P 16: Low Pressure Plasmas II & Dusty Plasmas II

Time: Friday 11:00–12:30 Location: H2

Invited Talk P 16.1 Fri 11:00 H2

Configurational temperature of multi species complex (dusty) plasmas — •Dietmar Block[1], Frank Wieben[1], Michael Himpel[2], and Andre Melzer[2] — [1]IEAP, Universität Kiel, Germany — [2]Institut für Physik, Universität Greifswald, Germany

The dust charge of the two species in a binary mixture of particles in a dusty plasma has been measured using the concept of configurational temperature. There, the dust charge and the respective dust charge ratio is determined from the comparison of the instantaneous particle positions and the kinetic temperature. For that purpose, experiments of binary mixtures of melamine-formaldehyde and silica particles have been evaluated. The configurational temperature approach has also been checked against simulations. From these analyses it is found that the charge ratio of the two species can be obtained quite accurately, whereas for the determination of the absolute charge values a good knowledge of the confining potential is required.

P 16.2 Fri 11:30 H2

Simulations and Experiments of Phase Separation in Binary Dusty Plasmas — •Stefan Schütt and André Melzer — Institute of Physics, University of Greifswald

Molecular dynamics simulations of binary dusty plasmas have been performed and their behavior with respect to the phase separation process has been analyzed. The simulated system was inspired by experimental research on phase separation in dusty plasmas under microgravity on parabolic flights. Despite vortex formation in the experiment and in the simulations the phase separation could be identified. From the simulations it is found that even the smallest charge disparities lead to phase separation. The separation is due to the force imbalance on the two species and it becomes stronger with increasing size disparity or decreasing mean particle size. In comparison, experiments on phase separation have been performed and analyzed in view of the separation dynamics. It is found that the experimental results are reproduced by the simulation regarding the dependency on the size disparity of the two particle species.

P 16.3 Fri 11:45 H2

Waves in binary dusty plasmas — •Lasse Bruhn and Dietmar Block — Institute of Experimental and Applied Physics, Kiel University, Germany

Complex plasmas containing charged dust particles are an ideal model system for research on strong coupling phenomena. In two-dimensional systems waves can be excited either thermally or by external manipulation. The dispersion of waves propagating in monodisperse complex plasmas is well understood. However, the dynamics of waves in binary mixtures, containing two differently sized particle species, are less examined, but an interesting field of research. In this contribution, a method to derive the dust charge ratio as well as the absolute charges of the two particle species from the thermal dispersion is presented.

P 16.4 Fri 12:00 H2

Wave turbulence in fluid complex plasmas — •Prapti Bajaj[1], Christoph Räth[1], Alexei Ivlev[2], and Mierk Schwabe[1] — [1]Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt (DLR) — [2]Max-Planck-Institut für Extraterrestrische Physik

Turbulence is a physical phenomenon observed in out of equilibrium systems exhibiting non-linear properties, and it is being studied intensively in a plethora of fields like fluid dynamics, plasma physics et cetera. Here, we study wave turbulence in a complex plasma, which is a system of micrometer-sized particles embedded in a low-temperature plasma. Our experiment was conducted in the ground-based setup of PK-3 Plus, where microparticles were injected in a capacitively coupled RF-plasma chamber and a laser illuminated a vertical cross-section of the microparticle cloud. This makes it possible to study particle behaviour at the kinetic level by using high-speed imaging. Waves form spontaneously in the cloud of confined microparticles due to ion-streaming instability. Our analysis shows that the power spectrum exhibits a slope of -5/3 in Frequency-Fourier space, corresponding to the scaling law predicted for Kolmogorovian turbulence, also observed in many classically turbulent systems. Our aim is to investigate the spectrum of short-scale disturbances generated due to the cascade of different wave modes, and their isotropisation.

P 16.5 Fri 12:15 H2

Correlation of the void dynamics with transition events of the growth chain of nanodust in a reactive argon-acetylene plasma — Sebastian Groth[1], Nancy Fassheber[2], Gernot Friedrichs[2], and •Franko Greiner[1] — [1]Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel — [2]Institut für Physikalische Chemie, Christian-Albrechts-Universität zu Kiel

Using imaging Mie ellipsometry in combination with 1D extinction measurements we have fully characterized the spatio-temporal size and density evolution of nanoparticles grown in a reactive argon acetylene plasma [Groth et al. PSST 2019, https://iopscience.iop.org/article/10.1088/1361-6595/ab5412]. The growth process is usually divided into four phases: (i) creation of precursors from acetylene, (ii) nucleation of nanometer-sized a:C-H clusters (nucleation phase), (iii) coagulation of the clusters to 50 nm nanoparticles (coagulation phase), and finally (iv) further growth of negatively charged particles by sticking of molecules and molecular ions (accretion phase).

The analysis of the dynamical behavior of a nanodust cloud completely embedded in another cloud, consisting of larger particles, can link events in the spatio-temporal evolution of the nanodust cloud to events along the growth chain of the nanoparticles. This permits the verification of theoretical predictions about the occurrence of specific plasma chemical events along the growth chain by means of laser spectroscopy.