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Fracture and material geometry MICHELLE DRISCOLL, SIDNEY NAGEL, University of Chicago, BRYAN CHEN, VINCENZO VITELLI, Leiden University, Instituut-Lorentz for theoretical physics — Linear elastic fracture mechanics provides a firm foundation for understanding crack propagation in a continuum material– how are these predictions modified when a material elastic constant becomes vanishingly small? We study fracture in fragile lattices in experiments by fabricating materials containing voids, thus modifying the ratio of shear to bulk modulus, G/B, such that G/B→0. We compare these results to simulations on a braced square lattice where rigidity is controlled by varying coordination number [1]. In the quasi-static limit for both experiment and simulation, we observe a crossover as the material becomes more fragile: propagating cracks are progressively superseded by isolated bond-breaking events. This crossover is signaled by the crack width increasing as G/B→0, until it saturates at the system size, consistent with the random breaking of bonds. We also study dynamic fracture in a material containing a 1D array of voids. We measure the crack velocity, and again find two distinct regimes of behavior governed by material rigidity.
[1] B. G. Chen, S. Ulrich, N. Upadhyaya, L. Mahadevan, V.Vitelli, in preparation

Michelle Driscoll
University of Chicago

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