PK-3 Plus – Investigation of Complex Plasmas on the International Space Station

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Complex plasmas are consisting of electrons, ions, neutral gas and in addition micron-sized particles [1]. Due to their high charge the microparticles interact strongly among each other and can even form liquid and crystalline systems. On Earth the corresponding structures are strongly affected by the gravitational force. For the investigation of the wide phase space of complex plasmas experiments in microgravity conditions are therefore essential. PKE-Nefedov, launched in 2001 and operational until 2005, was the first natural science experiment aboard the ISS for the investigation of complex plasmas in space [2-3]. It is followed by the successor PK-3 Plus, which has a more sophisticated hard- and software system. Extensive dedicated experiments in the PK-3 Plus laboratory were performed by the Russian cosmonauts V. Tokarev, P. Vinogradov, M. Turin, F. Yurchikhin and Y. Malenchenko, as well as the German ESA astronaut T. Reiter. A broad range of parameters was investigated in so-called basic experiments and many new phenomena related to liquid and crystalline complex plasmas were discovered [4]. In our presentation we will give an overview of the scientific results gained in the PK-3 Plus experiments on the International Space Station. Interesting examples are the experimental discovery of "electrorheological complex plasmas" [5] and the spontaneous appearance of waves and oscillations in the microparticle component [6].

References: