The challenge of seismic forecasting and the micro-mechanics of an earthquake.

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Earthquake forecasting is still a great challenge in seismology and in the field of stochastic processes in general. The standard seismological approach has traditionally assumed that an earthquake "does not know how large it will become". In the last years an extended literature has attacked this problem. The common tools are, both, the analysis of the statistical organization of events in earthquake catalogues, and the generation of numerical catalogues by branching models based on phenomenological laws.
We adopt here a microscopic approach and investigate the unjamming transition in a seismic fault model via three dimensional Molecular Dynamics simulations. A granular medium, representing the fault gouge, is confined between two rough rigid plates, i.e. the fault planes. The stick-slip dynamics consists in large slips and small slips (micro-slips). The unjamming transition from the stick to the slip phase is characterized by a non trivial two-time force-force correlation function and a susceptibility related to the system response to pressure changes. The correlation function unveils the micro-mechanical changes occurring both during micro-slips and slips, together with the presence of different relaxation times. The susceptibility encodes the magnitude of the incoming micro-slip.