

ple rather than its volume and thus does not contribute to the sample's entropy.

I also found Terry Goldman's comments interesting. Strangely enough, several research groups, including my own, have performed crystallization experiments on colloids in micro-gravity during orbit. The physics of the liquid-to-crystal transition is the same in space as on the ground. That is because the transition has its basis in the purely geometric problem of particle packing. Using the crystal and random packing limits that researchers have found in experiments on granular systems, we can evaluate the entropy of a system at lower densities, and the ordered state has the higher entropy. For molecules on Earth and for colloids in space, thermal energy dominates gravitational potential energy, and entropic effects produce the crystallization with which we are familiar.

Reference

1. T. C. Hales, *Ann. Math.* **162**, 1065 (2005).

Paul Chaikin
(chaikin@nyu.edu)
New York University
New York

A brief etymology of cybernetics

In Robert Park's stimulating review of Steven Jones's *Against Technology* (PHYSICS TODAY, April 2007, page 59), there is an historical error: Although Norbert Wiener did use the term "cybernetics" in his 1950 book, *The Human Use of Human Beings: Cybernetics and Society* (Houghton Mifflin), he had already brought out a book in 1948 entitled *Cybernetics*.¹ I still have a copy that I bought in December 1948 when I was studying mathematical biology at the University of Chicago.

Apparently, André Ampère had already used the term *cybernétique* to describe the art of government, and much earlier Plato used the Greek term *kybernetes*, meaning governor and steersman, in conjunction with governance.

Of interest in conjunction with Jones's book and Park's review is the wide-ranging introduction to Wiener's book on cybernetics, which he wrote in 1947 while he was at the National Institute of Cardiology in Mexico City. Wiener expressed concern that those who have contributed to the then-new science of cybernetics "stand in a moral position which is, to say the very least, not very comfortable," because they are

contributing to the concentration of power, which always tends to end up "in the hands of the most unscrupulous." He offered, nevertheless, the "very slight hope" that a better understanding of man and society would result.

Reference

1. N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Wiley, New York (1948).

Frank R. Tangherlini
(frtan96@sbcglobal.net)
San Diego, California

Science on stage: Minor clarification

In my reply to William Bennett (PHYSICS TODAY, February 2008, page 11), one awkward phrase has left an impression I did not intend. *American Theatre* magazine did not request that I write a rebuttal in response to Kirsten Shepherd-Barr's book *Science on Stage: From "Doctor Faustus" to "Copenhagen."* The magazine editor requested a review, which turned into a major rebuttal as it developed.

Carl Djerassi
Stanford University
Stanford, California

Spontaneous knots and the law of snaggature

What a pleasure to read the brief story on how string spontaneously forms knots (PHYSICS TODAY, November 2007, page 19). The report immediately called to mind my late father, Paul S. Cohen, from the College of New Jersey's chemistry department. He formulated—only half in jest—what he termed the "law of snaggature," which states that everything in the universe spontaneously snags everything else, including electrical cords, ropes, string, cables, threads, hoses, and any other long, narrow, flexible objects. While he was confined to his hospital bed during his last days three years ago, he even joked about snaggature concerning his IV tubes.

How I wish I could show him this article. I know he would be immensely pleased to find out he was right.

Stephen Cohen
(drstevecohen@earthlink.net)
Horiba Jovin Yvon
Edison, New Jersey ■

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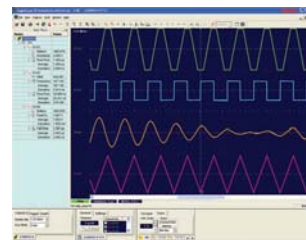
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