but not energy, is conserved at the vertices of Feynman diagrams. This facilitates the discussion of the range of forces in terms of the uncertainty principle. However, when the authors are finally forced to introduce a four-momentum transfer in the discussion of deeply inelastic scattering, its significance is lost on the student.

The origin of isospin as an approximate symmetry of the strong interactions is explained fairly well, but the use of isospin as a dynamical symmetry gets just a footnote and brief appendix.

One of the crowning achievements of the past two decades is electroweak unification. A student cannot possibly appreciate this work from reading this text. The weak mixing angle is introduced as a parameter, but there is no definition of what is mixing with what. The couplings of the Z boson to fermions are not even given, much less derived. Needless to say, the brief discussion of the Higgs boson in the final chapter is purely descriptive, and the student has no way of understanding its origin or significance.

I found the constant refrain that a subject "is complicated, and we shall not pursue it further" irritating and counterproductive. Students should be taught that particle physics is perhaps subtle, but basically simple and beautiful.

Instructors who prefer the more phenomenological approach would be well advised to stick to the traditional *Introduction to High Energy Physics*, third edition, (Addison-Wesley, 1987) by Donald Perkins. Those interested in a more conceptual approach should consider David Griffiths's *Introduction to Elementary Particles* (Wiley, 1987), which is written with exquisite clarity. And for experimental details there is the superb collection of reprints, *The Experimental Foundations of Particle Physics* (Cambridge, 1989) by Robert Cahn and Gerson Goldhaber. I use all three in my course with reasonable success.

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Fractals and Chaos in Geology and Geophysics

Donald L. Turcotte
Cambridge U. P., New York, 1992. 221 pp.
$54.95 hc ISBN 0-521-41270-6
$27.95 pb ISBN 0-521-44767-4

Earth science is one field where power laws and scale invariance are frequently encountered. *Fractals and Chaos in Geology and Geophysics* is an attempt to bring many examples of power laws from Earth science together in one place. It would seem natural that the concepts of fractal geometry be widely accepted among geologists and geophysicists. This has however not been the case. Donald Turcotte has been a relentless advocate for applying fractals to problems in Earth science. In fact, most of the work covered in this book is that of the author and his students. The topics encompass a wide range, from blasting and the resulting fragmentation, to earthquake seismicity patterns and statistics, to Earth's topography, to dynamical systems, including mantle convection and the origin of Earth's magnetic field. All of this is accomplished in 17 chapters and 221 pages. I liken this book to an Earth science power-law emporium. It is probably the only place where this breadth of material can be found between two covers.

Early in the book, the author explicitly departs from what many consider the essence of fractals—the notion of an underlying geometry. He basically defines a fractal as a set for which some statistical distribution function is a power law. Originally at least, fractals were advertised as a new geometry, described by a dimension, to be compared to the Euclidean dimension. Thus an object exists in space and the fractal dimension describes its irregularity in form and its scaling relationships. By relaxing this definition you can consider something such as the power-law probability distribution function of particle sizes after blasting to be a fractal. Such a definition considers only the scaling aspect, not how the objects fit in space or relate to the surrounding world. One cannot determine from such a statistical distribution function whether the particles were placed at random in the rubble pile or whether they were sorted by size and then lined up from large to small.

In the foreword, the book is said to introduce the fundamental concepts of fractal geometry and chaotic dynamics; relate them to a variety of geological and geophysical problems; and illustrate what chaos theory can really tell us and how it can be applied to Earth science. The book is also said to be appropriate for those with a basic background in physics and mathematics and as a text in advanced undergraduate and introductory graduate courses in the physical sciences. In my opinion, the book does not live up to these promises very well.

The book does indeed give many examples of power laws in Earth science and analyze the consequences. But too much is covered in too little space. The author's enthusiasm for the subject often gets in the way of the prose; he seems to have so much to tell that the text is frequently choppy, more like a collection of loosely connected thoughts. Often, the book's only apparent unifying thread is the power law and its consequences. Each chapter seems pretty much unrelated to the next. Remembering my struggles as a beginning graduate student, I would have had a devil of a time digesting the contents of this book in under three readings. This is not the book to use for an introduction to fractals—for Earth scientists or for others. By far the best introductory book for physical science courses is still *Fractals* by Jens Feder (Plenum Press, New York, 1988). *Fractals and Chaos in Geology and Geophysics* does, however, have its merits, and it deserves a place on the shelves of researchers and teachers of geology and geophysics. I know I'll refer to it frequently.

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Proceedings of the 1st Experimental Chaos Conference

Edited by S. Vohra, M. Spano, M. Shlesinger, L. Pecora and W. Ditto.
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ISBN 981-02-0898-7

Behind the fashionable term "chaos" stands a serious scientific enterprise that has emerged from more than two decades of hard work by a multitude of researchers. This enormous effort has led to a new understanding of dynamical systems and a new way of looking at familiar natural phenomena. Formally, chaos is a property of a new class of solutions of the differential equations describing the evolution of dynamical systems. These solutions are in some sense random, even though the underlying equations have no apparent randomness. They offer new hope for understanding disorder and randomness in nature, and they open up a wide range of possibilities for new discoveries. Following the profound developments in analytic and numerical studies of chaos, its direct observation and investigation in the laboratory became a challenge. This book shows clearly that the challenge is finally being met.

Until recently it was quite difficult to find good examples of chaos. Now it is difficult to find a place where chaos