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Experimental avalanches in a two-dimensional rotating drum: Universality or a first-order phase transition?[1] ALINE HUBARD, CUNY Graduate Center and Levich Institute and Physics Department of City College of New York, COREY O'HERN, Department of Mechanical Engineering & Materials Science, Department of Applied Physics, and Department of Physics, Yale University, MARK SHATTUCK, CUNY Graduate Center and Levich Institute and Physics Department of City College of New York — We study experimentally the dynamics of steel spheres in a quasi-two dimensional rotating drum to investigate whether avalanches occur as continuous or first-order transitions. In our experiments, monodisperse steel spheres are confined within a cylindrical region between the glass walls of the drum, and the drum rotation axis is perpendicular to the direction of gravity. The drum and spheres first rotate as a solid body, and the slope of the sphere packing increases until the packing becomes unstable. The avalanche proceeds until the system finds another stable packing. Using high-speed video, we track the particle displacements during each avalanche to quantify the statistics of the avalanche sizes and durations as a function of the rotation rate and particle size distribution. We find that the avalanche size and duration distributions display power-law scaling over several decades, which suggests universal behavior in this system.

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