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Mean-field description of plastic flow in amorphous solids JIE LIN, New York University, MATTHIEU WYART, EPFL — Failure and flow of amorphous materials are central to various phenomena including earthquakes and landslides. There is accumulating evidence that the yielding transition between a flowing and an arrested phase is a critical phenomenon, but the associated exponents are not understood, even at a mean-field level where the validity of popular models is debated. Here we solve a mean-field model that captures the broad distribution of the mechanical noise generated by plasticity, whose behavior is related to biased Lévy flights near an absorbing boundary. We compute the exponent θ characterizing the density of shear transformation $P(x) \sim x^{\theta}$, where x is the stress increment beyond which they yield. We find that after an isotropic thermal quench, $\theta = 1/2$. However, θ depends continuously on the applied shear stress, this dependence is not monotonic, and its value at the yield stress is not universal. The model rationalizes previously unexplained observations, and captures reasonably well the value of exponents in three dimensions. These results support that it is the true mean-field model that applies in large dimension, and raise fundamental questions on the nature of the yielding transition.

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