istics.

The principal analogy between the method of obtaining electron interference images of the edges of the films and the method of obtaining holograms in light optics makes it possible to use these phenomena in electron holography.

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* Coherent splitting of an electron wave can also be produced by the fields of the electrostatic charges created in a conducting or semiconducting film bombarded with electrons. In this case the film must be placed in the object plane of the objective lens of the microscope, and the interference image of the film edge is observed by suitable defocusing. We observed in such a system distinct interference patterns of the edges of thin collodion films.

VARIATION OF THE EMISSION WAVELENGTH OF A PARAMETRIC LIGHT GENERATOR BY MEANS OF AN EXTERNAL ELECTRIC FIELD

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Besides the existing methods for tuning the emission wavelength of a parametric light generator (PLG), namely mechanical rotation of the crystal in the resonator [1] and change of the crystal temperature [2], the electrooptical method is of definite interest.

The gist of the electrooptical method is that the output frequency of the PLG ($\Delta\omega$) is varied by applying an external electric field to vary the refractive index (Δn) of a KDP (or KH_2PO_4) crystal: $\Delta\omega \sim \Delta n \sim r_{63}E$, where r_{63} is the linear electrooptical coefficient, equal to 10^{-7} cgs esu at T = 300°K. Calculations performed for a KDP crystal [3] have shown that at room temperature even relatively strong fields (100 kV/cm) do not produce a noticeable effect. An appreciable change in the PLG frequency can be obtained in the region of the ferroelectric transition (the Curie temperature of the KDP crystal is T_C = 123°K). In this region, the electrooptical effect increases sharply and reaches 10^{-4} cgs esu units at the Curie point itself [4]. The results of calculations for a pumping wavelength λ_p = 0.53 μ (the second harmonic of a neodymium laser) and for an "eoe" type of synchronism are shown in Fig. 1, from which it follows that when an external electric field is applied to the KDP crystal the tuning curves shift in accordance with the magnitude and sign of the field. Thus, smooth tuning of the PLG frequency is possible at a fixed crystal direction, defined by an angle θ. To verify this possibility, we performed an experiment with the setup shown schematically in Fig. 2. A polarized beam from a Q-switched (rotating prism) Nd^{3+} glass laser passed through an amplifier and struck a KDP doubler crystal (ℓ = 3 cm), in which it excited a second-harmonic wave serving as a pump for the PLG. An additional plate was placed in the laser cavity at the Brewster angle to produce more complete polarization. A liquid

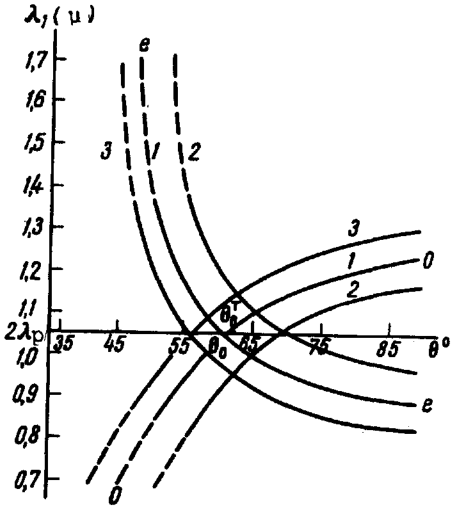

Fig. 1. Wavelength vs. E at $T \approx T_C$: 1) E = 0, 2) E = +10 kV/cm, 3) E = -10 kV/cm.

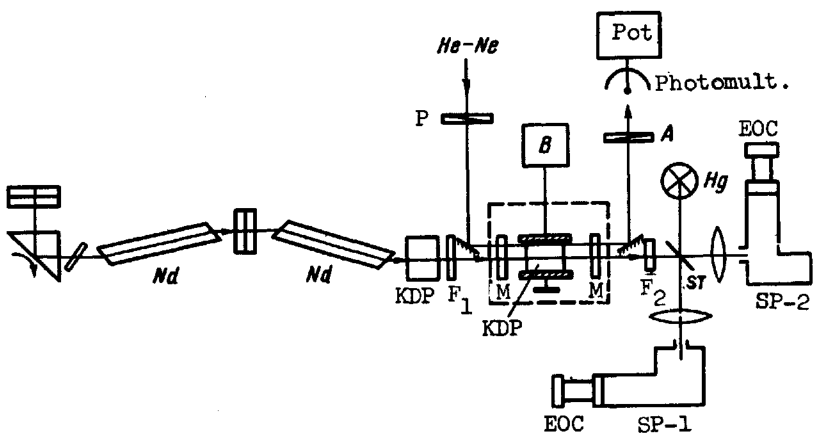

Fig. 2. Diagram of experimental setup.

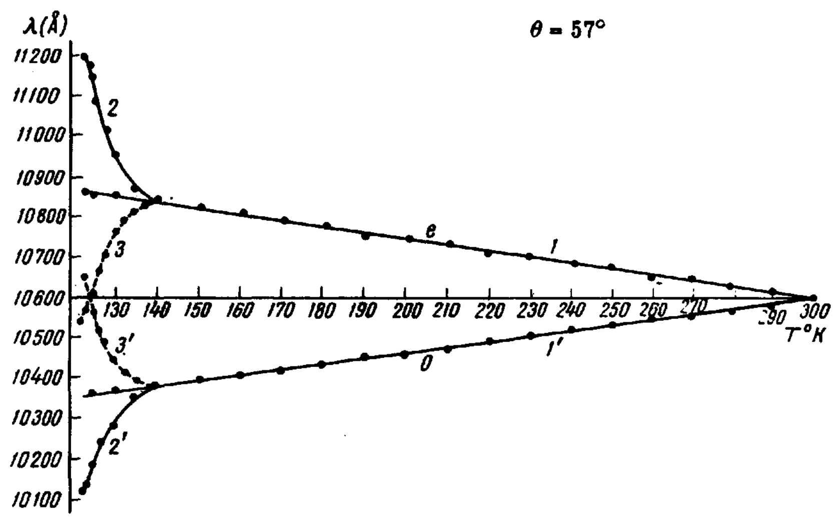

Fig. 3. Experimental dependence of the PLG wavelength on T and E: 1-1') E = 0, 2-2') E = +5 kV/cm, 3-3') E = -5 kV/cm.

filter (F_1) absorbed effectively the fundamental emission (λ = 1.06 μ) and passed ~90% of the pump emission (λ = 0.53 μ) to a KDP crystal (l = 3.3 cm) placed in an optical cryostat, in which the entrance and exit windows (the two mirrors M) formed a parametric resonator. The mirrors had a transmission coefficient ~85% at the pump wavelength and a reflection coefficient R = 95% at λ = 1.06 μ, with a "table" near the degenerate case of 500 - 700 Å at a level R > 90%. The parametric KDP crystal was cut at angles $\theta = 57°$ and $\varphi = 15°$. This value of the angle φ was chosen to satisfy simultaneously the two conditions $\Delta n(E) \neq 0$ and $\beta \neq 0$, where β is the parameter of the nonlinear interaction [5]. For such a cut, $\Delta n(E) = 0.5\Delta n(E)_{max}$ and $\beta = 0.87\beta_{max}$. A vacuum of 10^{-5} mm Hg was maintained inside the optical cryostat. The electrodes to which the pulsed field was applied served also as the cold fingers. The crystal temperature was determined from the characteristics of the transmission of an He-Ne laser beam by a polarizer + crystal + analyzer system (P, KDP, A in Fig. 2). From the relation $\Delta T = \lambda/l\alpha$, where α is the temperature coefficient of variation of the birefringence, we could determine the temperature interval between neighboring minima (or maxima) of the transmission characteristic of the system, $l/l_0 = \sin^2(\pi\Delta nP/\lambda)$, where l is the length of the parametric crystal. The maximum density of the pump power was 40 - 45 MW/cm^2 at a threshold power density 18 - 20 MW/cm^2 for the degenerate case. The corresponding theoretical value is 12 MW/cm^2.

Figure 3 shows the results of measurements of the tuning range made with the aid of spectrographs SP-1 and SP-2. Mercury lines served as wavelength standards for the SP-1 and SP-2. It follows from curve 1-1' that the maximum total temperature tuning range is $\Delta\lambda_T$ = 510 Å, or 2.4 Å/deg. When the temperature was varied from room temperature to T_C, the only branches of the tuning curves excited in our case were those for which λ_1 was the extraordinary wave and λ_2 the ordinary one, with $\lambda_1 > \lambda_0 > \lambda_2$. Curve 2-2' corresponds to the case E = +5 kV/cm, and curve 3-3' to -5 kV/cm.* It is seen from the curves that the electrooptical effect becomes operative (at the indicated fields) only at temperatures 20° or less from T_V. The maximum wavelength change due to the applied field only is $\Delta\lambda_E$ = 630 Å, which together with the temperature tuning amounts to a total change, for the degenerate case, $\Delta\lambda_{T,E}$ = 1080 Å. We were thus able to cover in our experiment the PLG wavelength range from 10 120 to 11 200 Å. This value is not the limit, since the crystal used in the experiment was cut in such a way as to yield only $0.5\Delta n(E)_{max}$. A different cut and a higher pump threshold would make a wider tuning range possible.

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* Reversal of the polarity of the field is equivalent to rotating the crystal through 180° inside the resonator and using the same field as before.