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Exact computation of the critical exponents of the jamming transition

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The jamming transition marks the emergence of rigidity in a system of amorphous and athermal grains. It is characterized by a divergent correlation length of the force-force correlation and non-trivial critical exponents that are independent of spatial dimension, suggesting that a mean field theory can correctly predict their values. I will discuss a mean field approach to the problem based on the exact solution of the hard sphere model in infinite dimension. An unexpected analogy with the Sherrington-Kirkpatrick spin glass model emerges in the solution: as in the SK model, the glassy states turn out to be marginally stable, and are described by a Parisi equation. Marginal stability has a deep impact on the critical properties of the jamming transition and allows one to obtain analytic predictions for the critical exponents. The predictions are consistent with a recently developed scaling theory of the jamming transition, and with numerical simulations. Finally, I will briefly discuss some possible extensions of this approach to other open issues in the theory of glasses.