



## Frictional flow patterns

A high-viscosity fluid moving into a low-viscosity one is typically stable enough that no patterns form. But complex flow behavior can arise if a high-viscosity fluid interacts with dry granular materials. The fluid dynamics and the friction of the granular materials sometimes combine to create intricate flow patterns. Dawang Zhang and Bjørnar Sandnes of the UK's Swansea University and their colleagues found one such pattern during their fluid-flow experiments with a Hele-Shaw cell, which consists of two parallel glass plates separated by a thin gap.

The researchers injected a white, high-viscosity fluid of water and

glycerol from a central inlet into the cell's 0.9 mm gap, already partially filled with tiny hydrophobic glass beads. (The cell radius is about 14 cm, and the gray outer region is filled with air.) At low injection rates without viscous effects, a single finger-like structure formed, which eventually reached the cell's edge. At higher injection rates, rising viscous pressure forced the fluid to flow radially outward, and the additional fingers that formed pushed the granular material aside to create the spoke pattern seen in this image. (D. Zhang et al., *Nat. Commun.* **14**, 3044, 2023; image courtesy of Dawang Zhang and Bjørnar Sandnes.)

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