Colored Noise and String-like Collective Motion in the Strongly Interacting Particle Systems

Hao Zhang

Department of Chemical and Materials Engineering, University of Alberta, Canada

Strongly interacting particle system refers to the particle system exhibiting non-trivial collective phenomena in equilibrium, near-equilibrium, or non-equilibrium states. For example in the supercooled liquids, the dynamics slows down abruptly as the system approaches the glass transition temperature where the strong reduction in the particle mobility and an enormous change in the rate of structural relaxation are found in association with the growth of string-like collective motion. Evidently, thermally excited collective string-like particle motion is a general, if not universal, property of strongly interacting particle systems. A better understanding of the collective atomic motion in diverse strongly interacting particle systems has the practical significance of this phenomenon in numerous further contexts of fundamental scientific and practical interest in material science. In this presentation, we will take grain boundaries and interfacial dynamics of nanoparticles systems as examples to demonstrate and discuss such important atomic motions. Moreover, we are looking into the possibility to find a relationship between colored noise and collective motion in amorphous materials since it is generally difficult to observe the string-like motion in atomic and molecular particle systems. Our attempt then is to somehow turn noise measurements into measurements of the extent of string-like collective motion.

H. Zhang, et al. PNAS, 106, 7729, 2009
H. Zhang, et al. Soft Matter, 6, 5944, 2010
H. Zhang, et al. J Phys Chem B, 115, 14068, 2011
Y. Liu, et al. J Phys Chem C, 115, 14591, 2011
H. Zhang and J.F. Douglas, submitted to Soft Matter, 2012