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The contact percolation transition[1] TIANQI SHEN, Physics Department at Yale University, COREY O'HERN, Department of Mechanical Engineering & Materials Science, Yale University, MARK SHATTUCK, Benjamin Levich Institute and Department of Physics, City College of New York of the City University of New York — Typical quasistatic compression algorithms for generating jammed packings of athermal, purely repulsive particles begin with dilute configurations and then apply successive compressions with relaxation of the elastic energy allowed between each compression step. It is well-known that during isotropic compression athermal systems with purely repulsive interactions undergo a jamming transition at packing fraction ϕ_J from an unjammed state with zero pressure to a jammed, rigid state with nonzero pressure. Using extensive computer simulations, we show that a novel second-order-like, contact percolation, which signals the formation of a system-spanning cluster of mutually contacting particles, occurs at $\phi_P < \phi_J$, preceding the jamming transition. By measuring the number of non-floppy modes of the dynamical matrix, the displacement field between successive compression steps, and the overlap between the adjacency matrix, which represents the network of contacting grains, at ϕ and ϕ_J, we find that the contact percolation transition also heralds the onset of nontrivial response to applied stress. Highly heterogeneous, cooperative, and non-affine particle motion occurs in unjammed systems significantly below the jamming transition for $\phi_P < \phi < \phi_J$,

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Tianqi Shen
Department of Physics, Yale University

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