the photon temperature relative to the neutrino temperature; through the neutral current weak interactions, the neutrinos (all of them!) remain in equilibrium until the temperature drops to a few MeV.

Having chosen as his goal the explication of the cosmic coincidences, it is surprising that Davies fails to reference the beautiful articles by V. Weisskopf, which cover the territory better; is Davies unaware of them? In turning to the anthropic principle for an "explanation," Davies has missed a golden opportunity to describe for the layman the exciting recent developments in particle physics and cosmology. To judge from his previous books, Professor Davies is quite capable of producing a lucid, informative and entertaining version of the book I wish he had written; I encourage him to do so.

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Solar Heating and Cooling: Active and Passive Design. 2nd ed. Jan F. Kreider and Frank Keith. 479 pp. Hemisphere, New York, 1982. Price: $34.50. (Reviewed by Jon McGowan.)

This book is the first revision of a well-accepted introductory text on the subject of solar heating and cooling systems. The authors, both respected technical experts in the field, have made major revisions and additions in content and scope, as shown by a 30% increase in pages. Following a short, but informative and current, introduction to solar energy conversion systems in general, the next four chapters present a summary of fundamental concepts required to understand and analyze solar thermal systems. Specifically, Chap. 2 summarizes some methods for determining the amount of solar radiation striking a surface at various orientations. The methods presented are very straightforward and are based on simplified algebraic relations. Two major components of most solar thermal systems, collectors and storage subsystems, are discussed in Chaps. 3 and 4. In both chapters the performance of these components is given by graphical representation, rather than detailed equations. Life cycle costing economics, as applied to solar heating and cooling systems, is presented in Chap. 5.

The next four chapters of the book describe thermal systems that are used for solar heating and cooling applications. Solar water and space heating systems of the active variety (mechanically powered) are discussed in Chaps. 6 and 8, where some methods for component and system performance prediction are given. Chapter 7 presents an overview of passive solar heating systems and a simplified graphical technique for performance of such systems is reviewed. In Chap. 9 solar cooling systems are reviewed, generally in a qualitative nature. Chapter 10, a special topics section, contains a short discussion of some topics that the authors considered related to solar thermal design: photovoltaic systems, solar ponds, and wood stoves. In Chap. 11 a detailed summary (from a 1979 paper) of the various states' approaches to solar legislation is presented. Eleven separate appendices give a wealth of solar related design information including a glossary of solar engineering terms, sun path diagrams and solar insolation data, physical and thermal properties, and design calculation procedure constants.

The book presents an excellent overview of solar heating and cooling state-of-the-art, is well organized and well written, and contains numerous calculational examples to illustrate the computational procedures presented in the text. It should serve as an excellent first text and reference book to a person, with a minimal previous technical background, who desires an introduction to the principles and design of solar heating and cooling systems. Also, it would make an excellent text for a short course on the subject or for a first- or second-year introductory course on the subject for technicians, engineers, or scientists.

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Introduction to Dynamics. Ian Percival and Derek Richards. Cambridge University, Cambridge, 1983. Price: $34.50 (cloth); $14.95 (paper). (Reviewed by Jerrold E. Marsden.)

Nonlinear dynamics is booming. Physicists, engineers, and biologists are finding this subject useful and refreshing. I recall talking with an engineer some years ago about stability of a particular piece of experimental apparatus. He was confused about why it would oscillate stably if the linearized analysis predicts instability. I tried to explain that in nonlinear systems it is very common for stable periodic orbits to surround unstable fixed points through, for example, the mechanism of Hopf bifurcation (which a model for this particular experiment turned out to possess). It soon became apparent that there was a terrible communication gap and I had to literally start from scratch in the explanation.

The tide has now turned. Nonlinear dynamics has become a standard tool for applied mathematics. The teaching of it to advanced scientists in workshops has, for several years, been common, and this will probably continue. For this purpose there have been several very useful advanced books, such as Arnold's books, *Mathematical Methods of Classical Mechanics* and *Geometrical Methods in the Theory of Ordinary Differential Equations*, Lieberman and Lichtenberg's, *Regular and Stochastic Motion*, and Guckenheimer and Holmes, *Nonlinear Oscillations, Dynamical Systems and Bifurcations of Vector Fields* (all published by Springer). Perhaps even more important is to make this material available to students at an early level through reforms in our undergraduate teaching. The book of Percival and Richards is a positive step in this direction.

The book proceeds in a straightforward manner, utilizing simple examples to motivate the basic mathematical structure. The basic theory is presented without undue abstraction, but the astute reader will be motivated to seek this by the valuable glimpses provided. The book takes us through basic elementary notions of dynamical systems, Hamiltonian systems up to topics of current interest including averaging and chaotic motion. The main drawback of the book is that it does not provide references or guidance to the reader who wishes to pursue the subject, an unfortunate omission. Despite this, I can heartily recommend the book for courses in dynamics at the junior–senior undergraduate level or for advanced workers who missed this important subject during their training.

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