MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Gravity and Fundamental Physics (1)

Author: Dr. Alexander Usachev
Joint Institute for High Temperatures of the Russian Academy of Sciences, Russian Federation

EXPERIMENTAL OBSERVATIONS OF WAVE AND HYDRODYNAMIC PHENOMENA IN DUSTY PLASMA UNDER MICROGRAVITY CONDITIONS.

Abstract

Micron size dust disperse particles put into a low temperature gas discharge plasma quickly acquire large electric charge and become an integral part of dusty (complex) plasmas. Such plasmas have a set of remarkable features: high nonideality, large characteristic times (up to 1 second), and new kinds of plasma instabilities and waves. The dust component of plasma can be observed and recorded by usual video cameras using laser illumination of dust particles. The most problem of such experiments is gravity – dust falls down. Special electrostatic traps are used to suspend the dust in laboratory plasmas, but the global solution of this problem is the microgravity condition for dusty plasma experiments. A set of such experiments – from "Plasma Kristall - 1" in 1998 till the present "Plasma Kristall - 3 Plus" - have been performed onboard MIR and ISS orbital space stations. New "Plasma Crystal - 4" experiment now is in preparation for ISS within the ROSCOSMOS-ESA cooperation. Due to its tube like shape, the "Plasma Crystal - 4" plasma chamber is especially suitable for investigation dusty plasma wave phenomena and dusty plasma liquids. In present work there will be reported next topics - brief introduction into the "Plasma Crystal - 4" setup, physics, international cooperation, and future plans; review of experimental observations of different kinds of dusty plasma waves and hydrodynamic phenomena in dusty plasma in the combined dc/rf low pressure gas discharge under microgravity conditions performed during parabolic flights onboard the NOVESPASE A300-ZeroG plane. Since 2003, totally 7 test parabolic flight campaigns have been performed with the "Plasma Crystal - 4" setup. This work has been supported by ESA during parabolic flight campaigns, by DLR under the grant 50 WM 0804, and by Russian Foundation for Basic Researches grant No 11-02-01333-.