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ing the generation of chemically reactive species. The predominance of neutral atoms and molecules, combined with the attendant myriad of excited states, makes low-temperature plasmas very complicated. Understanding their kinetics is essential to improving and extending their applications.

The book begins with an introductory chapter on basic plasma phenomena, including Debye shielding, equilibrium conditions and transport. The succeeding chapters go on to develop the theme of the book: the elementary collisional and radiative processes that exist in low-temperature nonequilibrium plasmas, and the kinetics that result. The kinetics of the population of excited states, ionization and recombination are considered in detail. One interesting and very useful chapter is on radiative transport. Radiation trapping, which is often important for weakly ionized plasmas, is thoroughly discussed. The electron energy distribution function is derived with the relevant inelastic processes included. The final chapters include brief treatments of transient effects in nonequilibrium plasmas and of the kinetics of molecular plasmas.

The book gives a useful understanding of the fundamental processes that govern low-temperature nonequilibrium plasmas. As such, it would be of value for developing a collisional-radiative model of a plasma or for quantitative spectroscopy. The lack of an index is unfortunate; however, the book contains useful appendices.

A number of topics of practical importance are covered only cursorily or not at all. Topics such as sheath effects and plasma-material interactions, which are important in, for instance, reactive-ion etching, are clearly beyond the scope of this book. Also, very little attention is given to radiofrequency plasma excitation: No specific discharge configurations are discussed.

The book would be a useful reference text for a graduate course in the fundamentals of low-temperature plasmas; the rather abbreviated derivations would make it difficult to use the book as the primary text. The authors make extensive use of energy-space diffusion models to discuss the kinetics of excited states and ionization-recombination. In doing so they provide an excellent physical picture for the onset of the departure from equilibrium in terms of competition among processes. Although the analytical techniques the authors discuss can be quite useful, they largely neglect the more powerful numerical

methods of analysis, which are now relatively easy to implement with the wide availability of computers.

There is much current interest in gaining a better understanding, through diagnostics and modeling, of the plasmas used in various technological applications. Despite some shortcomings, *Kinetics of Nonequilibrium Low-Temperature Plasmas* makes an important contribution toward achieving this objective.

JOSEPH L. CECCHI
Princeton University

Laser Analytical Spectrochemistry

Edited by V. S. Letokhov
Adam Hilger, Bristol, UK
(US dist. Taylor and Francis,
New York), 1986 [1985].
412 pp. \$109.00 hc
ISBN 0-85274-568-0

Laser Photoionization Spectroscopy

Vladilen S. Letokhov
Academic, San Diego, Calif.,
1987. 353 pp. \$57.50 hc
ISBN 0-12-444320-6

Photoacoustic and Thermal Wave Phenomena in Semiconductors

Edited by A. Mandelis
North-Holland, New York,
1987. 480 pp. \$75.00 hc
ISBN 0-444-01226-5

The Institute of Spectroscopy of the USSR Academy of Sciences, located in Troitsk, outside Moscow, was established in 1968, and since its inception researchers there have been engaged in the development of new techniques of laser spectroscopy. Important results have been achieved in fields such as hole-burning spectroscopy, laser detection of single atoms and molecules, and laser cooling of atoms. They have had particularly impressive successes in ultrahigh-resolution and ultrasensitive spectroscopies. Based on their successes they have developed analytical methods that use photoacoustics, induced fluorescence and multiphoton resonance coupled to other techniques such as gas chromatography or mass spectrometry.

Laser Analytical Spectrochemistry, edited by Vladilen S. Letokhov, director of the institute, contains eight separately authored chapters presenting tutorial reviews of several laser analytical techniques that were developed at the institute. The book

A selection of North-Holland publications on STATISTICAL PHYSICS



J.D. van der Waals: On the Continuity of the Gaseous and Liquid States

*edited with an introductory
essay by J.S. Rowlinson*

1988 xiii + 280 pages
US \$ 84.25 / Dfl. 160.00

The core of this book is a new edition of the English translation of the classic Leiden thesis of 1873 of J.D. van der Waals. A long introductory essay explains the historical context of the work and why it is still of great interest to physicists and chemists working in the fields of statistical mechanics, phase transitions and properties of liquids.

The thesis is followed by a translation of Van der Waals' first great paper on the theory of liquid mixtures, which is also frequently quoted, but which has not hitherto been available.

Simple Models of Equilibrium and Nonequilibrium Phenomena

edited by J.L. Lebowitz

1987 xii + 272 pages
US \$ 92.00 / Dfl. 175.00

This book consists of two articles of particular interest to researchers in the field of statistical mechanics. Its appeal is, however, not limited to this group. The first article is based on the premise that the best way to understand the qualitative properties that characterize many-body (i.e. macroscopic) systems is to study "a number of the more significant model systems which, at least in principle, are susceptible of complete analysis."

The second article deals exclusively with nonequilibrium phenomena. It reviews the theory of fluctuations in open systems to which the authors have made important contributions. Like the first article it emphasizes simple but interesting model examples.

The Wonderful World of Stochastics

*A Tribute to Elliott W. Montroll
edited by M.F. Shlesinger and
G.H. Weiss*

1985 xiv + 382 pages
US \$ 47.75 / Dfl. 140.00

Elliott W. Montroll had a profound influence on physics, beginning with his classical works on imperfect gases, the Ising model and the lattice

dynamics in the early 1940's. His innovative research continued over the next four decades with work ranging from the flow of electrons in amorphous semiconductors, to the flow of traffic on highways. This memorial volume contains ten original contributions by noted scientists to statistical and mathematical physics, a bibliography and review of Montroll's works, plus reprints of twelve of Montroll's classic papers.

The Kind of Motion We Call Heat A History of the Kinetic Theory of Gases in the 19th Century by S.G. Brush

Book 1: Physics and the Atomists

1976 (1st reprint 1986) xiv + 326 pages
US \$ 30.00 / Dfl. 75.00

Book 2: Statistical Physics and the Irreversible Processes

1976 (1st reprint 1986) xiv + 494 pages
US \$ 34.00 / Dfl. 85.00

Comprising two volumes this work provides a particularly comprehensive account of the development of kinetic theory and statistical mechanics up to the beginning of the 20th century. Book 2 is completed by an unusually comprehensive bibliography.

Stochastic Processes in Physics and Chemistry by N.G. van Kampen

1981 (3rd reprint 1985) xiv + 420 pages
US \$ 30.00 / Dfl. 75.00

Although the number of articles on fluctuations and the stochastic method for describing them must run to thousands, the physicist or chemist who wants to become acquainted with the field cannot easily find a suitable introduction. This book is an attempt to fill this gap in the literature.

Simulation of Liquids and Solids Molecular Dynamics and Monte Carlo Methods in Statistical Mechanics

*edited by G. Ciccotti,
D. Frenkel and I.R. McDonald*

1987 (paperback) xii + 481 pages
US \$ 32.50 / Dfl. 75.00
(also available as hardcover)

This book is a collection of key reprints of papers on the computer simulation of statistical-mechanical systems, introduced and commented upon by the editors.

Statistical Physics

*Invited papers from STATPHYS 16
edited by H.E. Stanley*

1986 xvi + 432 pages
US \$ 15.00 / Dfl. 50.00

The 52 papers in this volume are based on the principal invited talks presented at STATPHYS-16. These papers form a concise but coherent summary of the "state of the art" of statistical physics in 1986.

In Preparation:

Hydrodynamics of Dispersed Media

*edited by A.M. Cazabat, F.
Carmona, E. Guyon and J.P.
Hulin*

This book is part of the series
'Random Materials and
Processes'
*series editors: E. Guyon and
H.E. Stanley*

This book is based on the 4th EPS Liquid State Conference on the Hydrodynamics of Dispersed Media. It includes an extended general introduction presenting the various aspects of the hydrodynamics of dispersed media, followed by five main chapters from a microscopic to a macroscopic description: I. Wetting Phenomena and Interfacial Effects. II. Particle Dynamics in Dispersed Media. III. Statistical Descriptions of Multiple Scale Processes in Porous Media. IV. Macroscopic Description of Transport Processes in Dispersed Media. V. Experimental Approaches of Porous Media.

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opens with Letokhov's introduction to the properties of lasers and to problems of laser spectroscopy. The succeeding chapters cover applications in analytical chemistry including atomic fluorescence, photoionization, infrared absorption, photoacoustic and desorption spectroscopies.

Although the book is not a step-by-step guide, the novice can read it easily. This book presents the material with even more of a practical emphasis than does Nicolo Omenetto's *Analytical Laser Spectroscopy* (Wiley, New York, 1979) or Edward H. Piepmeyer's *Analytical Applications of Lasers* (Wiley, New York, 1986).

Over the past decade laser photoionization spectroscopy—also known as resonantly enhanced multiphoton ionization—has become a powerful technique for the study of atomic and molecular structure as well as for the detection of atoms and molecules in various environments. Stirred by successes such as G. S. Hurst's experimental demonstration in 1977 of single-atom detection, this distinct subfield of laser spectroscopy is being used by researchers in fields ranging from atomic and molecular physics to geochemistry. Letokhov, one of the early pioneers in the field, has written *Laser Photoionization Spectroscopy*, a monograph geared to this diverse audience.

The book can be separated into three sections: fundamental physics of ionization, techniques for producing free atoms and molecules, and applications. Letokhov presents first an introduction to resonant interactions between laser light and atoms or molecules. He follows this with descriptions of photoionization, field ionization and collisional ionization as well as an introduction to the comparative sensitivities of different excitation schemes: absorption, fluorescence, resonant deflection and photoionization.

Letokhov presents fairly complete descriptions of the current experimental configurations in which photoionization studies are done. He informs the reader of the ultrasensitive and selective nature of photoionization measurements. He also presents some noteworthy results obtained at the Institute of Spectroscopy, such as the achievement of a sensitivity of a few parts in 10^{11} for the detection of Na in semiconductors. In addition Letokhov presents a comprehensive survey of applications.

Laser Photoionization Spectroscopy is a valuable source book for anyone interested in resonance ionization spectroscopy. While books such as S. H. Lin, Y. Fujimura, H. J. Schlag

and E. W. Neusser's *Multiphoton Spectroscopy of Molecules* (Academic, Orlando, Fla., 1984); *Multiphoton Processes* (Springer-Verlag, New York, 1984) edited by Peter Lambropoulos and S. J. Smith; S. L. Chin and Peter Lambropoulos's *Multiphoton Ionization of Atoms* (Academic, Orlando, Fla., 1984); and Joseph Berkowitz's *Photoabsorption, Photoionization and Photoelectron Spectroscopy* (Academic, Orlando, Fla., 1979) cover various aspects of the field, none introduces the field, provides the fundamental physics needed to understand and appreciate the various processes, or presents as many of the key developments, both experimental and theoretical, as Letokhov's book does. Often awkward English, coupled with some misprints, make reading *Laser Photoionization Spectroscopy* slow and difficult the first time through. Also, Letokhov seems to have overlooked such serious problems as how to vaporize (laser ablate) a sample while maintaining its chemical integrity. All in all, Letokhov has done an admirable job, producing a valuable source of information that is profusely illustrated and includes a large number of references.

Following the introduction of techniques by books such as *Laser Photoacoustic Spectroscopy* by Letokhov and Vladimir P. Zharov (Springer-Verlag, New York, 1986), *Photoacoustics and Photoacoustic Spectroscopy* by Allan Rosencwaig (Wiley, New York, 1980) and *Optoacoustic Spectroscopy and Detection* by Yoh-Han Pao (Academic, New York, 1977), interest in photoacoustic techniques has spread over the past decade to fields ranging from gas chromatography to semiconductor characterization. Photoacoustics provides a useful nondestructive technique for measuring various properties of materials.

Photoacoustic and Thermal Wave Phenomena in Semiconductors, edited by Andreas Mandelis of the University of Toronto, provides insight into the use of photoacoustics, specifically in applications to semiconductors. The book's five sections consist of reviews of established and emerging thermal-wave microscopies; treatments of imaging using thermal-wave techniques (with concentration on measurement of parameters), of novel photothermal-wave techniques, and of techniques for monitoring phenomena at the electronic level; and reviews of progress in photothermal spectroscopic techniques. Among the specific examples mentioned are Tsuguo Sawada's measurement of subsurface defects in GaAs 50 μm below the surface and Rosencwaig's identifica-

tion of differences in the depth of surface-state annealing in silicon wafers: Wafers with few defects showed the annealing effect 50–100 μm beyond the irradiated region, whereas in wafers with a high level of structural damage (such as those that were heavily implanted) the annealing effect was confined to the irradiated region.

Each chapter contains many illustrations and a bibliography. This book augments the texts already published and will find a place on many a professional's bookcase. I recommend it.

RICHARD LEE
Amperex

Slatersville, Rhode Island

Lasers, Spectroscopy and New Ideas: A Tribute to Arthur L. Schawlow

William M. Yen and
Marc D. Levenson

Springer-Verlag, New York,
1987. 337 pp.

\$45.00 hc ISBN 0-387-18296-9

This book allows the reader to enjoy, at least remotely, the experience of physics research with Art Schawlow. Its 19 short articles, whose authors all have been students of Art's at Stanford University over the past 25 years, cover the three primary areas to which Schawlow has richly contributed—lasers, spectroscopy and "new ideas." Each article includes reminiscences of Art's humor, his excellent physics intuition and, most importantly, the immense joy and enthusiasm he brings to his research, teaching and lectures. It is interesting that many physics concepts can be more clearly grasped and understood with the informal writing styles used in this book.

As one might expect, the style and scientific content of the brief articles in this volume vary widely. Some are detailed and will serve as excellent references and reviews. Examples are the three articles on solid-state spectroscopy, by Roger M. Macfarlane ("Optical Spectral Linewidths in Solids"), Satoru Sugano ("Spectroscopy of Solid-State Laser Materials") and George F. Imbusch and William M. Yen ("Ruby Solid-State Spectroscopy: Serendipitous Servant"). Sugano discusses the early history of the laser. This is an ideal time to look back at the development of the laser, one of the major advances of this century, but I was disappointed that Schawlow's early laser research and that of his collaborators is not covered in this book. There is an interesting anecdote from the first session at a conference

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