The effect of magnetic field on diffusion and drift of electrons in helium and xenon

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Diffusion and drift of electrons in gases has been extensively studied [1-5] both experimentally and theoretically. A detailed tabulation of various electron drift characteristics in a constant and uniform electric field was performed. Also, the effect of degree of inhomogeneity on the drift characteristics was studied.

In this work, the characteristics of the electron drift in helium and xenon in the presence of a longitudinal or transverse magnetic field are presented. The Monte Carlo method has been used to calculate the kinetic characteristics of the electrons in two inert gases (He, Xe) when the electric field E/N = 10-100 Td upon induction of the magnetic field up to 10 Tesla at a gas density of 10^{17} atoms per cm^3. The basic characteristics of the electron drift (drift velocity, ionization coefficient, the diffusion coefficient, fractions of energy losses of electrons in elastic collisions, for excitation and ionization of atoms) have been obtained.

[1] G. H. Huxley and R. W. Crompton, The Diffusion and Drift of Electrons in Gases (New York, N. Y., 1974; Mir. Moscow, 1977).

[2] L. M. Biberman, V. S. Vorob'ev, and I. T. Yakubov, Kinetics of Nonequilibrium Plasma (Nauka, Moscow, 1982).

[3] R. I. Golyatina, S. A. Mayorov Effect of magnetic field on diffusion and drift of electrons in argon // Applied Physics, 2020, Issue 4, 2020, pp. 32-39.

[4] Maiorov S.A., Kodanova S.K., Dosbolayev M.K., Ramazanov T.S., Golyatina R.I., Bastykova N.Kh., Utegenov A.U. The role of gas composition in plasma-dust structures in RF discharges // Physics of plasmas – 2015. – Vol. 22. – P. 033705.

[5] I. Korolov, M. Vass, N.Kh. Bastykova, Z. Donko. A scanning drift tube apparatus for spatiotemporal mapping of electron swarms. // Review of Scientific Instruments, Vol. 87, 063102