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Unjamming dynamics: the micromechanics of an earthquake

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One of the main open questions regarding the shear stress driven unjamming transition, relevant to geophysical processes such as landslides and earthquakes, is the identi[U+FB01]cation of its underlying microscopic mechanical mechanisms. We tackle this problem via three dimensional Molecular Dynamics simulations of a model of a seismic fault, where grains between rough plates play the role of the gouge. The micromecanical mechanisms leading to the transition are analyzed at a level of spatial and temporal resolution not considered before.

The unjamming transition is characterized by defining a novel two–time force–force correlation function and a characteristic length related to the system response to external perturbations. The stick–slip dynamics, consisting in large slips and microslips leading to creep motion. The correlation function enlightens the micromechanical changes occurring both during microslips and slips. The characteristic length encodes the magnitude of the incoming microslip. Structural changes, as contact breaking, are the consequence and not the cause of the unjamming transition.