vanischem Kontakt mit dem Plasma, das Spannungen bis zu 40 kV gegen Masse erreicht. Aus dem Widerstand der Sonde im Plasma kann die Elektronendichte bestimmt werden. Durch Verschieben der Sonde erhält man das Dichteprofil im Plasma. Für das Experiment ergibt sich für die Elektronendichte in der Achse der Entladung der Wert $2 \cdot 10^{15}\ \mathrm{cm}^{-3}$.

Abb. 3 zeigt den Verlauf des übertragenen Sondenstroms bei fester Sondenspannung.

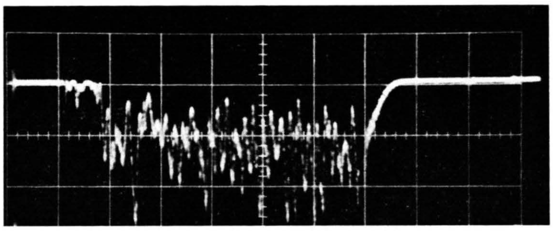

Abb. 3. Zeitlicher Verlauf des übertragenen Sondensignals. Zeitablenkung: 50 μs/cm (dem quasistationären Sondenstrom sind Schwingungen des Plasmas überlagert).

Gegenüber den meist benützten induktiven Übertragern besitzt der elektrooptische Übertrager den Vorzug eines einfachen Aufbaus mit geringer Störempfindlichkeit bei großer Bandbreite. Bei dem gewählten Aufbau können beliebig hohe Spannungen getrennt werden.

Zur galvanischen Trennung zweier Meßkreise kann auch das Prinzip des Mikrowellenübertragers angewandt werden [3]. Im Vergleich hierzu erfordert der elektrooptische Übertrager kleineren Aufwand bei kürzerer Anstiegszeit.

Der elektrooptische Übertrager kann leicht auf mehrere Kanäle erweitert werden.

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Fluctuations in the Positive Column of a Neon Glow Discharge

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Some properties of the light fluctuations in the positive column of a neon glow discharge were determined measuring the frequency spectra at different positions along the tube. A growth and a saturated region of the fluctuations was found. In the growth region linear processes are dominant and in the second region nonlinear effects play a significant role.

In the positive column of a noble gas glow discharge high amplitude fluctuations may be observed in a broad region of discharge parameters [1]. Recent experiments [2, 3] have shown that some properties of them may be predicted by the linear theory for ionization waves [4]. These waves are convectively unstable in a certain domain of discharge parameters [5]. It is the purpose of this article to describe some experimentally obtained properties of the fluctuations which at least qualitatively confirm the theoretical prediction of convective instability. The mechanism of the fluctuations excitation is not clear and remains to be examined.

The measurements were done at a stabilized discharge current of 20 mA and at a gas pressure of 0,1 Torr in a pyrex glass tube with i. d. of 2 cm. The distance between the two cylindrical nickel electrodes was 120 cm. The filling gas was spectroscopically pure neon. The discharge light fluctuations were detected by mouveable photo field effect transistors. Some of the fundamental properties of random oscillations were obtained by recording the average noise power of the signal from the photodetector during its motion along the discharge tube from the cathode to the anode. The record is represented in Fig. 1. According to this picture the noisy glow discharge at given conditions may

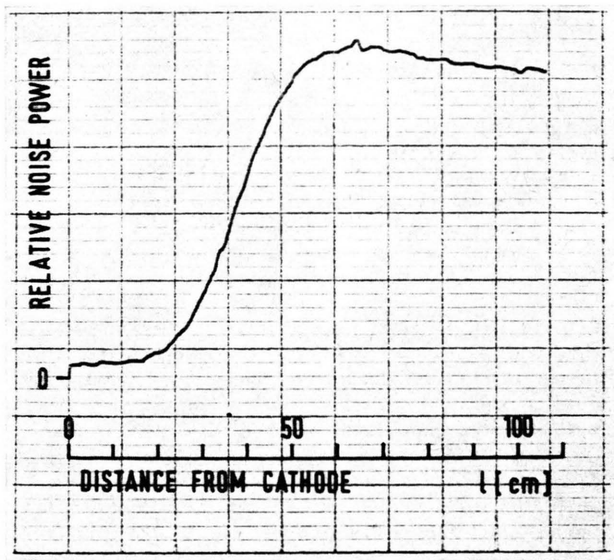

Fig. 1. Relative noise power of the light fluctuations as a function of position along the discharge tube. Neon pressure 0.1 Torr. Discharge current 20 mA.

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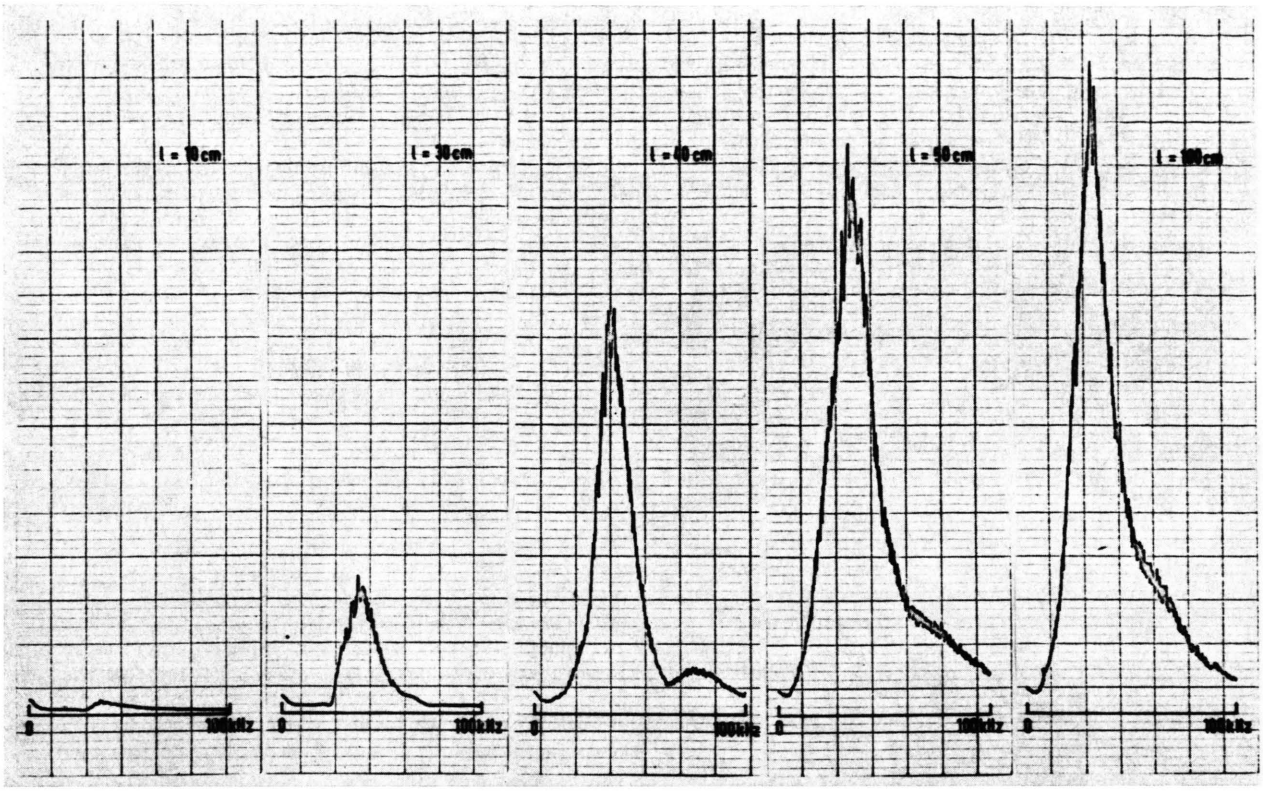

Fig. 2. Relative power frequency spectra of light fluctuations measured at different positions along the discharge tube.

be devided into three main regions: The low noise region, spreading from the cathode to the end of the Faraday dark space, and the growth as well as the saturated region lying in the positive column. Similar courves as that in Fig. 1 may also be obtained in a noisy glow discharge in argon [6]. Minor changes in the courve shape near the electrodes may appear at different discharge conditions. In the low noise region the oscilloscopic patern shows symmetrical noise. In the second region the average noise power is growing with distance from cathode. Going further towards the anode the oscillations stop growing. Characteristic for this region is an asymmetrical noise signal. The average noise power is practically constant in the remaining part of the column and is by about an order of magnitude higher than at the beginning of the growth region. To determine the properties of the fluctuations in more detail the frequency spectra were measured at various points along the discharge tube. Fig. 2 shows the records of the spectra at 10, 30, 40, 50 and 100 cm distance from the cathode. The first spectrum is characteristic for the beginning of the growth region. The third record is measured at that part of growth region where the noise becomes asymmetrical. From spectra measured between 10 and 40 cm, that at 30 cm, we can conclude that this part of the positive column acts as a selective amplifier. In the region from 40 cm to 50 cm the growth of the noise power diminishes at the same time first the second harmonic appears and then the spectrum broadens. In the remaining saturated part of the positive column the spectrum is nearly unchanged as can be seen from the records taken at 50 and 100 cm. It is important to note that the frequency of the spectral maximum is practically the same at any position in the mentioned regions. The stopping of the growth, harmonic generation and broadening of the spectrum indicates that some nonlinear effects become important.

The correlation functions of the light fluctuations measured in the saturated region show backward wave character of the fluctuation like in Ref. [2, 3].

From all mentioned facts we conclude that the observed fluctuations are stochastic ionization waves developed from the noise in the cathode region of the discharge. For the description of these fluctuations, at least at the beginning of the growth region, the linear theory of the ionization waves [4] could be used. This theory is valid for homogeneous columns. Therefore it would be applicable to cases where the growth region is much longer than the transition region between the Faraday dark space and the positive column.

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