Self-organisation in currents: complex plasmas vs. humans

M. Kretschmer¹, M. Thoma¹, H. Höfner¹, G. Morfill¹, A. Usachev², A. Zobnin², O. Petrov², V. Fortov²

¹Max-Planck-Institute for Extraterrestrial Physics, 85748 Garching, Germany
²Joint Institute for High Temperatures of RAS, 125412 Moscow, Russia

Complex plasmas – low temperature plasmas with micron sized particles – exhibit various effects of self-organisation. This can be used to simulate the behaviour of matter in nearly any state from solid (crystalline) to liquid – even super-critical states have been realised so far – on the kinetic level of individual particles (‘atoms’). To avoid gravitational effects experiments have been performed under microgravity conditions on parabolic flights and onboard the International Space Station ISS. [1]

The ‘Plasmakristall (PK-) 4’ setup uses a HV DC discharge in a glass tube to create a complex plasma for studying mainly fluids on the particle level [2,3]. During parabolic flights we observed another self-organisation effect, so-called ‘lane formation’. This effect occurs under certain conditions [4] when two types of particles pass through each other. It is known from two-component fluids, granular media and even people moving in a crowd [5]. A comparison of these cases with the PK-4 experiment (fig. 1a, b) is given here.

Fig.1a: Initial (laminar) state of the flow with lanes, b: later, stop-and-go waves occur.

References