MOLECULAR DYNAMICS SIMULATIONS OF PHASE SEPARATION IN 3D BINARY COMPLEX PLASMAS

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Binary liquid mixtures may undergo phase separation under certain conditions, driven by the interaction nonadditivity in equilibrium systems and/or by temperature, pressure, shear flow or electric field in non-equilibrium systems[1]. Phase separation has been studied in many different systems such as colloids, polymer blends and alloys for several decades. In particular, recent theory[2] has indicated that it could also happen in binary complex plasma (BCP), i.e., complex plasma consisting of mixtures of two different sized dust particles.

Complex (dusty) plasmas[3] are composed of a weakly ionized gas and charged micron-sized particles and they occur widely in astrophysical environments, as well as in the laboratory. Typically, dust particles in the laboratory plasmas acquire large amount of negative charges, of the order of 1000 to 10000 elementary charges, so that they can interact quite strongly with each other. Since motion of dust particles in complex plasma can be easily observed in experiment and their dynamics is rather weakly damped by the background gas, the BCP should be an ideal system to study liquid mixtures at the atomistic level.

In the near future, there will be a series of dedicated experiments performed in PK-3 Plus chamber[4], to study 3D BCPs. Therefore we performed molecular dynamics (MD) simulations to investigate the structure and phase evolution of 3D BCPs. The phase separation is stimulated by the nonadditivity of the interaction potential energy between unlike particles. Pair correlation functions have been evaluated to characterize the structure of the binary complex plasma as well as to estimate the phase separation of the system. Preliminary results show that the phase separation depends strongly on the nonadditivity parameter and the system temperature.

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