physics, astrophysics, geophysical sciences and engineering. *Turbulence* is also aimed at readers such as myself, who would like to learn something of the subject at a sophisticated level.

The title reveals an immediate advantage of this book: It is not a book on fluid dynamics with a chapter or so on turbulence; it is instead a modern, physics-oriented discussion of a difficult subject about which surprisingly little can be said to be known with confidence. The author discusses Andrei Kolmogorov's 1941 work on turbulence, employing in the process concepts from dynamical-systems studies such as symmetry breaking and deterministic chaos not developed until decades later. For instance, Frisch carefully rederives the main results of Kolmogorov's three 1941 papers, using assumptions of symmetries of the turbulent flow instead of Kolmogorov's assumption of "universality." There is an impressive chapter on the problem of intermittency and a final chapter that reflects the author's intuition as to where the field is heading. Examples include dynamical systems, fractals and turbulence, and two-dimensional turbulence. Discussions of almost all topics are linked to modern experimental data. Indeed, key experimental data are reproduced in the book.

This is a work of great scholarship. The author includes a number of illuminating historical discussions, something I find most helpful in learning a new subject. For example, I can recall Lars Onsager telling me about his own derivation of the Kolmogorov theory and the efforts of Werner Heisenberg and Carl von Weiszäcker along similar lines. The short historical discussion in section 6.5 is the first place I ever encountered the actual sequence of events. There are also complete citations to papers, including authors, titles and page ranges, as well as both an author and a subject index. All of these time-consuming labors of the author certainly make it easier for the reader.

This book belongs in the library of any college or university where physics is taught. It can productively be used as a reference in advanced undergraduate courses or as a text for a one-semester course on turbulence itself. For US physics students at least, a prior course in fluid mechanics would probably be a necessity if the book is to be covered substantially in 30 or so lecture hours. It would help the reader if, in a future edition, Kolmogorov's papers were included in some appropriate form in an appendix.

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Theory of Electron–Atom Collisions Part I: Potential Scattering

Philip G. Burke
and Charles J. Joachain
Plenum, New York, 1995. 293 pp.
$69.50 hc ISBN 0-306-44546-8

This monograph is the first part of a three-volume set. Part II is to deal with the general theory at low energies and Part III with the general theory at high energies. Such a partition is completely natural, not only by virtue of the sharp division of methods in the two energy regimes, but because the two authors have themselves specialized in the respective energy domains and associated methodologies. How necessary the present volume (Part I) will be in the context of those future volumes one can only surmise.

The authors, Philip G. Burke and Charles J. Joachain, have each written a previous book in the field, Burke's *Potential Scattering* (Plenum, 1977) and Joachain's *Quantum Collision Theory*, (North Holland, 1983). The present volume is more detailed than Burke's but significantly less comprehensive than Joachain's.

The central theme of the four chapters and five appendixes of *The Theory of Electron–Atom Collisions, Part I*, is the scattering of a particle (think electron) in a fixed external potential. Although all of the material is available from many other sources, I found the current text to be sufficiently detailed to be reasonably self-contained yet sufficiently selective so as not to be unwieldy. The first chapter (general theory), for example, contains a nice derivation of the optical theorem wherein the relationship between the imaginary part of the forward scattering amplitude and the total cross section arises from the interference between the incoming and scattered waves. In most texts this relationship is rather formally derived, and one really does not appreciate the physics underlying its origin.

In the second chapter (approximation methods), the section on the R-matrix method is rather longer than one might think necessary. However, that method is the basis for an elaborate suite of calculational programs—initiated by Burke and now widely used—for electron scattering from many-electron targets (and related processes such as photoionization). As such, it will undoubtedly be an essential chapter of Part II, so the presence of the fundamentals of the approach here is well justified.

If there is one major flaw in this book, it is the absence of a section devoted to separable *nonlocal* potentials in chapter 3 (analytic properties of the scattering amplitude). Not only is that material less well known than the local potential results (which constitute the core of the included material), but nonlocal potentials reveal a much richer analytical structure of the amplitude on the negative real energy axis and would thus have served as an excellent introduction to the (still unsolved) problem of electron–atom dispersion relations (also likely to be dealt with in Part II).

Chapter 4 deals with spin and relativistic effects; all of its six subsections, especially those devoted to the Dirac equation, its nonrelativistic limit and density matrices, are clearly delineated, and will be useful in both Parts II and III.

Some of the appendixes are dispensable, in my view. This is especially true of Appendix E on Clebsch–Gordan and Racah coefficients, because that material is contained in so many places and is primarily of use in the many-particle situation which, as stated, is not properly the domain of Part I. Its inclusion here is clearly an attempt to make the book self-contained, its use being confined to the coupling of spin and orbital angular momentum for the total angular momentum (j) components characterizing the solutions of the Dirac equation. But Racah coefficients (6-j symbols) are not used at all. Appendix C, on Dalitz integrals, is pedagogically superior to a similar appendix in Joachain's previous book.

The above criticisms notwithstanding, I found this book to be an excellent one, of considerable potential utility, particularly to those entering the field.

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Galaxies and Cosmology

Françoise Combes, Alain Mazure,
Patrick Boissé and Alain Blanchard
Springer-Verlag, New York, 1995.
407 pp. $69.95 hc
ISBN 3-540-58933-3

Galaxies and Cosmology is intended as a graduate-level introduction to extragalactic astrophysics and cosmology. The first 7 of its 13 chapters, those dealing with normal galaxies and their interactions, are followed by chapters on radio galaxies and on quasars; the final section covers large-scale structure and galaxy formation and rapidly reviews Friedmann cosmologies and