the book lacks narrative cohesion; it is full of diversions that add little to its main themes. Does the reader really need to know which administrative staff member at Caltech's seismological laboratory was acutely afraid of lizards? Why is there a chapter at the end of the book about seismological controversies that occurred decades after Richter's death and that seem to have little to do with any of Richter's scientific ideas?

Richter's Scale is not the book about seismological history that I wanted to read. Perhaps those who have personal connections to the Caltech seismology community will find it interesting and revealing. But I think that the meatier parts of this material plus some scientific content could make a much better book. I hope that someone will write it.

James S. Langer
University of California, Santa Barbara

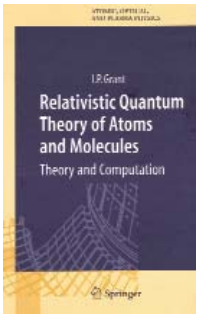
Relativistic Quantum Theory of Atoms and Molecules

Theory and Computation

I. P. Grant
Springer, New York, 2007. $199.00 (797 pp.). ISBN 978-0387-34671-7

Ian Grant, a professor emeritus of mathematical physics at Oxford University, is well known in the atomic-physics community for his seminal contributions to relativistic atomic physics, his excellent review articles on relativistic atomic-structure methods, and his role in creating the widely used software codes for GRASP, the General-purpose Relativistic Atomic Structure Program. Until now only a few complete and up-to-date reference books on relativistic calculations of structure and scattering in atoms and molecules have been published. Grant's *Relativistic Quantum Theory of Atoms and Molecules: Theory and Computation* fills the gap admirably.

Studies of the structure of multielectron atoms based on the Dirac equation can be traced back to 1935, when Bertha Swirles, later coauthor of *Methods of Mathematical Physics* (University Press, 1946) with her husband Harold Jeffreys, formulated relativistic, self-consistent field equations for atoms. Because of the complexity of Swirles's equations, now referred to as Dirac-Hartree-Fock equations, little early progress was made on the computational front. From 1940 through 1960, numerical solutions of the DHF equations without the interactions involving electron exchange were obtained for the copper ion and for several heavy, neutral atoms.



Grant reexamined the relativistic, self-consistent theory in 1961 and, with the aid of Racah algebra, brought the DHF equations into a compact and easily used form. Numerical solutions to the DHF equations with exchange were published by various authors between 1960 and 1980. General purpose multiconfiguration DHF codes, including codes written by Grant and his associates, became publicly available from the Computer Physics Communications Program Library, which was established in 1969 and contains more than 2000 programs in computational physics and chemistry. Since 1980, relativistic atomic-structure calculations have become a matter of course; they are now standard, even for light atoms for which relativistic effects are small, because they automatically account for fine-structure phenomena. Moreover, relativistic calculations of elastic and inelastic electron–atom and electron–ion scattering, photoionization, and other continuum processes are now quite common, as are relativistic studies of molecular structure.

Grant's book is divided into three parts. Part 1 is an overview of atomic physics, aimed at helping the reader identify the signatures of relativistic effects. It is a standalone introduction to relativistic atomic physics and could reasonably be used for the atomic-physics part of a graduate course on modern physics. Part 2 details the theoretical foundations of the field, starting from relativistic wave equations and quantum electrodynamics. Grant offers a concise introduction to QED, culminating with an informative discussion of the "no virtual-pair approximation." He also discusses relativistic versions of density functional theory.

Part 3, which makes up more than half of the book, is devoted to computational methods; it examines atomic structure, molecular structure, transitions, scattering, and photoionization. Chapter 7, on computation of atomic structure, emphasizes the DHF method as realized in the GRASP codes; however, liberal reference is made to alternative methods, such as many-body perturbation theory. The section in chapter 9 that describes relativistic scattering calculations emphasizes the Dirac atomic *R*-matrix code, or DARC. Again, Grant presents liberal reference to and discussion of alternatives, such as relativistic close-coupling methods and the relativistic random-phase approximation.

The book also contains two useful appendices. The first contains a collection of formulas, with their derivations, that are frequently encountered in atomic-structure studies and a description of available software packages. The second is a kind of minicourse on mathematical physics that includes a complete discussion of the angular momentum theory needed in atomic-structure calculations. Material on numerical methods, such as finite-difference schemes, is also included in the second appendix.

Relativistic Quantum Theory of Atoms and Molecules is a book that should be on the desk of every atomic-physics student and research scientist. Written by a master of the field, it contains a wealth of information about relativistic atomic and molecular structures. The progress on relativistic structure of many-electron atoms detailed in the book brings to mind a comment by Richard Feynman in the final section of his *Theory of Fundamental Processes: A Lecture Note Volume* (W. A. Benjamin, 1961). Feynman states that readers could now do many, but not all, physics problems by themselves, and he gives the many-electron atom as an example of a problem beyond their grasp.

Feynman may well have been impressed by the progress that has been made on the many-electron-atom problem in the nearly half century since that comment was written.

Walter Johnson
University of Notre Dame
Notre Dame, Indiana

Conceptions of Cosmos

From Myths to the Accelerating Universe—A History of Cosmology

Helge S. Kragh
Oxford U. Press, New York, 2007. $70.00 (276 pp.). ISBN 978-0-19-920916-3

In 1882 the philosopher John Stallo pooh-poohed theories that purported to apply physical and dynamical laws to the entire universe. But attacks on cosmology as unscientific did not end in the 19th century. In *Conceptions of Cosmos: From Myths to the Accelerating Universe—A History of Cosmology*, Helge Kragh cites (page 249), in addition to Stallo, a prominent British astronomer, Mike J. Disney