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**Testing ergodicity in dense granular systems** GUO-JIE GAO, JERZY BLAWZDZIEWICZ, COREY O'HERN, Yale University — The Edwards' entropy formalism provides a statistical mechanical framework for describing dense granular systems. Experiments on vibrated granular columns and numerical simulations of quasi-static shear flow of dense granular systems have provided indirect evidence that the Edwards' theory may accurately describe certain aspects of these systems. However, a fundamental assumption of the Edwards' description—that all mechanically stable (MS) granular packings at a given packing fraction and externally imposed stress are equally accessible—has not been explicitly tested. We investigate this assumption by generating all mechanically stable hard disk packings in small bidisperse systems using a protocol where we successively compress or decompress the system followed by energy minimization. We then apply quasi-static shear flow at zero pressure to these MS packings and record the MS packings that occur during the shear flow. We generate a complete library of the allowed MS packings at each value of shear strain and determine the frequency with which each MS packing occurs. We find that the MS packings do not occur with equal probability at any value of shear strain. In fact, in small systems we find that the evolution becomes periodic with a period that grows with system-size. Our studies show that ergodicity can be improved by either adding random fluctuations to the system or increasing the system size.

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