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Measuring Temperaturelike State Variables in History-Dependent Jammed Granular Systems EPHRAIM BILILIGN, KAREN DANIELS, North Carolina State University — Granular systems are athermal, thus a complete statistical mechanics framework must be based on a set of macroscopic state variables which excludes temperature. One leading theory incorporates a stress-based ensemble, and predicts a Boltzmann-like distribution of the force-moment tensor with respect to the conjugate, temperature-like variable, angoricity. We experimentally test this theory on a static, bidisperse, two-dimensional packing of discs. Basal friction is eliminated by floating the discs on a sub-fluidizing upflow of air, and the packings are subjected to either uniaxial compression or simple shear. We simultaneously measure the contact forces acting on each disc using photoelasticity. These measurements are repeated over many configurations of discs by dilating and rearranging the system, and the angoricity is computed as a function of the confining pressure. In particular, we test the predicted linear relationship between angoricity and pressure. Comparison to prior results and numerical simulations also suggests a history-dependent angoricity, an undesirable feature in the proposed state variable.

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