

# Conversion of energy of fast charged particles into electricity due to non-uniform inert gas ionization

Filippov A V<sup>1,2,@</sup>, Babichev V N<sup>2</sup> and Pal' A F<sup>3,2</sup>

<sup>1</sup> Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia

<sup>2</sup> State Research Center of the Russian Federation—Troitsk Institute for Innovation and Fusion Research, Pushkovykh Street 12, Troitsk, Moscow 108840, Russia

<sup>3</sup> Skobeltsyn Institute for Nuclear Physics, Lomonosov Moscow State University, Leninskiye Gory 1, Moscow 119899, Russia

@ fav@trinity.ru

In [1], it was experimentally found that in  $e$ -beam created Ar plasma at atmospheric pressure the current collected by the Faraday cup is directed opposite to the  $e$ -beam. In [2,3], in numerical calculations of a non-self-sustained discharge (NSSD) with an external source of Ar gas ionization, it was shown that the electric field in the anode region changes direction at low voltages applied to the discharge gap. This work is devoted to the experimental and theoretical study of an inhomogeneous plasma created by the  $e$ -beam ionization and the determination of short circuit currents and no-load voltages in He, Ne, Ar, Kr, and Xe. The experiments were carried out on the setup [2] with a stationary electron gun with the energy of fast electrons in the range of 50-120 keV as a source of gas ionization. Numerical calculations of the current-voltage characteristics of the NSSD are carried out by the use of the diffusion-drift approach. Both in the experiments and in the numerical calculations, the effect of the electromotive force generation caused by inhomogeneous ionization of an inert gas has been confirmed.

- [1] Pal' A F, Persiantsev I G, Pertushevich Y V and Starostin A N 1979 *Sov. Phys. Dokl.* **24** 453–457
- [2] Filippov A V, Babichev V N, Dyatko N A, Pal' A F, Starostin A N, Taran M D and Fortov V E 2006 *J. Exp. Theor. Phys.* **102** 342–354
- [3] Filippov A V, Babichev V N, Pal' A F, Starostin A N, Cherkovets V E, Rerikh V K and Taran M D 2015 *Plasma Phys. Reports* **41** 895–904