Research Topic for the Thesis 2017+
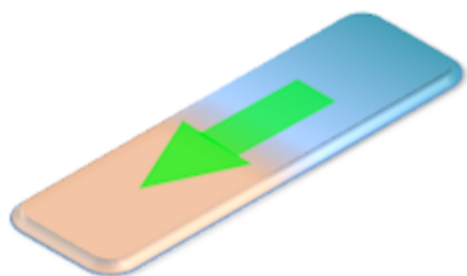
Statistical Mechanics of Inhomogeneous Freezing

PCT team of Gulliver lab at ESPCI : http://www.pct.espci.fr
MSC lab at U.Paris-Diderot : http://www.msc.univ-paris-diderot.fr
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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 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, Taste for creating new framework, rather than playing established games. The level of **my M2 course** (see below).

Contacts:
    Ken Sekimoto (ken.sekimoto@espci.fr) - Prof. of Université Paris-Diderot, MSC

Advertisement:
    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)