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Frictional families in 2D experimental disks under periodic gravitational compaction[1] ALINE HUBARD, MARK SHATTUCK, The Graduate Center and City College of the City University of New York, COREY O'HERN, Yale University Departments of Mechanical Engineering & Materials Science and Physics — We studied a bidisperse system with diameter ratio 1.2 consisting of four 1.26cm and three 1.57cm stainless steel cylinders confined between two glass plates separated 1.05 times their thickness with the cylinder axis perpendicular to gravity. The particles initially resting on a movable piston are thrown upward and allowed to come to rest. In general this frictional state is stabilized by both normal and tangential (frictional) forces. We then apply short (10ms) small amplitude bursts of 440Hz vibration, temporarily breaking tangential forces and then allow the system to re-stabilize. After N of these compaction steps the number of contacts will increase to an isostatic friction-less state and additional steps do not change the system. Many frictional states reach the same final friction-less state. We find that this evolution is determined by the projection of the gravity vector on the null space of the dynamical matrix of a normal spring network formed from the contacts of the frictional state. Thus each frictional contact network follow a one-dimensional path (or family) through phase space under gravitational compaction.

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