Pushing charged dust with an electron beam in a plasma crystal

C.M. Ticoş[1], D. Ticoş[1], J.D. Williams[2]

[1] *National Institute for Laser, Plasma and Radiation Physics, Bucharest 077125, Romania*

[2] *Wittenberg University, Physics Department, Springfield, OH 45501, USA*

We demonstrate transport of charged microscopic matter by a 13 keV collimated electron beam (EB) over tens of millimetres in a dusty plasma. Hundreds of electrically charged microspheres levitated inside a weakly ionized plasma and forming a plasma crystal are locally irradiated. When the EB is turned on a dust flow moving with a peak speed ~10 mm/s in the direction of the EB is produced. Far from the irradiation zone the plasma crystal preserves its spatial structure. The peak kinetic energy of the dust flow is ~630 eV resulting in an energy transfer factor of 0.048 from the EB to the microparticles. The flow is laminar in the first 300 ms and becomes turbulent as its speed and width increase. During this transition vortices formed initially at the entrance of the EB in the plasma crystal give rise to subsequent eddies which propagate downstream the flow. The particle image velocimetry (PIV) technique is employed to monitor the evolution of the dust flow in time. Spatio-temporal maps of the dust flow speed, kinetic energy and vorticity give insights into the flow dynamic regime.