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Microscopic Order Parameter for Shear Anisotropy for Systems near Shear Jamming JIE REN, JOSHUA DIJKSMAN, ROBERT BEHRINGER, Duke University — Sheared granular systems at packing fractions between $\phi_s \leq \phi \leq \phi_J$ can exist in states with zero and nonzero stress. A system, prepared in a stress-free states in this density range, upon being sheared exhibits first fragile, then shear jammed states, both having high stress and fabric anisotropy. The onset of shear jammed states resembles an order-disorder transition. In recent work, we showed that the order appears in a force space (Bi et al. to appear, PRL). Here, we identify an order parameter associated with individual particles, making it possible to construct correlations in physical space. We identify local (particle-scale) order with Γ, the deviatoric part of the force-moment tensor. This is a real symmetric, traceless matrix characterized by two coefficients, a and b, such that $\Gamma = aU_1 + bU_2$, and where U_1 is diagonal with elements ± 1, and U_2 has 0's on the diagonal, and 1 for the off-diagonal elements. The U_i's are orthogonal under an appropriate scalar product. Then, (a, b) provides a vector particle-scale order parameter. Γ is additive over all particles, and is analogous to the magnetization in a spin system. Also, particles with orthogonal shear stresses now correspond to anti-parallel vectors. We use this representation to investigate both the collective order of the system and also correlations. This talk presents analysis of experimental data that explore the properties of this new order parameter.

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