Considerations and Perspectives on the Glass Transition Problem

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Glass Transition (GT) takes place in every many-body system undergoing a change from an equilibrium liquid-like state to a non-equilibrium amorphous solid-like state (the glass). Glasses have become the archetype of disordered solids despite the underlying mechanism controlling GT not being understood. Obvious manifestations of glassy behavior appear in molecular liquids, colloidal and polymer fluids, spin glasses, and granular media. This broad emergence illustrates why understanding glasses is considered one of the most important unsolved problems in condensed matter physics. In my talk I will discuss the two supposedly antithetical visions of the GT phenomenon: the kinetic and the thermodynamic perspectives. I will focus on the universal cooperative dynamics and static correlations observed in glass-forming systems. In particular, I will show specific, yet representative, examples of dynamic correlations and structural patterns detected in glassy systems with isotropic and non-isotropic microscopic interactions. I will conclude my talk by addressing some open questions concerning the glassy behavior recently reported in out-of-equilibrium active systems.

Bibliography:
Cell 156, 183 (2014).

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