The third part of the text, "Photons and Radiation," introduces the concept of field quantization. Most of the material covered is standard, but the presentation is unusually complete. Contact with the subject of the text, coherent excitation, is maintained in a smooth and natural way. Moreover, our understanding of coherent atomic excitation is enhanced. Two chapters are devoted to examining the self-consistent interaction between the field and atomic excitation, including wave propagation. Were Shore to conclude his work at this point, we would most certainly still have a useful and valuable text, but he is just getting started.

Much of the material in the second volume has never before appeared in book form. Part IV, "Multistate Atoms," introduces three-level atoms building on results from the discussion of two-level atoms and includes population trapping and quantum beat effects. The global RWA is introduced along with other methods for solving the three- and N-level atom equations such as long-time averaging and the Laplace transform method.

Part IV also covers N-state ladders with solutions derived for special cases and particular kinds of state linkage patterns. Solutions for bounded and unbounded N are obtained for special cases. Discussions of multiphoton excitation, anharmonicity, and atomic beam deflection are noteworthy. Extension of the formalism is made to continuum processes for those situations involving ionization. Part IV concludes with coverage of radiative transitions and rate equations applicable to N-level atoms.

In order to deal effectively with more complicated structures, Part V, "Angular Momentum and Complex Atoms," offers an extensive review of the required quantum theory of angular momentum operators. With this foundation, Shore covers the excitation of degenerate systems and of fine and hyperfine states including branched excitation and Zeeman splitting.

The text concludes with Part VI, "Incoherence," aimed at determining when it is necessary to employ rate equations. Coverage includes discussion of the sources of incoherence including Doppler broadening, orientation effects, and collisions. The rate equation limit of the Schrödinger equation is derived, and various methods of dealing with fluctuations and interruptions are treated.

Finally, several appendixes are included covering mathematical topics, numerical analysis, classical Lagrangian mechanics, probability theory, and electromagnetism. A thorough index is provided at the end of Vol. II, although it would be desirable to have a copy of the index included in Volume I also.

In addition to the comments made in this necessarily brief overview, I offer the following observations. Overall, I am quite impressed with the completeness of coverage, both in the selection of topics and in their exposition. I am equally impressed with the author's skill in presenting the material in lucid terms and in his ability to keep the reader's attention focused on the main themes of the text.

The designated audience of the text is "physicists, optical scientists, spectroscopists, and physical chemists." I have no doubt that the book will prove an invaluable work for this group. The level of presentation is suitable for a graduate course, and I would recommend the book for such a course. The text covers much material in its nearly 1700 pages so that the instructor may need to exercise some selectivity in the topics to be covered. In terms of classroom use, the text would be enhanced by the inclusion of worked examples and exercises. All students will benefit from Shore's pedagogic style.

The author has succeeded in his endeavor to make the various parts of the book self-contained, including references. Many points are repeated when needed so that cross-referencing to previously covered material is minimized, but at the expense of somewhat greater bulk. This makes for more efficient and pleasurable reading while adding to the utility of the book for researchers.

We are entering a new era in applied optics, and Bruce Shore has succeeded admirably in presenting to us the tools of the trade that will be employed in that era. He tempts us with exciting possibilities. Laser isotope separation is one such application and receives coverage in the book, although this is done in only a few pages of fairly general discussion. I would like to have seen specific applications discussed in some detail, but I appreciate the constraints of time and space. Bruce Shore is to be congratulated for his fine work, and I recommend his book without reservation.

Thomas Speziale is a scientific specialist at the Idaho National Engineering Laboratory and directs the Advanced Concepts Program for the Department of Energy Office of Arms Control. He received his PhD from the University of Rochester, specializing in resonant laser-plasma interaction in support of the Laboratory for Laser Energetics. He taught and did research at the University of Arizona in the nuclear engineering department before joining the Theory Division at KMS Fusion, where he performed research in support of the fusion and SDI programs. He served as a technical leader upon joining the Physics Group at EG&G Idaho, conducted research in nuclear pumped lasers, and managed the Applied Physics and Analysis Section before moving into his present position in the Special Programs Group.

The Physics of Ionized Gases

Author	L. Tanovic
Publisher	Nova Science Publishers, Commack, New York (1989)
Pages	728
Price	$145.00
Reviewer	E. Bickford Hooper, Jr.

This book contains the Proceedings of the 14th Yugoslav Summer School and International Symposium on Physics of Ionized Gases (SPIG '88), held in Sarajevo, Yugoslavia, August 15–19, 1988. The meeting was attended by 172 participants from 25 countries. The editors separated the book into four sections. Space is lacking to fully describe the articles; perhaps a few that caught the attention of this reviewer can typify the collection for the reader.

1. *Atomic Collision Processes* (12 papers)—Smith has provided an excellent description of recent advances in the paper entitled, "Electron Impact Ionization of Ions Relevant to Fusion." Following a brief discussion identifying important impurities and their roles, data are presented comparing measurements of selected single ionization cross sections with Born and semiempirical formulas. Among the other papers

in this section are (a) an analysis of the effects of molecular vibrational resonances effects on inelastic electron collisions by Gauyacq; (b) Čadež et al. discuss the detection and production of vibrationally excited hydrogen, including coupling to production of negative hydrogen and deuteron ions; and (c) Potvliege and Shakeshaft describe the time-dependent theory of multiphoton atomic processes in intense laser fields.

2. *Particle and Laser Beam Interaction with Solids* (7 papers)—Papers in this section range from theoretical analysis and modeling of atomic collisions in solids (Möller and Baretzky) and film growth and erosion (Nobes et al.) to a review of the status of surface conditioning using plasma or plasma-assisted techniques (Bell et al. and Teer). These latter reviews describe nitriding and other surface conditioning techniques that have important commercial applications.

3. *Low-Temperature Plasmas* (12 papers)—Four papers are dedicated to diagnostic techniques ranging from interferometry to spectroscopy. Alkali vapor plasmas can be formed by resonant radiation, e.g., from a laser, as discussed by Eletskii and Smirnov and by Bahns et al. Milošević describes spectra in alkali vapors, including bands due to dimers or "quasi-molecules"; nonequilibrium excitations in optically thick mercury arc plasma are analyzed by Karabourniotis et al.

4. *General Plasma Theory* (7 papers)—Balescu provides an interesting thermodynamic view of neoclassical transport; this report is followed by papers on various aspects of waves in plasmas. Computer modeling of ion-beam-generated turbulence, by Kofoed-Hansen et al., includes a successful search for coherent structures, providing a powerful description of the processes. An experimental paper on flutes in the Risø *Q* machine, by Huld et al., is not successfully analyzed by this technique—real experiments never have data as clean or detailed as computer experiments. However, analysis continues.

Ionized gases occur in a fascinating range of natural and applied phenomena—in astronomy, the ionosphere, thermonuclear fusion, sparks, and materials processing among many others. The result is a coupling to many—perhaps all—branches of physics, from nuclear to kinetic theory to solid state. The science of plasma and related phenomena has matured, although there are many interesting, often complex phenomena facing investigators.

Unfortunately, any book that touches on more than a small subset of plasma topics will inevitably be unable to do any of them justice. The proceedings of the SPIG '88 invited papers and progress reports are no exception. The articles are generally good to excellent, but there is no focus strong enough to attract serious students of any subset of plasma physics; the book belongs, instead, in a library.

The SPIG series of meetings has been ongoing since 1952 and, by all accounts, has been highly regarded by all participants. The proceedings are an excellent source for individual papers of particular interest, especially in fields outside fusion.

E. Bickford Hooper, Jr. (BS, 1959, and PhD, 1965, physics, Massachusetts Institute of Technology) is the physics group leader for the Microwave Tokamak Experiment at Lawrence Livermore National Laboratory. He has worked on a variety of topics in plasma physics and magnetic fusion, including the confinement and heating of toroidal plasmas, experimental plasma physics of tandem mirrors, the physics and design of advanced tandem mirrors, and diagnostics for plasmas and fusion research. He led the development of intense negative deuterium beams using double charge-exchange in alkali metals. He has spent a postdoctoral year at the Royal Institute of Technology in Sweden, has been employed as an assistant professor of applied science at Yale University and has taught graduate courses in physics at the University of California–Davis, Livermore Extension.