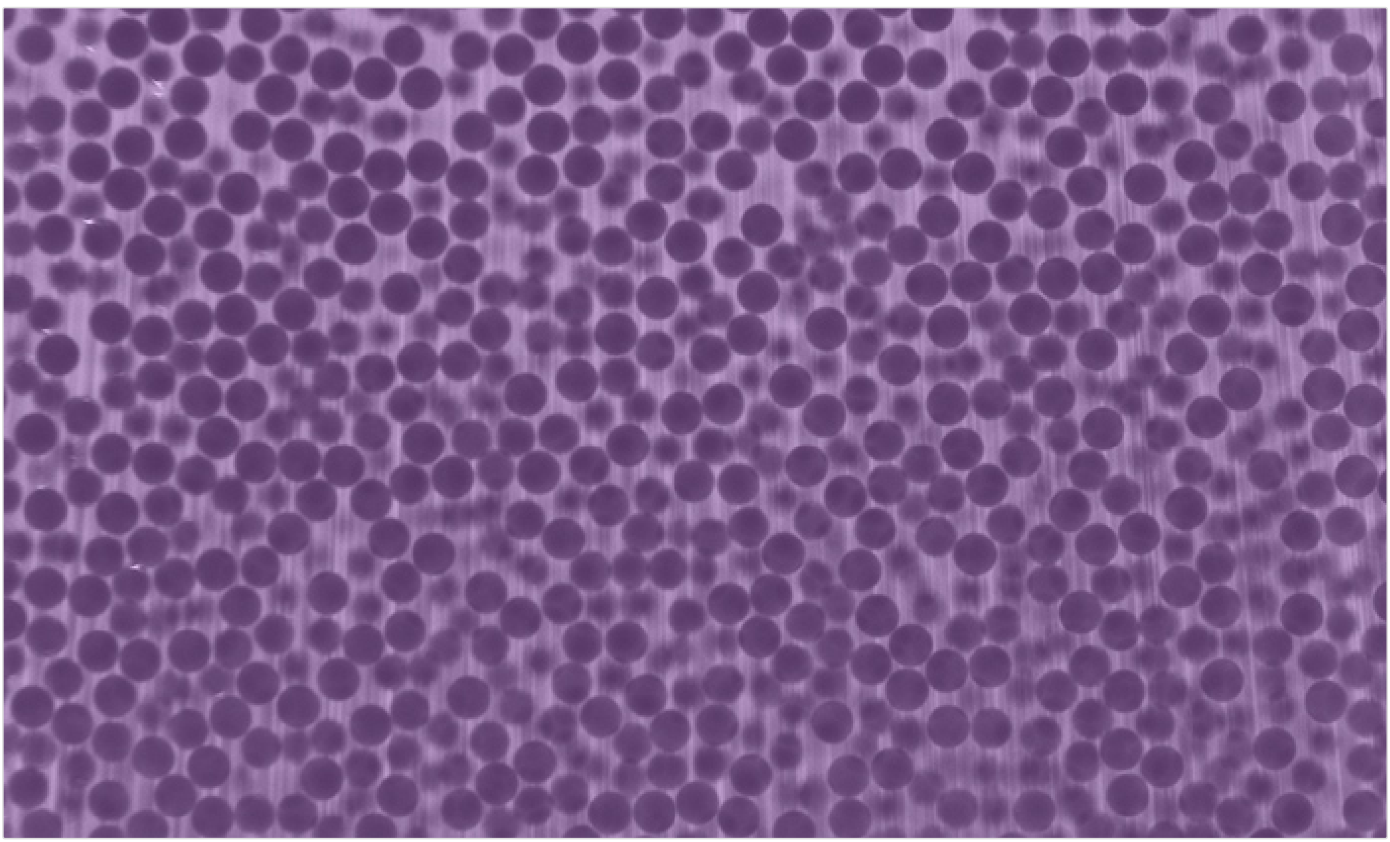
NEWS

From the College of Natural Sciences

Researchers Demonstrate How to "Freeze" Sand

Thursday, 22 February 2018 Marc G Airhart Physics, Mathematics



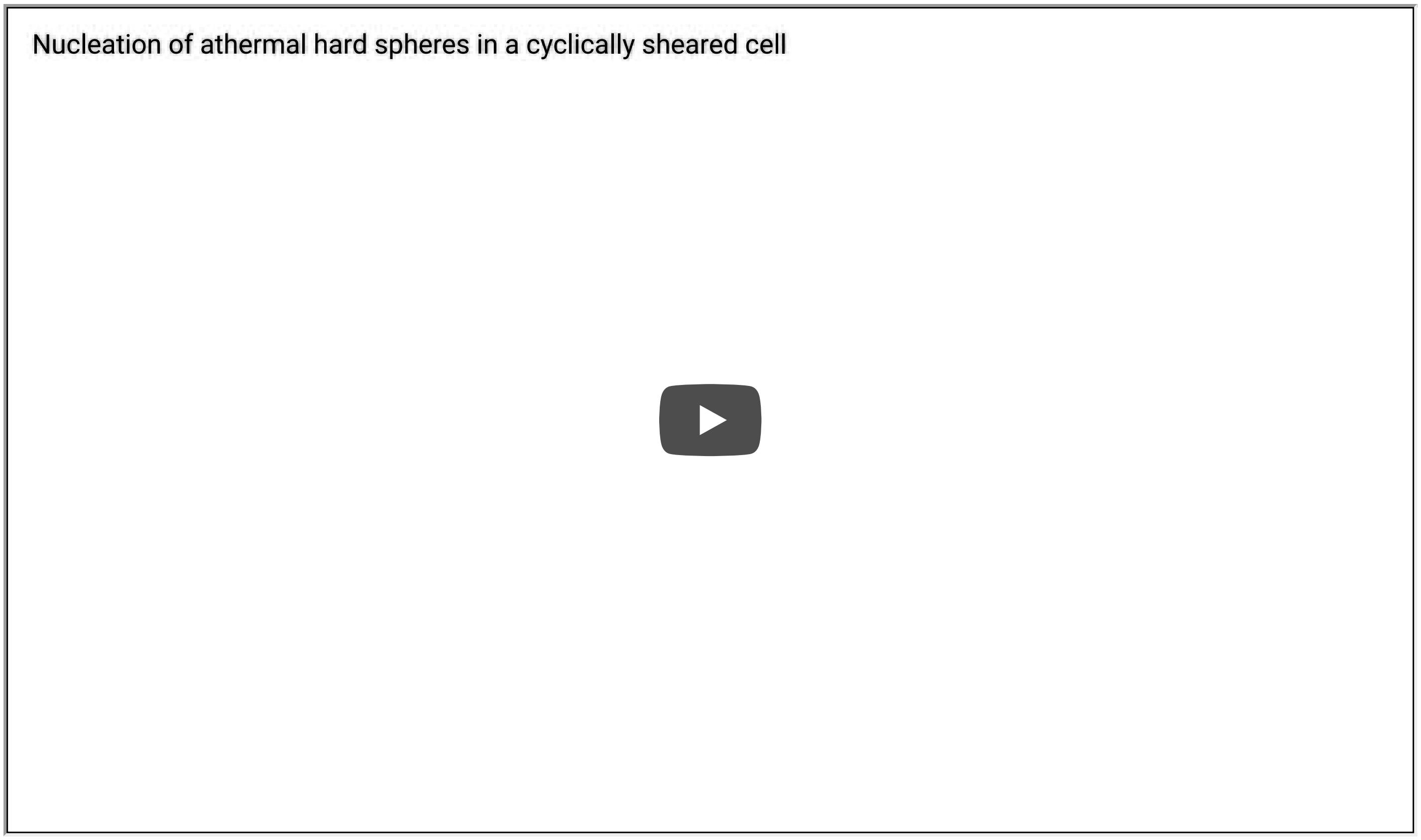
Using a novel imaging technique, a team of U.S. and German researchers found that wiggling the walls of a box packed with sand-sized glass spheres causes the spheres to form crystal structures similar to those formed when liquids freeze. By increasing the order among grains, the grains took up less space. One possible application would be to pack sand or other granular material more densely to save on shipping costs.

Charles Radin, mathematics professor at The University of Texas at Austin and co-author of the paper appearing in the journal *Physical Review Letters*, said this also opens up new avenues for basic research.

"This begs for the study of this new material at the fundamental level, determining in detail how crystalline sand responds to various forces and also at the practical level, how the physical properties can be useful," Radin said.

Harry Swinney, physics professor at UT Austin, is another co-author on the paper.

The grains in a naturally occurring pile of sand take up about two-thirds of the available space, as a result of their disorderly arrangement. In their experiment, the researchers filled a cubic box with hinged walls, called a "shear cell," with sand. By slowly tilting two opposite walls back and forth by a small angle many thousands of times, they found that the grains reorganized into a very orderly crystalline arrangement, allowing them to fill up nearly three-quarters of their available space.



"The video is not a simulation," said Radin. "We used an interesting technique involving a laser to visualize all the particles in the box."

The researchers, would begin by moving two opposite walls back and forth for a while. Then they would stop and run a thin laser sheet across the whole box, illuminating a cross-section of spheres, while a camera snapped a photo. Then they moved the laser sheet slightly closer to the camera and took another photo. By scanning across the entire box, they built up a complete three-dimensional image of the spheres at that stage. They repeated this process—wiggling walls for a while, stopping, building a 3D snapshot—many times and strung together the snapshots into a video to reveal how the grains rearranged themselves and crystals formed.

Radin and Swinney's German co-authors are Matthias Schröter from the Max-Planck-Institute for Dynamics and Self-Organization and from Friedrich-Alexander-Universität Erlangen-Nürnberg; and Frank Rietz also from those institutions, as well as University Magdeburg.

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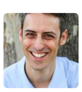

Marc G Airhart

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Marc Airhart is the Communications Coordinator for the College of Natural Sciences. A long time member of the National Association of Science Writers, he has written for national publications including Scientific American, Mercury, The Earth Scientist, Environmental Engineer & Scientist, and StarDate Magazine. He also spent 11 years as a writer and producer for the Earth & Sky radio series.

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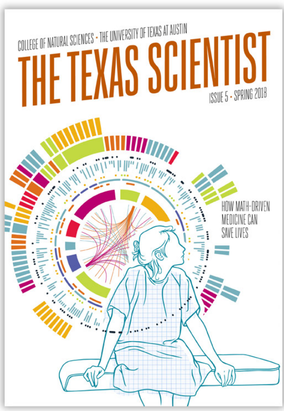

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