

The impact of solid-state physics on society is hard to overstate.

But it would be disingenuous to imply that the attraction of research in solid-state physics is primarily driven by a desire to benefit humanity materially. Such a motivation is undoubtedly present within the community, but for most physicists studying the solid state, the central appeal is similar to that driving their more exotically inclined brethren: intellectual richness and the excitement of the imagination. And a very large element of surprise.

Consider two very different examples, both of which continue to feature frequently in these pages. Just over twenty years ago, the solid-state physics community was shaken by the discovery of high-temperature superconductivity — the unanticipated realization of zero-resistance electrical transport in a family of complex copper oxides, at temperatures too high to be accommodated by the theoretical framework that already existed for explaining such phenomena. (As it happens, the classical Bardeen–Cooper–Schrieffer (BCS) theory of conventional superconductivity is itself celebrating its 50th anniversary this year.) Of course, this stimulated much anticipation about how such materials might find serious practical application — still largely wishful thinking, unfortunately, although not altogether beyond the realms of possibility. But what continues to drive interest in these fascinating materials is the fact that their properties have yet to be understood.

More recently, this same community has borne witness to another unexpected development: the discovery of unusual electronic and

mechanical properties in graphene — individual crystalline layers of carbon only one atom thick. The surprise in this case is that these layers, when stacked up to form their parent material, graphite, constitute a well-known and much-studied material system that, from a solid-state physics perspective, arguably does fit the description of mundane. This system, too, has potential for practical application, but let's not get ahead of ourselves — the true cause for compelling interest is that graphene provides a powerful test-bed on which to explore the validity of some of the core concepts of solid-state physics. So far, these theoretical foundations are standing up to scrutiny pretty well, but there may well be further surprises to come. Several papers in this issue highlight some of the richness of graphene and of solid-state research in other areas (see pages 36, 52–70 and www.nature.com/conferences/aps/index.html).

The next few years can be expected to bring outstanding, high-profile science as the Large Hadron Collider at CERN, the European particle-physics laboratory near Geneva, starts to explore the landscape of particles and forces at energies never before attained in a laboratory. Who knows what other surprises may be in store (see page 16) as astronomers and physicists probe the nature of the vacuum in other ways? The results will be of no obvious use to anyone, and yet they represent exactly the sort of fundamental exploration that fascinates much of humanity. At the much lower energies found in any university lab, meanwhile, solid-state physicists will carry on unobtrusively changing our lives. ■

Not saving the whale

Japan's professed interest in whale research rings rather hollow.

As the world's biggest consumer of whale meat, Japan has a special interest in whale conservation. While fighting tenaciously to protect its whaling industry, it publicly supports the need for conservation. In a statement released last June, for example, it called on the International Whaling Commission (IWC) to “protect endangered and depleted species, while allowing the sustainable utilization of abundant species under a controlled, transparent and science-based management regime”.

Japan has placed considerable emphasis on research into whaling. It spends about ¥830 million (US\$7 million) each year to establish whether there are enough whales to support whaling (and in the case of the minke, at least, it finds that there are). And it works hard to get support in the IWC, sometimes from member nations that have no obvious interest in whaling. Two weeks ago, many of these countries sent representatives to a meeting in Tokyo — boycotted by the Western nations most strongly opposed to whaling — at which Japan reaffirmed its commitment to the goal of sustainable whaling.

When it comes to events on the high seas, however, Japan's actions leave much to be desired. Lately, for example, there have been repeated cases of western grey whales (*Eschrichtius robustus*) being caught in Japanese fishing nets. Only about 120 of these whales, which migrate

along the Pacific coasts of Asia, are thought to survive, although a much larger, sustainable population of eastern grey whales lives off the west coast of North America. The World Conservation Union (IUCN) estimates that the population of reproductive female western grey whales totals only about 30 animals. But four females have been trapped in Japanese fishing nets and accidentally killed in the past two years.

Japan has expressed concern over this issue. Its fisheries agency says it has been asking fishermen to report sightings of the whales, and to release them when trapped, instead of keeping them and selling their meat, as permitted under the law. The agency claims that its effort has worked so far, with no meat from grey whales being sold on the market.

However, the agency's efforts have not actually prevented the deaths, even though much could be done to that end, including supporting better research into the whales' migration and breeding habits, and the development and use of fishing nets that can release trapped animals. One might expect the Institute of Cetacean Research (ICR), which heads Japan's research whaling programme, to take charge of this effort. But it says that responsibility rests with other research institutes and with the fisheries agency. The overall result has been inaction.

The ICR is often characterized by its critics as little more than a cover for Japan's whaling industry. If it is to claim a real role in whale conservation, it could start by responding more energetically to the clear and present danger to the grey whale. ■

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