

Research Topic for M2 training +? 2017-?

Statistical Mechanics of Inhomogeneous Freezing

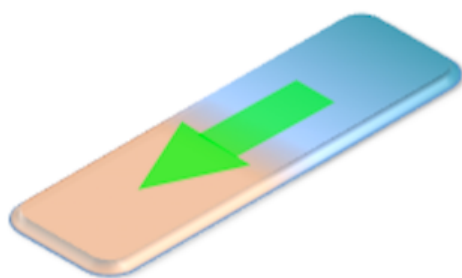
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Key Words: Theory, Non-Equilibrium, Freezing, Hyperuniformity, Statistical Physics



When being cooled down, many systems undergo the freezing/glass transition. At different rates of cooling, both the state histories and the resulting frozen states can differ.

Recent studies, experimental, numerical and theoretical, have clarified different level of understanding of these phenomena.

However, only a few things are known, both experimentally and theoretically, if the cooling down occurs in a spatially inhomogeneous manner. For example, no definitive answer is known about how the spatial cooling-speed modifies the spatial correlations.

Furthermore, generalization in many directions is conceivable, such as the inhomogeneous growth of biopolymer network (actin gelation) from a boundary and flow-and-compaction of granular matters.

The goal of the present subject is to investigate these fascinating systems using (i) the *freezing boundary condition* we developed while studying the quasi-crystals; and eventually (ii) the recent experimental data obtained by the group of Damien Vandembroucq in ESPCI.

The research will take place first purely theoretically, then hopefully within the context of a collaboration with experimental physicists from ESPCI, and probably with BioPhysicists.

Required background of the student: Good background in Physics and Mathematics, and Taste for creating new framework, rather than playing established games.

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M2 Course : ED Système Complexe, "Advanced stochastics, dynamics and energetics" from Jan.16

BOOK : *Stochastic Energetics*, (Ken Sekimoto, Lecture Notes in Physics, vol.799, Springer)