astronomers who are "starting to study the Sun and want to pursue an advanced course in solar physics, but lack the basic knowledge of solar astronomy." However, they do not pursue the careful pedagogical development that is the hallmark of a good textbook. In fact, it is best not to read it from beginning to end: The level of exposition ranges from informal to difficult. Although it contains few equations, the reader will need to have mastered basic physics and have a good knowledge of astronomy, optics, and calculus to follow much of the text. A glossary helps with the terminology. The English in the book is not uniformly correct, but the authors' intent is generally clear.

The book's packaging is quite attractive. Its front cover displays an intriguing image of a Sun god from India; the back shows pictures of Bhatnagar, who passed away in May, and Livingston. The text contains many photographs, illustrations, and graphs, some in full color. The first chapter, "Ancient Solar Astronomy," provides an interesting compilation of ancient mythologies and observatories from around the world—from the Middle East and Asia to the Americas and Europe. However, the text reads like a concise encyclopedia. Additional references would have been helpful for readers seeking more information.

Chapter 2, "Modern Solar Observatories," is also encyclopedic in nature. The sections on ground-based, optical facilities and current space missions are reasonably comprehensive. But in the section on solar-radio observatories, many major facilities, such as the Nançay Radioheliograph in France and the New Jersey Institute of Technology's Owens Valley Solar Array in California, are surprisingly absent. Chapter 3, "Structure of Solar Atmosphere," is primarily about the solar interior, and I would have combined it with chapter 9, "Solar Interior and Helioseismology." Chapters 4 and 5 cover "The Quiet Sun" and "The Active Sun," respectively.

Readers need to be on alert for occasional errors. In chapter 3, for example, g, the gravitational acceleration, appears in the ideal gas law. Also, the authors incorrectly state that "conduction occurs only in solids and is irrelevant for stars and Sun." After the authors correctly show that the gyro-frequency is independent of density, chapter 4 contains the statement "The gyrofrequency of radio emission is a function of density and magnetic field strength."

Chapters 6 through 8 address "Observational Techniques," "Solar Optical Instrumentation," and "Solar Eclipses," respectively. Those chapters include such practical issues as evaluating and determining the orientation of the Sun, the position of the Sun's features, the types of solar-optical telescopes, and eclipse seasons and paths. The authors also offer a section on determining the gross properties of the Sun (distance, mass, luminosity, and so forth), as well as technical sections on optical filters and different measures of temperature. Although the authors cover a range of topics, their emphasis and greatest strength are in the area of ground-based, solar-optical astronomy. The final chapter, "On the Joy of Observing the Sun—A Personal Experience," is a delightful, approximately two-page essay that I would have placed at the front of the book.

Bhatnagar and Livingston frequently make the case for the continued value of observing the Sun with the human eye. The book presents fascinating comparisons of the detail in historic drawings of the Sun with modern high-resolution photographs. Chapter 8 encourages first-time solar-eclipse observers to leave their cameras at home and experience the sensations of an eclipse. Moreover, it includes a list of phenomena that can be observed with no more than a dark filter.

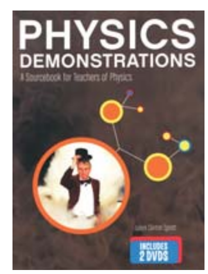
Fundamentals of Solar Astronomy could have been more effective for students and amateur astronomers. Nevertheless, it contains useful, interesting information for all readers. The authors' personal comments are priceless, and I am glad to have their book available on my shelf.

Gordon D. Holman
NASA's Goddard Space Flight Center
Greenbelt, Maryland

Physics Demonstrations

A Sourcebook for Teachers of Physics

Julien Clinton Sprott
U. Wisconsin Press, Madison, 2006. $45.00 (290 pp.).
ISBN 0-299-21580-6, DVDs



Julien Clinton Sprott is one of the great physics showmen of our time. Since 1984 his lecture and demonstration program series, "The Wonders of Physics," has been presented yearly at the University of Wisconsin–Madison. Program features have included a grand entrance out of a birthday cake, an exit behind a liquid-nitrogen flume, "interviews" with Albert Einstein and Isaac Newton, and an array of exciting demonstrations. Videotapes of his programs, which come with a manual describing each program and its associated demonstrations, have been available to the public for many years. Now Sprott's *Physics Demonstrations: A Sourcebook for Teachers of Physics*, which includes a set of two DVDs, presents details of about 85 of those demonstrations.

The book has chapters on motion, heat, sound, electricity, magnetism, and light; each contains sections labeled by demonstration or concept, with some sections containing several individual demonstrations. Many of the classic physics demonstration books contain a lot of descriptive material concerning demonstrations and their construction. What sets Sprott's book apart is additional material that is crucial to making quality presentations that are real teaching and learning experiences. Sprott uses lots of colorful pictures to discuss the apparatus for each demonstration, the physical basis for the demonstration, what the demonstration does and how it explains the concept of interest, and even a few of his favorite gags. He discusses safety considerations and highlights specific possible dangers.

Sprott's book should be placed in the libraries of all college physics departments and would be useful for many high-school physics programs. I would like to see a section specifically on demonstrations in modern physics—quantum mechanics, atomic and nuclear physics, for example. Yet scattered throughout the book's other topics are many nice modern-physics demonstrations. Several detailed presentations on chaos and related topics are included, which makes *Physics Demonstrations* a significant update compared with other classic demonstration books such as *Physics Demonstration Experiments* (Ronald Press, 1970), edited by Harry Meiners; *Physics Demonstration Experiments at William Jewell College* (William Jewell College, 1971) by Wallace Hilton; and *A Demonstration Handbook for Physics* (American Association of Physics Teachers, 1972) by George Freier and Frances Anderson.

Sprott offers some unusual and sophisticated demonstrations that often provoke discussion among physicists. He has something for everyone—from the novice physics lecturer to the experienced physicist who is looking for new ways to excite his or her students. Even after doing classroom demonstrations, including the "Physics is Phun" program, for more than 30 years at my university, I continue to get new ideas from Sprott.

A thorough bibliography is included at the end of the book. For those new to the physics-demonstration business, Sprott provides appendices of selected vendors of equipment and audiovisual and computer-based materials. I found the index helpful, too. In the accompanying DVDs, Sprott demonstrates with his unique style the experiments discussed in his book. The videos are of high quality; the camera work is excellent, allowing the viewer to see in detail exactly how the equipment works and how Sprott uses the demonstrations to teach physics. I found his interviews with his student subjects particularly interesting: His very personable approach and his effective use of humor make it easy to see why his programs have become so popular. Aspiring physics demonstrators should find these videos very helpful.

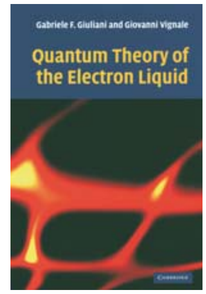
As with any book of this magnitude, a few typographical errors exist, but they do not detract from the book's pedagogical value. Sprott does an admirable job of simply explaining complex demonstrations. However, one error often found in many textbooks may merit further discussion: It is my understanding that the Coanda effect more accurately explains airfoil lift and the ball levitating on an air jet than does the Bernoulli effect.

Physics Demonstrations and its accompanying DVDs are excellent reference materials for beginning physics teachers, experienced lecture demonstrators, and interested students. I thoroughly enjoyed reading the book and watching the videos; they will assume an honored place in my library, among my collection of "The Wonders of Physics" tapes and kit. I hope many of my colleagues will also take the opportunity to learn from Sprott.

Richard E. Berg
University of Maryland
College Park

Quantum Theory of the Electron Liquid

Gabriele F. Giuliani and Giovanni Vignale
Cambridge U. Press, New York, 2005. $95.00 (777 pp.). ISBN 0-521-82112-6



Quantum Theory of the Electron Liquid is a veritable encyclopedia of a field that continuously rejuvenates itself with fresh physics discoveries and novel materials. Nothing escapes the attention of authors Gabriele F. Giuliani and Giovanni Vignale, who seem to cover the gamut. Topics range from Eugene Wigner's 1934 theory of the three-dimensional electron crystal to the most recent developments of the time-dependent density functional theory, from weakly interacting electrons in two and three dimensions to the novel correlation phenomena occurring in a 1D conductor or in ultra-high magnetic fields.

The book, unquestionably attractive to the more experienced reader, is accessible and designed to be comprehensible to graduate students in condensed matter theory. It is an invaluable source of material for many-body theory as a part of condensed matter physics graduate courses. The reader is guided effectively through a large body of knowledge that the condensed matter community has produced over the course of 70 years.

Normally a book in this field would focus on a subclass of problems—strong correlations, density functional methods, lattices, 1D systems, and so forth. Instead, in 10 chapters, the authors cover with comparable care, clarity, and depth a broader area of the quantum theory of electronic systems. Topics are presented in a highly original manner, with the authors often deriving the same results through several different approaches.

Readers will likely find something remarkable just by opening the book at random. For instance, the authors provide the proof of Albert Overhauser's famous Hartree–Fock instability theorem. Except for the original articles, I know of no other literature that gives the proof. Giuliani and Vignale uniquely spell out the validity limits of the celebrated random-phase approximation of David Bohm and David Pines, and they clearly show how that random-phase approximation can be improved. The book contains sophisticated and important concepts, such as spin-dependent effective electronic interactions, a subject virtually impossible to find in other textbooks.

Giuliani and Vignale cover density functional theory and allow ample space for the most recent developments in the time-dependent theory. In particular, they discuss in great detail the formalism of current-density functional theory in magnetic fields and the problem of the ultra-nonlocality of the exchange-correlation potential. Their