ered and the accretion-powered varieties). However, this survey is rather superficial, is strongly colored by their particular theoretical view, gives short shrift to the most recent observations of relevance to pulsar evolution and contains a number of observational *faux pas*, including a persistent belief that all soft x-ray emission from pulsars is pulsed and comes from the stellar surface.

The authors turn in Chapter 3 to an outline of the basic ideas of a rotating magnetosphere along with the processes of gamma-ray emission and electron–positron pair creation. They give proper attention to the basic problem to be resolved: How can the electric current pulled from the surface by the electric field become part of an electric current system that leaves the star effectively neutral? They then turn to the elaboration of their own theory in Chapters 4 through 6, which are essentially reproductions of several papers published in the journals *JETP* and *Astrophysics and Space Science* between 1983 and 1988. They suggest that the outflowing plasma must pass through what amounts to a switch-off, collisionless shock near the so-called light cylinder, where a corotating particle would move with the speed of light.

This theory is at first glance a mathematical *tour de force*, for they find analytical solutions for both the magnetic structure and the boundary layer forming the "shock." Unfortunately, to achieve their results analytically, they make simplifying assumptions that lead to a model that fails to conserve energy and angular momentum. In fact, formally, nothing gets out to the distant universe, yet the model star spins down! While one learns much from their technical methodology, there is little about real stars here, even though the authors courageously apply the details of their theory's predictions to the observations of pulsar spindown. No serious attention is paid to this fundamental discrepancy; instead, the authors vaguely suggest that somehow the energy is lost in terms of "fluctuating fields" and unspecified plasma outflow.

They present an elaboration of a pair creation model first described in the mid 1970s by Malvin A. Ruderman and Peter Sutherland that relies on the now-discredited belief that a neutron star's surface forms a strongly bound solid so that a vacuum electric field can be maintained at the stellar surface. (In fact, recent x-ray observations suggest the surface to have a definite atmosphere, from which charge can be freely extracted.) Consequently, a number of results of essential importance to pulsar magnetospheric physics, such as the number of pairs flowing out of the polar regions per second and the rotation period as a function of magnetic field strength at which pair creation ceases, are not computed in a manner that has relevance to real pulsars.

Finally, they present their theory of pulsar radio emission based on their calculations of the properties of small-amplitude waves in the outflowing relativistic pair plasma. This theory is known to be incorrect; M. Nambu, G. Machabeli, and Q. Luo and D. B. Melrose have identified and published on several fatal flaws.

The authors do not address the pulse-to-pulse variations, which may provide a sensitive test of theories, and they also address higher-frequency pulses (optical, x-ray and gamma-ray) in a very cursory manner, without any definite results.

In conclusion, those interested in understanding how pulsars shine are warned against taking seriously the sweeping claims made in this book for the success of the authors' own model. They would be better advised to turn to the observationally oriented book *Pulsar Astronomy*, by A. G. Lyne and F. G. Smith (Cambridge, 1990), and to the very different theoretical biases but much more complete attention to the facts found in *Theory of Pulsar Magnetospheres* by F. Curtis Michel (Chicago, 1991).

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Nonlinear Magnetohydrodynamics

Dieter Biskamp
Cambridge U. P., New York, 1993. 378 pp. $79.95 hc
ISBN 0-521-40206-9

There has been great progress during the past two decades in understanding the dynamics of magnetized plasmas. This has been due in large part to advances in numerical methods; simulations have allowed not only detailed modeling of laboratory and astrophysical phenomena but, more importantly, the testing and refinement of physical theories. This interplay among theory, experiment and simulation is the most interesting feature of this excellent book by Dieter Biskamp, *Nonlinear Magnetohydrodynamics*. Biskamp has unique qualifications to author this book; he is one of the few individuals who have made original contributions to laboratory and space plasmas using both analytic and numerical theory.

The book deals solely with the MHD approximation for magnetized plasmas; there is no discussion of kinetic phenomena such as particle acceleration. The material presented divides naturally into three parts: an introductory section, a description of key areas of current research in nonlinear MHD theory and a section on application of theory to fusion devices and astrophysical phenomena. The introductory section contains the standard background material found in most plasma physics textbooks, such as Glenn Bateman's *MHD Instabilities* (MIT Press, 1978), a discussion of the basic MHD equations that includes a good description of the reduced MHD formalism, a discussion of MHD equilibria and a review of the linear theory of the important instabilities in laboratory and space plasmas: the ideal kink and the resistive tearing. The presentation is elegant, but it may be too terse to serve as a first course in the subject. Its main purpose is to introduce the concepts and notation for the subsequent sections of the book.

I found the next section, which deals with present theories of nonlinear processes, to be the most interesting and enjoyable part of the book, especially the chapters on reconnection and turbulence. If for no other reason, I would recommend purchasing the book for this section, because it contains among the best reviews of reconnection and MHD turbulence I have read. These two processes are at the heart of many important laboratory and space phenomena and, as Biskamp emphasizes in his book, reconnection and turbulence are invariably intertwined. Either one will lead to the other. Biskamp has made significant contributions to both subjects, primarily by the use of numerical simulations to test and develop physical models, and he draws heavily on this material for his book. Although I find his results and arguments to be convincing, it should be emphasized that some of his conclusions on reconnection are controversial and are not universally accepted, which is to be expected in any area of active research.

The final section of the book deals with the physics of two fusion devices, tokamaks and reverse-field pinches, and of one astrophysical phenomenon, solar flares. The discussions of disruptions and oscillations in tokamaks are particularly clear and informative, but if there is any weakness in this book it is in the final chapter on solar flares. There I feel that Biskamp tries to cover too much material in too little space. On the other hand, the book is very thoroughly referenced; an interested reader can easily find the relevant literature.

In summary, I found this to be a well-written book that would be highly valuable to anyone working in laboratory or space plasmas. The book should not be considered a standard textbook, like the classical *Principles of Plasma Physics* (McGraw-Hill, 1973) by Nicholas Krall and Alvin Trivelpiece. For example, there are no problems in Biskamp's book. In spirit it is more like Eugene Parker's *Cosmical Magnetic Fields* (Clarendon, 1979), because it presents a clear description of current areas of research, with the emphasis always on the physics of the phenomenon.

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Principles of Symmetry, Dynamics and Spectroscopy

William G. Harter
Wiley, New York, 1993.
846 pp. $125.00 hc
ISBN 0-471-05020-2

Group theory has come into its own. In contrast to the situation in the 1930s, when it was regarded by many as an unnecessarily complicated and almost perverse tool of theoretical physics, group theory is now seen as an essential component of graduate and even undergraduate education. Nothing could demonstrate this change of heart better than William Harter's *Principles of Symmetry, Dynamics and Spectroscopy*. In it, European esoterica have been supplanted by American practicalities.

Harter senses that most physicists would be happy working under the hood of a car, and he has brought the vision of an intellectual auto mechanic to group theory. The formal theory that both senior undergraduates and graduate students can profitably absorb is interspersed with mechanical analogs. As someone who has tackled the vibrating fullerenes, Harter is particularly strong on normal modes. This topic leads into the calculus of angular momentum, level splittings (particularly for SF_6, where Harter himself has made major contributions), spherical tensors and the Wigner–Eckart theorem for finite symmetries and SO(3). The emphasis is on the representations of groups rather than the abstract groups them-