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Multiscale minimal modeling of microscale crystal plasticity: Finite-size scaling and stochastic plastic flow STEFANOS PAPANIKOLAOU, Johns Hopkins University, PETER ISPANOVITY, Etvs University — We investigate the multiscale description from continuum to discrete modeling of crystal plasticity in the context of a minimal model. We develop a continuum plasticity description of discrete edge dislocations moving athermally in a single slip system; Our continuum modeling not only matches the statistical behavior of the model, but also the onset of emergent length scales as load increases. We perform quasistatic stress-controlled simulations of our continuum model and compare it with the corresponding discrete dislocation dynamics model, which describes crystal plasticity at a smaller spatiotemporal discretization scale. We investigate the properties of strain bursts (dislocation avalanches) occurring during plastic deformation, as well as the onset of a dislocation patterning lengthscale, and compare in detail the continuum and discrete descriptions. Our approach provides a pathway to multiscale modeling of complex, multi-slip and three dimensional crystal plasticity.

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