were held constant. The small change in the floating plate voltage was much less than that caused by the temperature difference between the plates. The slope of the striaght lines fitted to the experimental points give a value for S of 3.81×10^{-3} volt/degree, for a ratio of measured to calculated values of 1.78. This is as good an agreement as one could expect because of the approximations made in the theory. The value obtained from the experiment also compares favorably with the value of 2.06×10^{-3} volt/degree calculated from Eq. (5) of reference 3.

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VARIATION OF THE ELECTRON DENSITY ALONG A PLASMA COLUMN

B. Agdur, B. Keržar, and T. Nygren
Microwave Department, Royal Institute of Technology, Stockholm, Sweden
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In connection with studies of noise radiation and scattering from a plasma column,[1] it was found that there can be an appreciable variation in the electron density along a plasma column. The experimental studies of this effect have been carried out by using a hot-cathode, low-pressure, mercury discharge tube in which the plasma column had a length of 140 cm and a diameter of 13 mm. The wall thickness of the glass tube surrounding the plasma was 1.4 mm, and the variation of the diameter of the glass tube was less than 4%. The mercury gas pressure was controlled by the temperature of the mercury, and the glass tube surrounding the plasma was kept at a higher temperature than that part of the tube which contained liquid mercury. The temperature of the mercury could be varied from 10 to 60°C corresponding to a pressure variation from 0.5×10^{-3} to 25 $\times10^{-3}$ mm Hg. The electron density was measured by means of the microwave cavity method; the cavity, which operated in the TM_{010} mode, could be moved along the plasma tube.

Figures 1, 2, and 3 show the electron density as a function of the distance from the cathode for three different temperatures of the mercury bath with the beam current as parameter. Strong low-frequency oscillations may occur in the plasma under certain conditions. The data shown in the figures were, however, obtained under conditions of very low or no oscillations in the electron density.

At low plasma densities, the frequency shift

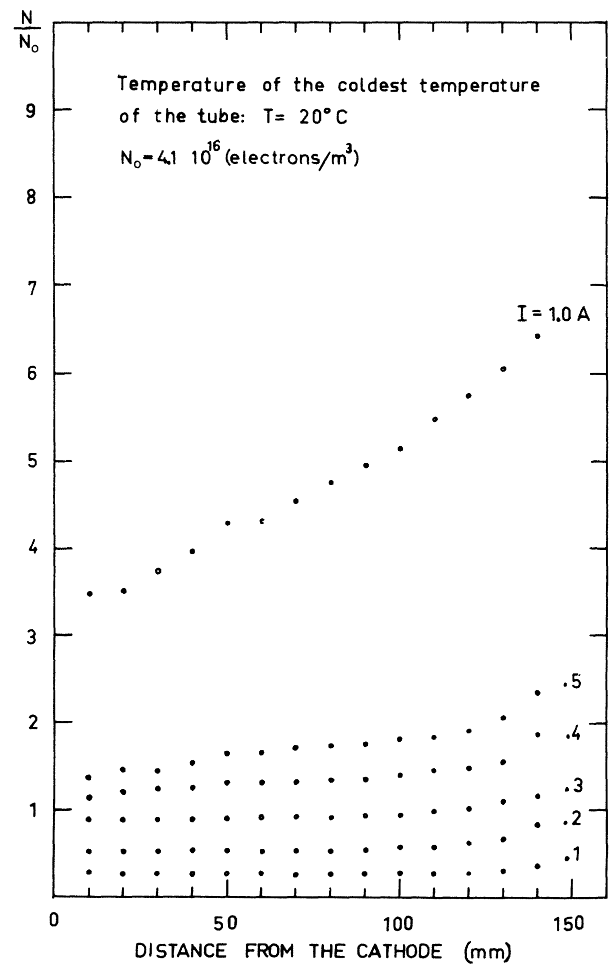

FIG. 1. Electron density as function of distance from cathode for $T=20°C$ for several values of beam current.

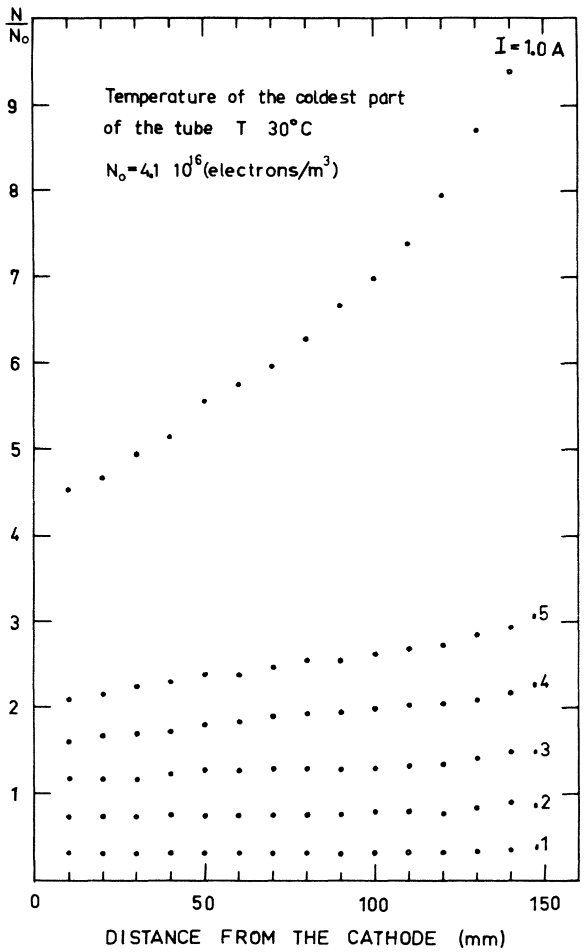

FIG. 2. Electron density as function of distance from cathode for $T = 30°C$ for several values of beam current.

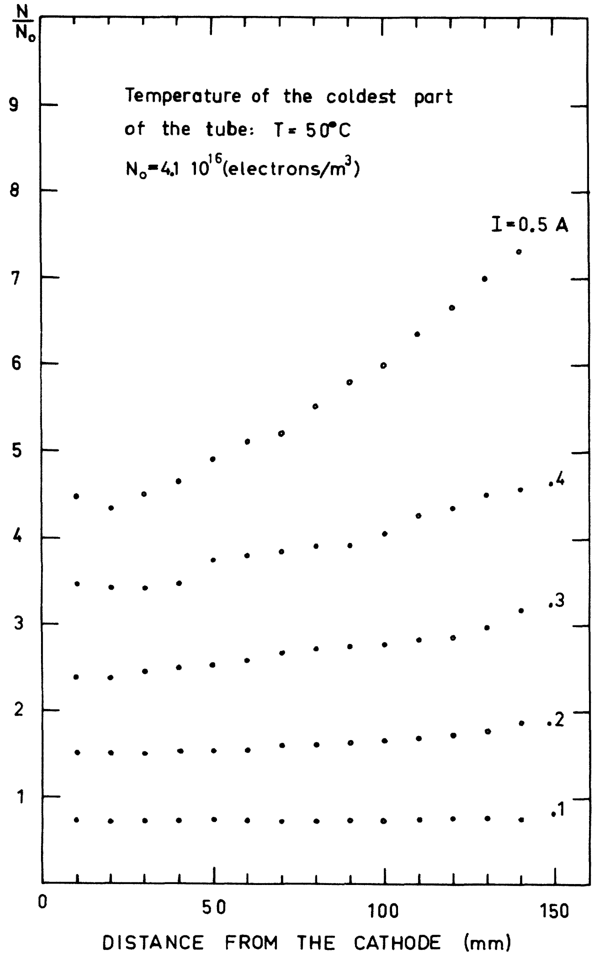

FIG. 3. Electron density as function of distance from cathode for $T = 50°C$ for several values of beam current.

for the TM_{010} mode depends only on the mean value of the plasma density and not on the density distribution. At high plasma densities, however, both the mean value of the electron density and the distribution of the density influence the frequency shift. In our calculation of the electron density we have assumed that the electron density has a rectangular distribution. If, for instance, we assume a parabolic distribution of the electron density, the mean value of the electron density would be higher than that corresponding to the values given in our figures.

The variation of neutral gas density along a plasma column has been studied experimentally and theoretically by Klarfeld and Poletaev,[2] who have shown that the gas density increases towards the anode of the discharge tube. It is most probable that the variation of the gas density is interconnected with the variation of electron density regarded above. A more detailed investigation of this phenomenon has been started at our institute.

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