FIRST OBSERVATION OF SLOW DYNAMICAL PROCESS IN A QUASI-2D BINARY COMPLEX PLASMA NEAR GLASS TRANSITION

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Complex plasmas are composed of a weakly ionized gas and charged microparticles. The latter can be visualized individually. In strongly coupled complex plasmas, particle dynamics can be virtually undamped. Such properties make it an ideal model system to investigate generic processes occurring in liquids and solids at kinetic levels.

One of these generic processes of general interest concerns super-cooled liquids. Understanding slow dynamical processes here is a major challenge of condensed matter physics. As one of the most important characteristic features, structural relaxation of super-cooled liquid has been intensively investigated in both experiments and numerical simulations. Currently, experimentalists tend to use colloidal suspensions as a model system to explore $\alpha$ relaxation while both $\alpha$ relaxation and $\beta$ relaxation can be studied in detail in a poly-dispersed hard-sphere system by Brownian dynamics simulation.

In this contribution, we report the first observation of slow dynamical process in a quasi-2d binary complex plasma near glass transition. The experiment was performed in a GEC discharge chamber. As a most simple type of poly-dispersed particle system, we levitated particles of two different sizes in quasi-monolayer in an rf discharge. The vertical deviation is less than 1/4 of the inter-particle distance. After the system was quenched to approximately 1000 K, two types of particles mixed together in the center of the chamber, forming an amorphous 2d structure.

By tracking individual particles from the top view we calculated the evolution of the self-part of the intermediate scattering function (ISF) for several wave vectors. The ISF curve is fitted by stretched-exponential (Kohlrausch) laws, which give a good empirical description of $\alpha$ relaxation. The stretching exponent and Kohlrausch time scale decay with increase of the wave vectors. However, the absolute value of decay time strongly depends on the density as well as the mixture ratio, which requires further careful study.