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Jamming: Relating Shear and Effective Temperature[1]

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In an equilibrium system, temperature not only influences the average properties of a system, such as its pressure or density, but also controls the fluctuations around those averages. In systems driven far from equilibrium, however, temperature is no longer well-defined, and fluctuations can be non-thermal in origin. I will discuss a class of such systems, namely steadily-sheared glasses, for which there is a considerable body of evidence that the idea of an effective temperature is useful, at least in certain regimes. Using nonequilibrium molecular dynamics simulations, we have now calculated seven different definitions that yield a consistent value for the effective temperature, which can be many orders of magnitude higher than the bath temperature. However, if we want to understand the behavior of a material, measuring its temperature is only a start. I will discuss recent results that show that when shear-induced fluctuations dominate over thermal fluctuations, the effective temperature controls materials properties such as the rheology and the extreme slowing down of the dynamics as the system jams.

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