

Optical diagnostics of complex plasmas

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Particle-containing (dusty) plasmas offer and require the development of sophisticated diagnostic techniques to measure particle motion, particle density, particle size and even particle charge.

The determination of the three-dimensional trajectory of particle on the individual kinetic level can be achieved by stereoscopy using multiple cameras. This can be used to study, e.g., vortex flows in dust clusters with more than 1000 particles or wave motion in a restricted volume of extended dust clouds.

Optical tomography reveals the spatially resolved particle density in dense dust systems from angle-resolved absorption measurements. Further, Mie scattering allows to measure the size and size distribution of particles trapped in the plasma. Here, the long-time evolution of the confinement of the dust clouds as well as dust particle sputtering processes can be investigated.

Finally, in the infrared spectral regime the light-scattering properties of particles can reveal the charge state of the particles from the blue-shift of the optical phonon resonance in certain types of materials.

The talk will give an overview over the diagnostics and some recent applications.