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Turbulent complex (dusty) plasma

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As a paradigm of complex system dynamics, solid particles immersed into a weakly ionized plasma, so called complex (dusty) plasmas, were (and continue to be) a subject of many detailed studies. Special types of dynamical activity have been registered, in particular, spontaneous pairing, entanglement and cooperative action of a great number of particles resulting in formation of vortices, self-propelling, tunneling, and turbulent movements. In the size domain of 1–10 mkm normally used in experiments with complex plasmas, the characteristic dynamic time-scale is of the order of 0.01–0.1 s, and these particles can be visualized individually in real time, providing an atomistic (kinetic) level of investigations. The low-R turbulent flow induced either by the instability in a complex plasma cloud or formed behind a projectile passing through the cloud is a typical scenario. Our simulations showed formation of a fully developed system of vortices and demonstrated that the velocity structure functions scale very close to the theoretical predictions. As an important element of self-organization, cooperative and turbulent particle motions are present in many physical, astrophysical, and biological systems. Therefore, experiments with turbulent wakes and turbulent complex plasma oscillations are a promising mean to observe and study in detail the anomalous transport on the level of individual particles.