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Glass transition as the consequence of spatially correlated stochastic dynamics

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Despite the decades of intense research, the glass transition, i.e. the extreme rise in the viscosity (by 10^{14} for molecular and 10^3 for colloidal glasses) of the disordered system as it becomes denser/colder, is far from being fully understood. One important limitation here is the lack of analytically solvable models for the systems with arbitrary interactions. In this presentation such one-dimensional model is introduced. The model originates from the recent theoretical advancements in the field of Langevin dynamics driven by the spatially correlated noise (SCN). SCN can be linked to the diffusion in colloids or dynamic heterogeneity in molecular systems. Recently, it has been shown that the thermodynamic consistency requires SCN to be accompanied by the dissipation represented as the friction-response matrix. I will show that in the thermodynamic limit, this matrix can develop a genuine singularity in dissipation for finite volume packing, thus heralding the system jamming. Since this happens under the assumption of complete molecular disorder, this jamming is identified as the glass transition. The model introduces new perspective on the role of spatial correlations in vitrification, i.e. it shows that they might not be the consequence, but the cause of jamming. It also provides the exact relation between the noise correlation length and the critical packing. Finally, it suggests that the spectrum of the friction-response matrix might be the order parameter for the glass transition.

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