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Jamming as a critical phenomenon: A field theoretical approach
SILKE HENKES, BULBUL CHAKRABORTY, Brandeis University — The proposed jamming diagram (Nature **396**, 21 (1998)) features a special point, termed point J, along the packing fraction axis where the jamming transition is sharp. Recent simulation work (PRE **68**, 011306 (2003)) has shown that point J has some features of a critical point. To model the jamming transition along the packing fraction axis, a field theory of frictionless, zero-temperature grain packings in two dimensions has been constructed (PRL **95**, 198002 (2005)). A mean-field theory involving two order parameters, $\langle\phi\rangle$, the average force per contact, and $\langle z\rangle$, the deviation of the average contact number from its isostatic value, predicts a transition from a jammed to an unjammed phase. The transition is of mixed order with a jump in $\langle\phi\rangle$ and divergent fluctuations. Current work focuses on application of this formalism to simulation data. This allows for the study of spatial fluctuations of ϕ and attempts are made to relate these to the concept of force chains. The ϕ-field emerges as an excellent tool for data analysis and allows quantification of the structures seen in granular packings. Work supported by NSF-DMR 0403997.

Bulbul Chakraborty
Brandeis University

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