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Out-of-equilibrium, activated dynamics in glassy landscapes: a geometrical approach

The study of Langevin dynamics within highly non-convex random landscapes has been crucial for understanding fundamental aspects of glassy dynamics such as aging, violations of fluctuation-dissipation relations, the emergence of effective temperatures, and the role of high dimensionality and entropy in slowing down relaxation. A comprehensive understanding of the activated regime of the dynamics, where the system transitions between metastable states by overcoming energy barriers, remains however elusive. In the talk I will consider a prototypical model of a high-dimensional energy landscape with Gaussian statistics, exhibiting plenty of metastable states. After recalling the main reasons why activated dynamics is theoretically challenging, I will consider effective processes in which the system jumps in the landscape, visiting the closest metastable states at given energy. Understanding this effective dynamics requires to analyze the geometry of the landscape, particularly the joint distribution of triplets of metastable states that lie in the same region of the high-dimensional configuration space. I will report on the results of this geometrical analysis, and comment on implication for activated dynamics.