A 2D granular crystal

In this photo, the interstitial spaces between Delrin spheres (roughly 2 cm in diameter) have been tightly filled with stainless steel cylinders (about 8 mm in diameter). The two-dimensional arrangement forms a so-called granular crystal in which the components couple through contact interactions: When two neighboring objects are pressed together, they deform and generate a nonlinear, mutually repulsive force. The shapes and compositions of the various building blocks in a granular crystal significantly influence their interactions, and the discrete architecture allows defects to be introduced in precise positions. As a result, the crystals offer a unique opportunity to explore and tailor nonlinear phenomena.

Variations on the 2D geometry shown here offer a quick taste of the possibilities. For spheres of Delrin, which is much lighter and less stiff than steel, experiments and simulations show that after an impact on one side of the lattice, a significant fraction of the energy spreads laterally. But when the spheres and cylinders are both steel, the energy fans out roughly in a circle. Such an ability to shape wave propagation may lead to better shock absorbers and other applications. (A. Leonard, C. Daraio, *Phys. Rev. Lett.* **108**, 214301, 2012.)

For more on granular crystals, see the article by Mason Porter, Panayotis Kevrekidis, and Chiara Daraio on page 44. (Photo by Andrea Leonard and Chiara Daraio.)

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