understanding of the solar atmosphere as the result of the flight of Skylab, the OSO-8 satellite and detailed solar-wind studies. In some ways it is therefore already somewhat outdated. Athay makes only minor mention, for example, of what now turns out to be one of the major recent discoveries in solar physics: the identification of the so-called "coronal holes" and their associated open magnetic-field configuration as Julius Bartels's M regions, which are responsible for the geomagnetic disturbances.

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Equilibrium and Non-equilibrium Statistical Mechanics

R. Balescu
742 pp. Wiley, New York, 1975. $29.95

The field of non-equilibrium statistical mechanics has long awaited a definitive graduate-level textbook. At last a leading practitioner, Radu Balescu of Brussels, has presented us with a big, beautifully produced book, which we open with great expectations. We are promised an integrated approach to classical and quantum equilibrium and non-equilibrium statistical mechanics.

One notes with pleasure many hoped-for topics: distribution functions, Wigner functions, thermodynamic limit, the ergodic problem, critical phenomena, Green–Kubo relations and the long tail of correlation functions, dense fluids and normal modes of linearized kinetic equations. The treatment is lucid, the style is lively.

Embedded in this textbook, and occupying seven of the eleven non-equilibrium chapters, one finds a monograph on subdynamics, a Brussels speciality. Because it appeals to an advanced audience, this material should have been published separately. The treatment here becomes highly mathematical, detailed and clear, but the astounding claims made appear to me unproved as presented.

Returning to the textbook proper, one finds three chapters on general concepts and seven on equilibrium, preceding the four on non-equilibrium for the non-specialist. Here, admiration for the clarity of the new topics is balanced by disappointment at omissions, obscurities, and obsolescence. For example, Balescu's treatment of the relation of thermodynamics to statistical mechanics appears perfunctory, with no mention of adiabatic processes; he obtains the hydrodynamic moment equations only from the Boltzmann equation, making no reference to the Kirkwood–Zwanzig technique; the Chapman–Enskog equation he solves by the Sonine expansion, without the use of variational methods; he introduces the transport coefficients without reference to dispersive properties; the treatment of plasmas, which is vintage 1960, ignores the work of the last 15 years, and the photon and phonon gases are dismissed in a short paragraph. I found an occasional tendency to present formulas without interpretation; the most glaring example is the definition and use of the symbol Λ without its identification as de Broglie length. The omission of problems constitutes a serious flaw—these could have illustrated and extended the treatment in the text.

I conclude with thanks to the author for undertaking this monumental presentation; my disappointment is tempered by the hope that a second edition will find these flaws overcome.

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Gauge Theories of Weak Interactions

J. C. Taylor
167 pp. Cambridge U.P., New York, 1976. $26.50

Since 1970 many exciting developments in theoretical particle physics have been in work concerning gauge theories. It is today an extremely active research area. Many features of these theories are yet to be fully studied. However, in the area of weak-interaction physics their application is relatively well-understood, and such theories provide a coherent and theoretically satisfying description of the phenomena observed. Recent new particle discoveries fit beautifully into this picture—they may well be the charmed particles that are a necessary component of gauge theories of the weak interactions.

Given this satisfying situation, it is indeed welcome to find a textbook that provides the necessary information to enable a student to become familiar with these theories. *Gauge Theories of Weak Interactions* is such a book. J. C. Taylor has been a steady contributor to the development of gauge theories over the past several years. His clearly written book begins at a level comprehensible to any student familiar with the basics of quantum field theory. The book is brief, but the material covered is extensive—Taylor does not waste words. It will require considerable work on the part of any student to master all the concepts and techniques presented. However, Taylor provides a clear path for the student to follow and ample references to the literature for further discussion of most points. (One reference I miss is to Sydney Coleman's 1973 Erice lectures on "Secret Symmetry". These lectures in-

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J. C. Willmott

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troduce gauge theories on a level comparable to that presented by Taylor, and they provide an admirable complementary source for the student seeking to understand this material.)

Of the eighteen chapters of this book, only two are specifically concerned with the application of gauge theories to the weak interactions. The majority of the book develops step by step the theoretical concepts involved in constructing a gauge theory and in proving it to be renormalizable. In general, I find Taylor's choice of topics well considered and his presentation logically ordered and clear. I would recommend this book to the student interested in learning about gauge theories in general. However, I find the discussion of weak-interaction phenomenology and the related subject of model building rather too limited. The author comments in his preface that "elaborate models and the details of present experimental tests are less likely to retain interest." With this I agree, but I feel that some discussion of the kinds of choices one has in building a model, and some references to the literature on the subject, would be useful to the student using this book.

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book notes

Remote Sensing for Environmental Sciences (Ecological Studies, Vol. 18). E. Schanda, ed. 367 pp. Springer-Verlag, New York, 1976. $29.80

Seven color plates, including a radiobrightness map of the world and multispectral photos and scanner data obtained with the Earth Resources Technology Satellite, enliven this volume. Erwin Schanda, of the Institute for Applied Physics of the University of Bern, introduces the topic of remote sensing in a book intended to acquaint natural scientists and graduate students with the capabilities of the remote approach. One finds chapters on aerospace photography; radar, sonar and infrared sensing methods; the applications of lasers and gamma-radiation, passive microwave sensing and digital picture processing.

Theories of Vision from Al-Kindi to Kepler. D. C. Lindberg. 324 pp. Chicago U. P., Chicago, 1976. $20.00

"The early practitioners of visual theory considered their endeavor chiefly a matter of mathematics, physics, and physiology, and on these aspects of visual theory I too will concentrate." So states David Lindberg, head of the science-history department at the University of Wisconsin at Madison, in his preface to a book that ranges over ancient, medieval and renaissance thought on this subject. In leading up to Johannes Kepler's successful explanation of vision in terms of the retinal image, Lindberg discusses the visual theories of Euclid, al-Kindi, Avicenna, Alhazen, Roger Bacon, Leonardo da Vinci and others. (Alhazen, according to Lindberg, was most significant among Kepler's predecessors; a tenth-century Arab, he formulated a unified theory whose traditions persisted into the seventeenth century and influenced Kepler.) The author provides many line drawings and ray diagrams to guide interested historians of science through the welter of visual theories and speculations.

Fundamental Aspects of Nuclear Reactor Fuel Elements. D. R. Olander. 613 pp. Technical Information Center, ERDA, Oak Ridge, Tenn., 1976. (Available as TID-26711-P1 from NTIS, US Dept. of Commerce, Springfield, Va. 22161 for $16.25)

Donald Olander has written a book about the physics behind fuel-element behavior for the first-year graduate student in nuclear materials and for those concerned with the design and performance of nuclear reactors. The approach is analytic rather than descriptive, and the author makes no attempt to provide a method for rational fuel-element design. Instead, he employs basic physical principles to explain the processes occurring in metals and ceramics that produce the complex irradiation behavior of the fuel pin. Chapters on statistical thermodynamics and crystal structures, on point defects and diffusion in solids and other fundamental considerations, precede the technical "hard core"—fuel chemistry, swelling due to fission gases, mechanical properties of uranium dioxide and so on.

Biophysical and Physiological Systems Analysis. E. Basar. 429 pp. Addison-Wesley, New York, 1976. $24.50 clothbound, $12.50 paperbound

Based on Erol Basar's lectures to graduate students at the Institute of Biophysics in Ankara, this volume is for graduate students and researchers not only in biophysics, but also in physiology, biomedical engineering, electroencephalography, mathematics and physiological psychology. The author, citing Norbert Wiener's contributions in cybernetics, takes a systems approach to the interpretation of medical and biological effects. Topics covered include nonlinearities in biology, circulatory autoregulation and smooth-muscle contractions. Basar's main chapter deals with electrical signals from the brain; here he examines transmission characteristics through the brain's neural networks and sets forth principles for the understanding of evoked potentials.