

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Facilities and Operations of Microgravity Experiments (5)

Author: Mr. Ralf von Heise-Rotenburg
OHB System AG - Munich, Germany, ralf.von.heise-rotenburg@kayser-threde.com

Dr. Peter Hofmann
OHB System AG - Munich, Germany, dr.peter.hofmann@online.de

Mr. Roland Seurig
OHB System AG - Munich, Germany, roland.seurig@ohb.de

Prof. Gregor Morfill
Max-Planck-Institut für Extraterrestrial Physics, Germany, gem@mpe.mpg.de

Dr. Hubertus Thomas
Max-Planck-Institut für Extraterrestrial Physics, Germany, Hubertus.Thomas@dlr.de

Mr. Herwig Hoefner
Max-Planck Institut, Germany, hhh@mpe.mpg.de

Prof. Vladimir Fortov
Joint Institute for High Temperatures of the Russian Academy of Sciences, Russian Federation,
fortov@fcp.ac.ru

Dr. Vladimir Molotkov
Institute for High Energy Densities, Russian Academy of Sciences (RAS), Russian Federation,
molotkov@ihed.ras.ru

Prof. Oleg Petrov
Joint Institute for High Temperatures, Russian Academy of Sciences (RAS), Russian Federation,
ofpetrov@ihed.ras.ru

RECENT RESULTS AND DEVELOPMENTS FOR COMPLEX PLASMA EXPERIMENTS FOR THE
INTERNATIONAL SPACE STATION

Abstract

Complex plasma research under microgravity conditions is one of the present key research topics in fundamental physics and material science on the International Space Station (ISS). Experiments started with PKE-Nefedov, launched with PROGRESS M-44 as early as February 2001. PKE-Nefedov was a joint scientific experiment between the Max-Planck-Institute for Extraterrestrial Physics (MPE) in Garching/Munich and the Joint Institute for High Temperatures of the Russian Academy of Science (JIHT) in Moscow. The facility was developed and built by MPE, JIHT, RSC Energia and Kayser-Threde with national German funding (by DLR). Russia was responsible for funding launch, operations and training of PKE-Nefedov. The facility was operational from 2001 until 2005 and accommodated in the Russian segment of the ISS.

Next in the Plasma Crystal family is PK-3 Plus which is an improved version of PKE-Nefedov, developed and built accordingly. PK-3 Plus was launched in December 2005 and is in continuous operation on the ISS. In January 2010 mission no. 13 was conducted onboard the ISS. For mission no. 13 the PK-3 Plus had to be moved from its previous position at the service module in the Russian segment to the new Russian MIM-2 Module where it is permanently installed. Interface and adaptors had to be provided, tested and verified. From the technical and scientific point of view the mission was a 100 percent success.

The most recent development is PK-4 which is quite a different apparatus. Technically, PK-4 mainly uses high voltage DC for plasma control and possesses a rather large experimental chamber with wide gas parameter variations, particle manipulators as well as a sophisticated video observation system. The Phase C/D of PK-4 has been initiated in spring 2008 under ESA contract. From a programmatic point of view PK-4 still is a joint Russian/European project, now financed by ESA while Russia provides upload, download and crew resources. It has been decided that PK-4 will be accommodated in the EPM-rack in the European ISS-Columbus module. The CDR is planned for end of 2010.

The paper will present some selected results from recent PK-3 Plus sessions on the ISS and summarize the status of PK-4.