NEW RESULTS IN STUDYING DUSTY PLASMA UNDER MICROGRAVITY CONDITIONS

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The research of complex plasmas under microgravity conditions provide new insights and allows to observe phenomena, which are suppressed under gravity conditions on Earth even where gravity is compensated by other forces, e.g. thermophoretic force. In this report we will introduce some of the new interesting experimental results obtained with the help of "Plasma Crystal 3 Plus" ("PK-3 Plus") facility onboard of the International Space Station (ISS). First of all it is the discovery of electrorheological (ER) plasmas which can be formed with the "PK-3 Plus" laboratory on the ISS. ER fluids are fluids containing colloids which react on external electrical fields changing the viscosity by orders of magnitude. A similar physical process can be investigated in complex plasmas on the most fundamental - the kinetic - level by the use of low frequency fields. Sinusoidal signals were applied to the rf electrodes at frequency 100 Hz, with the amplitude voltage between 13.3 V and 32.8 V varied in steps of 2.2 V. At weak fields charged particles form a strongly coupled isotropic fluid phase with typical short-range order. As the field is increased above a certain threshold, particles start to rearrange themselves and become more and more ordered, until eventually well defined particle strings are formed. The transition between isotropic and string fluid states is fully reversible. The other interesting phenomenon is interpenetration of two clouds of different grain sizes. In these experiments the structure consisting of 14.9 or 9.19 or 6.81 μm was built initially. Then 3.42 μm grains were injected from the left side. Lane formation is observed in the outer region while the speed of the penetrating grains is high. Closer to the middle of the structure the grains speed reduces and they form a droplet. The process of lane formation is of interest for several fields, e.g. for studying colloidal systems. Additionally we performed a crystallization-melting experiment of the large 3D dusty plasma system. In this experiment we organized the 1.55 μm particles structure at 30 Pa. During a pressure decrease to 10 Pa the structure crystallizes. During the pressure increase the structure melts.