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H-12

APOKAMP – A NEW SOURCE OF IONISATION WAVES IN POTENTIAL PULSE-PERIODIC DISCHARGE

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In 2016 we have identified a new phenomenon in repetitive pulsed discharges in ambient air: a single or several plasma jets streaming off the bending point of the discharge channel. For their unusual, "off-bend" path we named such jests apokamps. Several conditions are needed for an apokamp to occur: (1) a repetitive pulsed discharge with a pulse repetition frequency of several to tens of kilohertz, (2) a high electrical potential of discharge channel with respect to ground, (3) an amplified electric field for which at least one electrode should be sharp ended, (4) a bent discharge channel, and (5) a gas mixture with electronegative components, which make the formation of an apokamp easier. In atmospheric pressure air, the apokamp represents a set of plasma bullets moving with a velocity of 100–220 km/s, which excludes plasma decay by convection, and its radiation spectrum is dominated by electron-vibrational transitions of N_2 and N_2^+ molecules.

Here we provide a review of our first findings that shed light on the dynamics of an apokamp and its parent discharge, present spectral data on apokamps in air, helium, and argon, and discuss possible applications of the novel phenomenon, in particular for simulating transient luminous events such as blue and red jets and for creating apokamp-based exciplex sources.

H-13

ELECTRON EMISSION FROM A CATHODE IN ELECTRON BEAM GENERATING DISCHARGES

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There is no single viewpoint on the mechanism of discharges, generating electron beams with high power efficiency. The basic part of the applied voltage U is concentrated in them in the cathode fall (CF) of discharge gap d, or the strong field is in all d (no CF). Actually, the universally recognized mechanism (see, e.g., the monograph by Kreindel) in the technological sources of electron beams is the electron emission from a cathode under the action of its bombardment by rapid atoms arising up at the charge exchange ions in strong discharge fields. A different mechanism is offered for an open discharge (OD) with the mesh anode – the photoemission discharge with a power efficiency ≈ 1. It is considered to be supported by the resonantly excited atom states illumination.

I will give a number of arguments from a report that testifies the inconsistence of photoemission discharge. One of opponents errors is identifying the power efficiency with a parameter η determinable on the anode and collector currents. It results in the overevaluation of the real power efficiency that can even exceed 1. So, parameter $\eta = 0.9988$ was obtained at $U = 3$ kV. Then the power losses concomitant to flight d by an electron from a cathode will make $eU(1 - \eta) = 3.6$ eV, that is even less than the atom energy in the resonant state. From where then do VUV photons, supporting a photo – discharge, come from? Besides, the charge reproduction in d and the flow of ions on a cathode are proportional to the flow of electrons from a cathode, including those due to photoemission, and the power efficiency can not grow. At the substantial contribution of photoemission (it can not be basic in principle!), additionally to the emission from heavy particles, the discharge yield would originate from the anomalous mode with a sharp current growth, as, for example, in a discharge with the additional ionization. In OD, such phenomenon is not observed, which is evidenced by the measurements in a wide range of conditions.