any phenomena in nature occur as the result of some kind of imbalance. For instance, an electric current flows when there is a difference in electric potential along a conductor (such as when an electric field is applied), and heat is transported when there is a temperature gradient between two boundaries of a material. Despite their ubiquity in everyday life, many aspects of such phenomena are still the subject of debate among theoretical physicists. One central issue is the role of spatial constraints, caused by the dimensionality of a system: the response of a system to external forces is intimately related to statistical fluctuations within it, and these, in turn, depend strongly on whether the system is one-, two- or three-dimensional. What happens to energy or charge transport in systems that are effectively one-dimensional, such as a nanowire or a DNA molecule? Onuttom Narayan and Sriram Ramaswamy1 discuss, it is reasonable to expect that the same equations should be exactly equivalent, at least for the intermediate sizes and timescales currently accessible in simulations. In this respect, there are open questions: can the anomalous behaviour actually be described by universal scaling laws, and to what extent does it depend on the nature of the microscopic interactions?

The conceptual challenge is not the only reason for studying energy transport in spatially constrained systems — there is also a variety of real systems in which these anomalies are important. Anisotropic crystals, magnetic chains, polymers and semiconductor films or wires are all examples of systems in which modern experimental techniques can probe the transport properties directly. Single-walled nanotubes (Fig. 1) are known through experiment to have an unusually high thermal conductivity, which is attributed mainly to quasi-one-dimensional lattice vibrations1, and it is reasonable to expect that the scaling laws derived for simple models should apply to nanotubes as well. Although, so far, an experimental test is lacking, molecular-dynamics simulations that use realistic energy potentials for the carbon atoms support this idea1. If the thermal conductivity did increase with nanotube length in a well-defined way, this would be a very promising feature to use in technological applications, such as the design of components that dissipate heat efficiently in nanocircuits.

In building models of energy-transport processes, the aim is to single out generic physical features, although this might sometimes be at the price of drastic simplifications. It hopefully, in the end, will go beyond pure academic interest and suggest new ideas for technological applications — perhaps the reader is astonished that so many interesting and innovative ideas are still emerging from classical mechanics.

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