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Toward Zero Surface Tension Limit: Granular Fingering Instability in a Radial Hele-Shaw Cell XIANG CHENG, LEI XU, AARON PATTERSON, HEINRICH JAEGER, SIDNEY NAGEL, The James Franck Institute and Department of Physics, The University of Chicago — Because of the absence of cohesive forces between grains, dry granular material can, in many respects, be thought of as a fluid with zero surface tension. In the zero surface-tension limit, viscous fingering is known to possess singular behavior. We have studied the viscous fingering instability in such a granular "fluid." In our experiment, we use a conventional radial Hele-Shaw cell consisting of two parallel glass plates separated by a gap. Gas with controlled pressures is blown through a hole at the center of one glass plate and displaces the surrounding dry granular material. We have systematically studied the fingering pattern as a function of gas pressure, gap thickness, and grain size. Two stages are observed during pattern growth. In the first stage, we find fluid-like fingering. However, as opposed to normal fluids, the pattern is more ramified at low pressure. In the second stage, we find several new behaviors in the system such as merging and pinching off of fingers and the existence of satellite bubbles.

Xiang Cheng
The James Franck Institute and Department of Physics, The University of Chicago

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