close to each other.

Such a picture was obtained for a stationary initial distribution. However, under real conditions the distribution of the beam in the initial plane is not stationary, since the power of the laser beam varies in time in accordance with the envelope of the laser pulse (usually giant pulse). As a result, the picture observed under real conditions is essentially different.[17] The main difference between this picture and the stationary one lies in the fact that the focal points move. They can stop only at individual instants of time. The spatial trajectories of the moving focal points are thin filaments directed along the beam axis. In the case of time-integrated experimental observation, the trajectories of the moving focal points should be received as self-focusing filaments.

Thus, the authors have advanced in their paper[17] a new point of view concerning the process of Kerr self-focusing, differing from the concept of waveguide propagation. In a subsequent paper,[18] the theory of focal points was extended to include the case when the laser beam passes first through a gathering lens before entering the investigated medium. In [19] there was also developed a theory of Kerr self-focusing of picosecond laser pulses and it was shown that for such pulses the picture of self-focusing is also characterized by moving focal points. It was established in [20] that the presence of an additional phenomenon of stimulated Raman scattering in self-focusing can influence the really attainable concentration of energy in focal points and their dimensions, without changing the picture of the self-focusing phenomenon itself.

Recently, special experiments were performed to solve the problem of whether waveguide propagation of light takes place in self focusing or whether moving focal points arise. Korobkin and Alcock[21] and Loy and Shen,[22] who worked with single-mode lasers (i.e., under conditions corresponding to the initial premises of the theory), have established that under these conditions one observes in self-focusing moving focal points, and not waveguide propagation of light.

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Thermal Self-focusing in a Beam with Decreasing Intensity Near the Axis ("Banana" Self-focusing).

In ordinary media (gases, liquids), the refractive index decreases upon heating, and therefore a powerful beam becomes defocused. It is shown in this paper that by special choice of the distribution of the beam intensity over the radius—by decreasing the intensity near the axis—it is possible to realize self-focusing of the main part of the beam in a medium in which a solid beam becomes defocused. Such self-focusing with loss of the edge zone of the beam ("peels") was called "banana" self focusing.

Experiments were performed on self-focusing of this type. A beam with an intensity dip was produced by placing a small screen on the axis for the beam (the screen was deposited on a glass plate), and the diffraction divergence as well as the intrinsic divergence smoothed out the sharpness of the intensity dip already at a distance on the order of 1 m. Lasers of two types were used—a pulsed solid-state laser without Q switching, and a cw gas laser.

In a beam from a ruby laser of energy 20 J, in a millisecond pulse, there was obtained external self focusing at a distance of 1 m from the cell 15 cm long, filled with water to which a slight amount of vitriol was added. The trace of the beam was photographed also on a film with a SFR camera. The film shows how the intensity dip gives way to the bright spot of the self-focused point of the beam (see ZhETF Pis. Red. **10**, 113 (1969) [JETP Lett. **10**, 71 (1969)].

Self-focusing inside a layer of liquid was investigated inside a cell of 1 m length. Figures 1a and b show the trace of the beam on a screen immersed in water with a slight amount of absorber: a) the energy of the light pulse attenuated with light filters (the absorbed energy was insufficient to observe self-focusing); b) at energy of 20 J (a bright spot is seen at the center).

To verify the influence of the thermal conductivity