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AN INFLUENCE OF DUST CLOUD ON THE POSITIVE COLUMN OF DC DISCHARGE UNDER MICROGRAVITY CONDITIONS.

Abstract

Dusty plasmas consist of electrons, ions, neutral atoms and charged dust particles. The dusty plasmas are widely distributed in nature (space nebulas, comet tails, planet rings, noctilucent clouds) and in technological processes (plasma etching, solid fuel rocket exhaust, TOKAMAKs, nuclear dust). A possibility of anomalous transportation of charged lunar dust is widely discussed during last years. Thus, the fundamental properties of dusty plasmas are of big scientific and practical interests. Microgravity conditions are necessary for experimental investigations of dusty plasmas. Except of falling platforms, all known microgravity methods - parabolic flights, sounding rockets, and orbital setups - were used for such experiments. The orbital setups were found to be most suitable for such investigations, which permits one systematically to explore miscellaneous dusty plasma properties under different experimental conditions. A series of such experiments – from “Plasma Kristall - 1” in 1998 till “Plasma Kristall - 3 Plus” at the present time - have been performed onboard the MIR and ISS orbital space stations. New “Plasma Kristall - 4” (PK-4) experiment now is in final phase of preparation for the ISS within the ROSCOSMOS-ESA cooperation. In this presentation we report final preparation of the PK-4 setup for the ISS, in particular, the results of spectroscopic investigation of dust cloud in the positive column of dc discharge under microgravity conditions, performed during 57th ESA parabolic flight campaign onboard the NOVESPASE A300-ZeroG plane in October 2012, and the results of analytical simulations of the influence of dust cloud on the emission of the dc discharge positive column. During the experiments, the

plasma glow was recorded by a CCD-camera simultaneously via two narrow-band optical filters tuned on two neon lines (585.25 nm and 703.3 nm) with different upper electronic levels. Then the ratio of intensities of these lines will be sensitive for the temperature of free electrons, and their amplitude will follow the electron density distribution. Simultaneously, the dust particles illuminated by diode laser were recorded by the CCD-camera via neutral filter. Neon emissive spectra were also recorded by the broad band (400 − 800 nm) spectrometer USB4000. All information from the listed 4 sensors will be treated to obtain information on distribution of electron temperature and electron density over the discharge chamber. This work has been supported by ESA during the 57th parabolic flight campaign, by DLR under the Grant 50 WM 1150, and by the Program of fundamental researches of Presidium RAS.