LETTERS

Fractures, Fractals and Foreign Physics

Fractals have been a fashionable topic in physics since the early 1980s, as remarked in the news story "Are Fractures Fractal or Quakes Chaotic?" (November, page 17). However, the connection to fracture processes was made much earlier than the story implies. Benoit B. Mandelbrot made the first approaches.[1] We, along with various colleagues, then made a rather comprehensive survey of the relation between crack growth in brittle materials and other fractal-generating growth models, such as diffusion-limited aggregation and dielectric breakdown.[2] Our first article was entitled "The Fractal Nature of Fracture." The answer to the question "Are fractures fractal?" is a qualified yes, in many cases. Research in the same direction has been pursued independently by other authors,[3] and the topic has induced lively debate in many scientific meetings. Even the question of self-organized criticality has been addressed in this context. There is also a wealth of experimental evidence accumulated subsequent to this work.[4]

One should perhaps remark that the news story concentrates on earthquakes, which, for all their social relevance, represent only an aspect of fracture processes. The ambitious title left room for a more comprehensive review.

A book reviewer in the same issue (page 82) remarks repeatedly that most of the experimental data in the book (on high-T_c superconductors) are of US origin. The members of the US physics community do a much better job of communicating their findings than others elsewhere, and this difference seems to be widening. We hope, however, that recognition in physics will depend on publicity efforts as little as possible, for the sake of scientific progress.

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12/90

November's Search and Discovery story "Are Fractures Fractal or Quakes Chaotic?" omitted mention of the elegant renormalization-group analysis of critical behavior in this class of models by R. F. Smalley, D. L. Turcotte and S. A. Solla (*Journal of Geophysical Research* **90**, 1894, 1985).

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12/90

Educating the Public at the Local Level

We are disturbed that the November special issue on communicating physics to the public made no mention of "grass roots" efforts by physics departments throughout the country to bring physics to the public. Nor was there any mention of AAPT's efforts in communicating science, including the area committee on science education for the public.

Big-ticket items such as telecasts, newspaper articles and science museums are an important part of science communication, since they reach large numbers of people. However, physics shows such as the Physics Funfest held annually at Purdue University, along with school visits by dedicated personnel, reach many thousands of children and adults each year. In fact, the publicity generated by these efforts indirectly touches an even larger portion of the population. If one tabulated all such efforts around the country, one would likely find that they expose hundreds of thousands of people to science each year—not an insignificant number. These types of public demonstrations have been around for hundreds of years. For example, the Christmas lectures held at the Royal Institution in Great Britain have over the years reached literally hundreds of thousands of people.

Physics demonstration shows are extremely useful for motivating interest in science. They are the most popular sessions at the national AAPT and National Science Teachers Association meetings. And by providing models and inspiration for others in the science community, they can generate future efforts to present science to the public better and faster than any other form of science communication.

If members of the public are to become scientifically literate, it is imperative that they first develop an interest in science, particularly at an early age. Television, print and science museums can be effective motivators, but demonstration shows, school visits and public lectures are equally effective and certainly deserved at least some mention in an issue dedicated to communicating science.

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Congratulations on a timely and informative issue! The articles on communicating physics to the public were excellent. At a time when golf commentators on TV refer to "centrifugal energy" (not that I ever watch the stuff) and toy stores label their shelf or two of science-oriented materials "Mad Scientist" (not that I ever go into toy stores) we certainly have our work cut out for us. My personal view is that compared with astronomers and elementary-particle physicists, solid-state physicists and materials scientists have not done enough to inform the public about the major influence their contributions have had on our lives. Whatever your area of physics, however, you can help in ways that range from talking to your child's elementary school teacher about the science component of his or her curriculum to supporting (or helping to establish) your local science museum.

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Binding Energies and Supernova Evolution

In his article on supernovae (September 1990, page 24) Hans Bethe errs when he calls ^{56}Fe the most strongly bound nucleus. ^{56}Fe is not only behind ^{62}Ni, which is the most strongly bound nucleus,[1] but also behind ^{58}Fe, which is second. Binding energy is a discrete quantity peculiar to each nucleus, slowly varying in the ^{56}Fe–^{62}Ni region. The importance of binding energy has been overstated: The rarity of ^{62}Ni and ^{58}Fe confirms that in the final mix of presupernova stellar evolution, small variations in binding energy in the ^{56}Fe–^{62}Ni region do not play the determining role.

Reference

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BETHE REPLIES: Edward Derringh and Richard Shurtleff are correct that ^{62}Ni has the greatest absolute binding energy. But what matters are the binding energies per nucleon, which are as follows: ^{56}Fe, 1.082 MeV; ^{58}Fe, 1.071 MeV; ^{62}Ni, 1.077 MeV. So on this basis, ^{56}Fe is the most strongly bound nucleus. However, I agree that variations in binding energy in this region of atomic weight do not play the determining role in nucleosynthesis.

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