

a supplementary problem book as well.

Despite these problems, the book is a very comprehensive and authoritative account of the formalism of semiconductor physics and on an advanced level, the present state of experimental understanding. Viewed from this angle, it probably has no equal. Despite its shortcomings as a textbook, it is a reference volume that I will find invaluable, and that should be very frequently consulted by those who are doing any sort of research work in semiconductor physics.

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Transfer of Radiation in Spectral Lines

V. V. Ivanov

461 pp. US Dept. of Commerce, 1973.
(Available from US Government
Printing Office, Washington, D.C.) \$7.45

Much of our understanding of astrophysical plasmas is based on line spectra. Too often the assumption is made, for simplicity, that the emitting gas is optically thin, that is, thick enough to emit radiation but thin enough that one ignores the effect of successive absorption and emission of photons by the gas. Another frequent assumption is that the medium is optically thick but, for simplicity, in a state of local thermodynamic equilibrium. The general case of an optically thick non-equilibrium plasma is of greater intrinsic interest than either of these two approximations but is much more difficult to treat, so much so that progress in the field is now in the hands of a few determined specialists.

This book is concerned with the equilibrium state of an optically thick gas controlled by its own internally-generated radiation field. The book is a revised and extended version of *Radiative Transfer and the Spectra of Celestial Bodies*, by V. V. Ivanov (Moscow, 1969), and contains roughly 100 additional pages devoted to results published between 1968 and 1971.

The author treats in great analytical detail the transfer of line radiation through a gas composed of idealized two-level atoms. This idealized problem deserves attention because it is central to the mathematical theory of the transfer of radiation in spectral lines, and because it provides underpinning for current research carried out with the use of digital computers.

The development is based on the analytical methods of E. Hopf, V. A. Ambartsumian, S. Chandrasekhar and V.

Springer-Verlag New York Heidelberg Berlin

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1973. 41p. 1 illus. paper/\$4.00

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NEW

The Electromagnetic Interaction in Nuclear Spectroscopy

edited by **W. D. HAMILTON**, School of Mathematical and Physical Sciences, University of Sussex, Brighton, England.

1975. about 930 pages US\$ 99.95/Dfl. 260.00

Over the past ten years there have been many spectacular developments in the study of electromagnetic interaction processes, tied in with an enormous increase in the range and precision of experimental data in low energy nuclear physics generally, and an improvement in the quantity and quality of tests for nuclear models.

The papers in this multi-author work combine to form a comprehensive and unified treatment of the basic theoretical and experimental methods of nuclear spectroscopy.

CONTENTS: Emission and absorption of electromagnetic radiation. Emission of gamma radiation and nuclear structure. Collective and microscopic model predictions of electromagnetic moments. Nuclear shapes and phase transitions. Transition probabilities. Delayed coincidence timing methods. Coulomb excitation. Nuclear resonance fluorescence. Doppler shift timing methods. The theory of international conversion. Experimental techniques of conversion coefficient measurements. Angular distribution and correlation of gamma rays, theoretical basis. Extranuclear perturbations of angular distributions and correlations. Angular distribution and correlation measurements using radioactive sources. Angular distribution and correlation of gamma ray. Measurement of electric and magnetic moments of excited states. Gamma-ray energy and intensity measurements with a curved crystal spectrometer. Gamma-ray energy and intensity measurements with Ge (Li) spectrometers. Subject Index.

Crystal Growth 1974

edited by **K. A. JACKSON, J. B. MULLIN** and **N. KATO**

1974. 724 pages US\$ 115.50/Dfl. 300.00

This book contains the Proceedings of the Fourth International Conference on

Crystal Growth, held in Tokyo during March 1974. It contains state-of-the-art contributions to the theory and practice of crystal growth by leading scientists from all over the world. In addition to recent advances in crystal growth theory and the characterization of crystal perfection, recent work is reported on vapor growth, epitaxy, melt growth, solution growth, as well as the growth of garnets, minerals, whiskers and thin films.

Gaseous Electronics Some Applications

edited by **J. W. McGOWAN** and **P. K. JOHN**

1974. 132 pages US\$ 19.25/Dfl. 50.00

The material contained in this volume is contributed by some of the leaders in the field of gaseous electronics, stressing the applications of this field in many areas, and summarizing its history and development over the last twenty-five years. It is a commemorative volume prepared on the occasion of the 25th Annual Gaseous Electronics Conference and in honour of Prof. W. P. Allis, M.I.T. and Leonard B. Loeb, University of California (Berkeley) who are among the founding fathers in the field of gaseous electronics and who have been instrumental in its growth.

Surface Effects in Controlled Fusion

Proceedings of the Conference on Surface Effects in Controlled Thermonuclear Fusion Devices and Reactors, Argonne, Illinois, 10-12 January, 1974

edited by **H. WIEDERSICH, M. S. KA. MINSKY**, and **K. M. ZWILSKY**

1974. 373 pages. US\$ 76.95/Dfl. 200.00

The fifty-six papers contained in this book represent the proceedings of the meeting. Written by the world's foremost plasma physicists and material scientists, they examine various aspects of plasma-wall interactions with an emphasis on problem definition and possible solutions.

Now also available in paperback

Superfluid Hydrodynamics

by **S. J. PUTTERMAN**

North-Holland Series in Low Temperature Physics, Vol. 3

1974. 466 pages

Hardbound edition: US\$ 47.95/Dfl. 125.00

Paperback edition: US\$ 24.95/Dfl. 65.00

A principal reason for studying superfluids is that they display quantum effects on the macroscopic level and obey hydrodynamics on the microscopic level. The experiments which led to these conclusions and the superfluid hydrodynamics theory which grew out of them, are covered in detail in this monograph.

CONTENTS: Hydrodynamics of He II on the level where dissipative effects are ignored. Hydrodynamics of He II when modified to include dissipation. Applications of He II hydrodynamics including dissipation. Incorporation of thermal fluctuations in the two fluid theory. Hydrodynamics of clamped superfluid helium. The problem of the critical velocities. Possible shortcomings of the Landau two fluid theory of He II. Properties of the condensed ideal Bose gas. Superconducting magneto-hydrodynamics. Open problems for future research. Appendices: Equality of the momentum and mass current densities in the two fluid theory. The Galilean transformation. The ideal fluxes. The Magnus force. Energy, velocity and impulse of a vortex ring in a classical incompressible fluid. The dissipative fluxes. Author index. Subject index.

Cooperative Effects - Progress in Synergetics

edited by **H. HAKEN**

1974. 302 pages. US\$ 23.25/Dfl. 60.00

The book represents the lectures of a summerschool dedicated to a rapidly developing new interdisciplinary field which deals with and compares cooperative effects, in particular disorder-order transitions, in various disciplines and which reveals amazing analogies in the behaviour of quite different physical, chemical, biological, sociological and other systems.

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V. Sobolev, although many of the results presented also can be obtained by Case's method (see K. M. Case and P. F. Zweifel, *Linear Transport Theory*, Addison-Wesley, 1967). Considerable space is given to research carried out in recent years at the University of Lenin-grad. The book stands as the definitive current reference for analytical line transfer solutions based on the two-level atomic model.

Similar problems are treated by computational methods in a recent book by R. G. Athay, *Radiation Transport in Spectral Lines* (Reidel, 1972). Related physical applications are discussed by J. T. Jefferies, *Spectral Line Formation* (Blaisdell, 1968) and D. Mihalas, *Stellar Atmospheres* (Freeman, 1970).

The translation by Eileen Weppner and D. G. Hummer is an excellent one, and reflects Hummer's complete knowledge of the subject and his familiarity with Ivanov's published work. The material should be of interest to those who study the theory of neutron diffusion as well as those who deal with radiative transfer theory.

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Astrophysical Concepts

Martin Harwit
561 pp. Wiley, New York,
1973. \$14.95

This is a book I would like to have my students read, particularly those whose background in physics has been weak or highly specialized. It gives a broad panorama of what might be called the physics of modern astronomy. Martin Harwit treats topics from the point of view of the physical principles believed to be involved rather than according to conventional dichotomies as to subject matter. Hence surprising juxtapositions of topics, such as galaxies and molecules, sometimes appear.

Discussion of modern developments does not crowd out classical subjects. Harwit's style in dealing with physical principles is lucid and clear, and he is to be commended for patiently explaining steps in derivations that are often glossed over or regarded as patently obvious by less skilled teachers. A nice feature of this treatment is the excellent set of problems, the solutions of which are given in the text. The material will be of great help to the student who likes to dig things out on his own. To a large extent the basic physics so necessary to modern astronomy is developed *Ab initio*.

It is unfortunate that important topics like synchrotron radiation could not have been developed in a more thor-

MATERIALS RESEARCH CENTER REPORTS . . .



On a new Raman
spectrometer
for remote
gas analysis.

At the Materials Research Center, Dr. J. J. Barrett has been investigating methods for the remote analysis of gases at low concentrations (ppm). These studies have led to the development of an instrument system that sensitively measures light which has been scattered from a gas by the rotational-Raman effect.

The Barrett Spectrometer is applicable to the detection and analysis of gases at a point remote (km range) from the instrumentation; this is of obvious value in studies of air pollutants. It efficiently detects natural CO_2 in air and scattering has also been observed from SO_2 , C_6H_6 , CO , NO , N_2O and HCl molecules. The system is useful as well in measuring the gas temperatures because it can measure the temperature dependence of the ratio of the Stokes to the anti-Stokes scattering intensity.

Conventional remote Raman spectrometers are limited by the relatively low intensity of vibrational-Raman scattered light and by low luminous transmission. These limitations are largely overcome by the new instrumentation; its sensitivity, for example, is 10^3 to 10^4 greater. This improved sensitivity together with high resolution is achieved through the ability of the system's unique Fabry-Perot interferometer to integrate optically all of the Raman lines in a band. (An essential part of the Barrett system is a wide-range scanning Fabry-Perot interferometer. This device appears to have marked advantages for various uses in addition to its present use in the new spectrometer.)

Compared to conventional Raman spectrometers, the Barrett system has three major advantages: (1) the larger rotational scattering cross section of a molecule is used; (2) all of the rotational Raman lines in a band are integrated to form the sum of the signals from the individual scattered rotational lines; (3) instrumental luminosity is as much as 100 times that of a conventional spectrometer.

The Materials Research Center work on detecting and measuring atmospheric species and pollutants is continuing as are other Raman-effect investigations.

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