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Microgravity Sciences Onboard the International Space Station and Beyond (6)

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PLASMA CRYSTAL RESEARCH ON THE INTERNATIONAL SPACE STATION

Abstract

Complex plasma research under microgravity conditions is one key research topic in fundamental physics and material science on the International Space Station (ISS). Experiments started with PKE-Nefedov, launched 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 with participation of RSC Energia (Russia) and former Kayser-Threde GmbH, now OHB System AG (Germany). It has been operated from the Russian segment on the ISS from 2001 to 2005.

Next in the Plasma Crystal family was PK-3 Plus. PK-3 Plus has been in operation on the ISS from December 2005 to July 2011. Twentyone (21) successful missions have been performed, until the facility was switched-off. Teaming, funding and responsibilities have been shared as for PKE-Nefedov between Germany and Russia.

The most recent development is PK-4. PK-4 has been launched to the ISS end of 2014. First experiment will be performed in spring/summer 2015. PK-4 primarily uses high voltage DC for plasma control, possesses a large experimental chamber with wide gas parameter variations, particle manipulators and a sophisticated video observation system. PK-4 is part of the European EPM rack accommodated in the Columbus module of the ISS. From a programmatic point of view PK-4 is a joint European/Russian project, with Russia providing upload, download and crew resources.

The paper will give a short overview of the plasma crystal programme. In more detail the capabilities of the new PK-4 facility will be described and some first results will be presented.