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Resonance Ionization Instability in HF and Microwave Discharges

SERGEY DVININ, Lomonosov Moscow State University, VITALIY DOVZHENKO, A.M. Obukhov Institute of Atmospheric Physics RAS — For the first time ionization instability of HF plasma has been described in [1]. Later it has been shown [2] that in the spatially limited low pressure microwave discharge the given instability leads not only to change plasma structure, but to appearance of resonances at electron densities, when the size of plasma becomes multiple to some number of half waves of the standing surface wave, exciting on plasma boundary. Evolution of electron density perturbation is defined by two processes – negative feedback owing to a total current continuity (as in striations) and positive one due to excitation of a wave, which is close to a resonance. In the given work the theory [2] has been improved with accounting of both processes that has allowed to reach better coincidence with experiment [3]. In addition, the general theory of ionization instability has been developed. Application of the model to CCP HF (100 MHz and higher) discharge with large electrodes has shown that excitation of the instability accompanied by surface waves, propagating along plasma-sheath-electrodes interface, is possible.

[1] V.B. Gildenburg, A.V. Kim. XI ICPIG. Berlin, 1976, 273.

[2] S. Dvinin, et al. Sov. Phys.: Fizika Plazmy, 8, 1982, 1228, 9, 1983, 1058.

[3] S. Dvinin et al, Sov. Phys.: Fizika Plazmy, 9, 1983, 1297.

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