LETTERS

Downsizing granular crystals and their kin

In their interesting article on granular crystals (PHYSICS TODAY, November 2015, page 44), Mason Porter, Panayotis Kevrekidis, and Chiara Daraio presented a rich set of recent developments in the field. They noted that switches and Boolean logic elements are among the possible applications of the propagation of nonlinear waves in granular media. Readers might be interested to know that Boolean logic operations have also been performed in related phononic crystals, although in that setting the functions do not rely on nonlinear phenomena.[1,2]

We strongly agree with the authors that the emerging possibility of downsizing granular crystals to the micron and perhaps submicron scale is full of potential. The richer physics of granular interactions at the smaller scales could serve as a bridge between macroscopic crystals and atomistic crystals. For instance, the rotational degrees of freedom inherent in granular media[3] offer unique opportunities to break the time-reversal symmetry of the dynamical equations. That could lead to topologically constrained wave propagation and the possibility of information-processing components that exploit the phase of waves instead of their amplitude.[4]

We believe, and we hope the authors will agree, that small-scale granular crystals and their phononic-crystal and acoustic-metamaterial cousins constitute a new frontier in the manipulation of acoustic waves and their utilization in technological progress.

References

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Correction

May 2016, page 12—The feature article by Steve Giddings appeared in PHYSICS TODAY, April 2013, page 30; the Quick Study by Hong Liu appeared in the June 2012 issue, page 68. PT

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