radiation in a very comprehensive way. It begins with a detailed examination of the simple source and continues with the integral equations for radiation from distributions of dipoles and quadrupoles. The source distributions are taken to be deterministic in space and time; Temkin does not treat the ensemble averages of spatial source distributions necessary to compute noise power radiated by turbulence. The book's treatment of sound emission by heat release will be useful to researchers using lasers as "steerable" sound source arrays. A shortcoming, however, is the neglect of electroacoustics, the phenomenon responsible for generating most of the volume velocities and forces that cause the sound waves we study.

The final chapter on sound absorption contains the most comprehensive treatment I have seen in a textbook on absorption of sound in gases. Temkin treats both viscosity and heat conduction theoretically and includes measurement results to demonstrate their separate contributions to absorption. He demonstrates clearly the concept and effects of relaxation, but omits the relaxation effects of chemical reactions, which are, however, more important in liquids than in gases.

This text establishes a broad and clear foundation for the physical nature of wave generation and propagation in fluids. It provides a good basis for beginning study in acoustics.

James E. Barger
Bolt Beranek and Newman Inc.

The Quest for Extraterrestrial Life: A Book of Readings

D. Goldsmith, ed.
308 pp. University Science Books, Mill Valley, Ca., 1980. $18.00 cloth, $12.00 paper

Strategies for the Search for Life in the Universe

M. D. Papagiannis, ed.
253 pp. Reidel, Dordrecht, Holland, 1980. $30.00

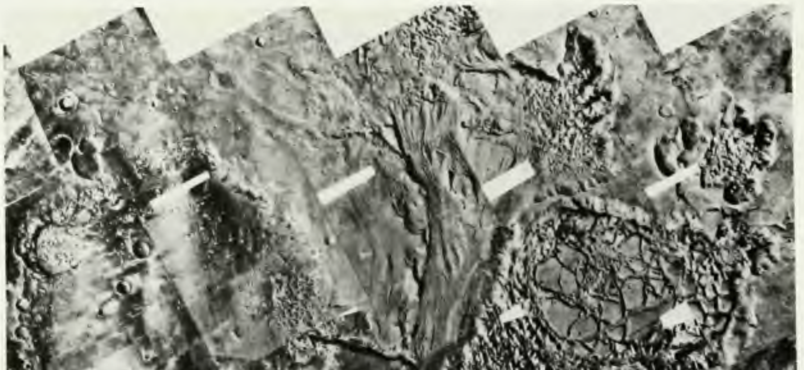
Life beyond Earth: The Intelligent Earthling's Guide to Life in the Universe

G. Feinberg, R. Shapiro, eds.
464 pp. Morrow, New York, 1980. $9.95

The three books listed above demonstrate that neither has the deluge of publications in the debate on extraterrestial life diminished nor has their diversity decreased. That diversity is especially well illustrated by *The Quest for Extraterrestrial Life: A Book of Readings*, edited by Donald Goldsmith, a California astronomer. Consisting of 58 selections chosen from the writings of authors as ancient as Lucretius and as contemporary as Gerald O'Neill and Carl Sagan, Goldsmith's anthology concentrates on the period after 1959, in which year Giuseppe Cocconi and Philip Morrison proposed using the 21-cm radio emission line of neutral hydrogen as the most natural and appropriate wavelength at which to seek signals from extraterrestrials. Their paper on the "water hole" of the universe helped unleash widespread interest in this topic, which from about 1920 to 1950 had fallen from favor because of the prevalence of encounter theories of planetary formation that predicted a planet-poor universe and also because of the excesses of the champions of a canaled Mars. Goldsmith's nine selections from pre-1910 publications, some translated specifically for this volume, remind us that the debate is one of longstanding interest and seems—even now, despite the progress of twentieth century astronomy—far from resolution.

Although Goldsmith's editorial apparatus is sparse, the wide array of methodologies and positions represented in his anthology, as well as their judicious balance, shows the presence of an active editor concerned with informing rather than propagandizing. John Ball and Ronald Bracewell, Frank Drake and Freeman Dyson, Michael Hart, Norman Horowitz, and Fred Hoyle, Carl Sagan and George Simpson are all among the anthologized authors, who in nearly every instance are scientists of prominence. Goldsmith's collection is sufficiently current to catch the wave of scepticism that came in the late 1970s following the seemingly negative results of the Viking missions and Michael Hart's 1975 paper urging that the absence of visits of extraterrestrials from the solar system combines with the apparent feasibility of interstellar travel by advanced civilizations to suggest that the number N of advanced civilizations in our galaxy may be very small. This position, developed by Frank J. Tipler in the April 1981 issue of PHYSICS TODAY, is now being taken seriously even by advocates of high values of N. Persons new to the field will find this book an excellent introduction, whereas persons who read many of these papers upon their first appearance will be happy to find them collected into a handsome, large volume that includes a useful bibliography.

The diversity in the debate is differ-



This mosaic of the Mangala Vallis region of Mars was taken by the Viking Orbiter 1 on 19–21 June 1980 at a range of 1600 kilometers. The area is noted for the variety of geological processes that have shaped it: Running water seems to have carved a vast channel system, and wind and mass waste have altered the surface with deposits and erosion. The picture appears in *The New Solar System*, edited by J. K. Beatty, B. O'Leary and A. Chaikin (224 pp. Cambridge U. P., New York, 1981. $19.95). The book summarizes and illustrates the findings of explorations conducted by interplanetary spacecraft.

NORTH-HOLLAND ANNOUNCES

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NEW BOOKS - NEW BOOKS - NEW BOOKS - NEW BOOKS -

Stochastic Processes in Physics and Chemistry

by N. G. VAN KAMPEN

1981. xiv + 416 pages
Price: US $76.50/Dfl. 180.00
ISBN 0-444-86200-5

The interest in fluctuations and in the stochastic method for describing them has grown enormously in the last few decades. The number of articles scattered in the literature of various disciplines must run to thousands and special journals are devoted to the subject. Yet 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.

CONTENTS: Preface. *Chapters:* I. Stochastic Variables. II. Random Events. III. Stochastic Processes. IV. Markov Processes. V. The Master Equation. VI. One-Step Processes. VII. Chemical Reactions. VIII. The Fokker-Planck and Langevin Equations. IX. The Expansion of the Master Equation. X. The Diffusion Type. XI. Unstable Systems. XII. Fluctuations in Continuous Systems. XIII. The Statistics of Jump Events. XIV. Stochastic Differential Equations. Index.

The Liquid State of Matter: Fluids, Simple and Complex

edited by: E. W. MONTROLL, *and* J. L. LEBOWITZ

STUDIES IN STATISTICAL MECHANICS, Vol. 8

1982 about 250 pages
Price: US $58.25/Dfl. 125.00
ISBN 0-444-86334-6

The objective of statistical mechanics is to explain and predict the properties of macroscopic matter from the properties of its microscopic constituents. The articles in this volume concern fluid matter.

The study of fluids has, in addition to its theoretical interest, many important practical applications. It would by very useful to be able to predict the properties of fluids, especially those composed of many different species of complex molecules. Chemical engineers designing large plants, mechanical engineers designing propulsion systems need to know equations of state, boiling points, heats of vaporization etc. On the other hand, the structure of real fluids, even the simplest ones, is too complex for a complete treatment from first principles.

CONTENTS: On the Equilibrium Theory of Fluids: An Introductory Overview *(J. L. Lebowitz and E. M. Waisman).* Non-Uniform Fluids *(J. K. Percus).* Dense Conducting Liquids *(N. W. Ashcroft).* The Equilibrium Statistical Mechanics of Simple Ionic Liquids *(B. Hafskjold and G. Stell).* Equilibrium Theory of Polyatomic Fluids *(D. Chandler).* Low Frequency Dielectric Properties of Liquid and Solid Water *(F. H. Stillinger).*

Development in High Power Lasers and Their Applications

Proceedings of the International School of Physics "Enrico Fermi", Course LXXIV, Varenna, Italy, 10-22 July 1978

edited by C. PELLEGRINI

1981 about 480 pages
Price: US $88.25/Dfl. 190.00
ISBN 0-444-85459-2

This book presents a review of the basic principles and recent developments of: high peak power lasers and their applications to laser fusion; high average tunable lasers and their applications to photochemistry, isotope separation and related fields.

CONTENTS: Preface *(C. Pellegrini).* Introduction to High Energy Lasers *(F. A. Hopf).* Laser-Fusion and Laser-Plasma Interactions *(R. Balescu).* High Power, Short Pulse CO_2 Laser Systems for Inertial Confinement Fusion *(S. Singer et al.).* The High Power Iodine Laser *(E. E. Fill).* High Power Tunable Lasers and Their Applications to Photochemistry and Isotope Separation *(K. L. Kompa).* Photophysical and Photochemical Properties of Gaseous UF_6 *(S. De Silvestri, O. Svelto and F. Zaraga).* High Power 16-Micrometer Lasers for Uranium Isotope Separation *(S. Martellucci and S. Solimeno).* High Power Chemical Lasers *(S. Solimeno and S. Martellucci).* Single Particle Theory of the Free Electron Laser *(S. Stenholm).* Coherent Dynamics of the Free-Electron Laser *(G. T. Moore et al.).* The Free-Electron Laser: The Storage Ring Operation *(A. Renieri).*

Physics of Defects

Proceedings of Les Houches Summer School, Session XXXV, 28 July - 29 August 1980

edited by ROGER BALIAN, MAURICE KLÉMAN and JEAN-PAUL POIRIER

1982 xxxvi + 844 pages
Price: US $174.25/Dfl. 375.00
Subscription price:
US $148.75/Dfl. 320.00
ISBN 0-444-86225-0

CONTENTS: Preface. **Courses: 1.** Dislocations and Walls in Crystals *(J. Friedel).* **2.** Defects in Amorphous Metals *(F. Spaepen).* Seminars: The Study of Dislocations by Electron Microscopy *(A. Bourret).* Defects in Three- and Two-Dimensional Colloid Crystals *(P. Piezanski).* Macroscopic Random Media: "Miam" *(E. Guyon).* **3.** Continuum Theory of Defects *(E. Kröner).* **4.** Gauge Theories and Densities of Topological Singularities *(I. Dzyaloshinskii).* **5.** Classification Topologique des Défauts et des Configurations des Milieux Ordonnés *(L. Michel).* **6.** Mathematical Concepts in the Theory of Ordered Media *(R. Thom).* Seminars: Disentanglement of Line Defects in Ordered Media *(K. Jänich and H.-R. Trebin).* Many Defect Structures, Stochasticity and Incommensurability *(S. Aubry).* **7.** Singularities in Waves and Rays *(M. Berry).* Seminar: Dislocations and Disclinations in Transverse Electromagnetic Waves *(J. Nye).* **8.** Structure and Events in Flow Fields *(J. Nye).* **9.** Dislocations and Earthquakes *(R. Madariaga).* Seminar: From Continental Drift to Dislocation Cores *(J.-P. Poirier).* **10.** Dynamics of Walls, Lines and Points in Magnetic Bubble Garnets *(J. C. Slonczewski).* **11.** Amphiphilic Mesophases Made of Defects *(W. Helfrich).* Seminar: Optical Techniques for the Analysis of Defects in Smectic Liquid Crystals *(S. T. Lagerwall and B. Stebler).* **12.** Defects in Ordered Biological Materials, Bibliographical Notes, *(Y. Bouligand).* **13.** Statistical Mechanics of Topological Defects *(B. I. Halperin).*

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ently illustrated by *Life beyond Earth*, the culmination of a collaboration between a Columbia physicist, Gerald Feinberg, and a NYU biochemist, Robert Shapiro. Possessed of unusual skills for serious popularization, lively imaginations, and a passion for proposing exotic forms of life, Feinberg and Shapiro have produced a volume that, one suspects, will be read and relished, but not believed, at least by many experts. Their cosmic elevator COSMEL that transports readers from 10^{-15} to 10^{25} times normal size is but one of their ingenious techniques for bringing greater clarity to a topic already rich with interest.

Among the hundreds of books that have proposed extraterrestrial life, that by Feinberg and Shapiro adopts one of the most extreme positions. In fact, their introductory promise to present a "fertile Universe [wherein life] exists not only on the solid surfaces of planets but also in dense planetary atmospheres, in rarified interstellar clouds, and even inside some stars" is more than made good. In their summarizing "tourist guide" table, which rates the possibilities for life elsewhere in the solar system, Jupiter and the surface of Titan (along with the Earth!) receive four stars, whereas three stars ("still a good bet") go to Saturn and to the interiors of Ganymede, Callisto and Titan. Venus gets two stars—"some possibilities exist"—as does Mars, concerning which the authors provide a detailed analysis of the results of the Viking life-detection package, which they sum up by stating: "In many respects [it] is a good illustration of how not to search for extraterrestrial life."

Concerning life beyond the solar system, four-star ratings go to the "high interiors of ordinary stars" ("plasma life") and the "interiors of white-dwarf stars." To interstellar gas clouds, they assign "radiant life" and three stars, two stars going to neutron star surfaces ("magnetic-atom polymer life") and to very cold planet surfaces ("solid-hydrogen life"). Perhaps the most extraordinary speculation in a book that abounds in suggestions that many scientists will find fantastic occurs when, after describing the strange forms of many galaxies, they write: "These descriptions may make a galaxy sound disturbingly like some of the [lowest] living forms . . . and indeed the structural parallels are eerie. Very probably these resemblances are coincidental, but—?"

Their book would be a gold mine for science fiction writers, except for the fact that they are chiefly concerned, not with the possiblities of *intelligent* life capable of communicating with us, but with life in general, defined in the broadest terms. To give them their due, however, they write with a full knowledge of the claims of those scientists who have adopted much more restrictive views, and they provide readers with comments that enable them to assess the radicalness of their proposals.

Fifteen technical papers presented at the 1979 Montreal meeting of the International Astronomical Union have been collected by Michael D. Papagiannis, a Boston University astronomer, to form a volume entitled *Strategies for the Search for Life in the Universe*. A simple listing of the titles and authors of three of these papers shows how far the astronomical community remains from a consensus concerning the number (N) of technologically advanced civilizations in our galaxy:

Michael Hart: "N Is Very Small"

Frank Drake: "N Is neither Very Small nor Very Large"

Michael Papagiannis: "The Number N . . . Must Be either Very Large or Very Small"

A reading of these papers reveals that the range of N assigned by different authors runs from 10^0 to 10^{11}, an incredible variation. Some of the promising new techniques for restricting this range are discussed in other papers in this volume. These include new methods of determining whether nearby stars possess planetary systems and also new ways to search for interstellar ships or signals.

The debate over the existence of extraterrestrials is extraordinarily exciting, but its resolution remains elusive. It is difficult to conceive of an instance in the history of science in which many scientists, possessing essentially the same background information and searching for a single number, have differed in their estimates by a factor as great as 10^{11}. One cannot but suspect that nonscientific influences—as lofty as metaphysical considerations, as mundane as funding possiblities—are playing a major if obscure role. In this situation one is impressed by the readiness of the IAU to include papers differing so fundamentally in their approaches and conclusions.

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University of Notre Dame

Theory of the Nuclear Shell Model

R. D. Lawson
546 pp. Oxford U. P., New York, 1981.
$129.00

The nucleus has been a subject of intense study for over 30 years. The number of recent conferences on nuclear physics suggests that the field continues to maintain much excitement. Since the 1950s, physicists have used two broadly applicable models to describe the nucleus: the shell model and the collective model. The manifestations of the former, focusing on the motion of individual particles in the nucleus, are most apparent in the neighborhood of the magic numbers—or closed nucleon shells. The latter applies in the region in between, in particular, when there are large nuclear deformations and where a single-particle description is inadequate. This model was conceived by Aage Bohr and Ben Mottelson, who devoted the first of their two-volume book, *Nuclear Structure*, to single-particle motion and the second to nuclear deformations. The shell model was proposed by Maria Goeppert Mayer and by J. Hans Daniel Jensen, Otto Haxel and Hans Edward Suess. Mayer and Jensen, in their 1955 book *Elementary Theory of Nuclear Shell Structure*, gave the experimental evidence for the shell model and some of the basic theory. In 1963, Amos de-Shalit and Igal Talmi presented the development of the new spectroscopic techniques required to analyze the nucleus in the light of the shell model. Much of the formalism in their book *Nuclear Shell Theory* is based on the tensor algebra of Giulio Racah. Though Racah's methods were meant for atomic spectroscopy, they were neglected by his contemporaries in atomic physics, brought up on their bible, *The Theory of Atomic Spectra* of E. U. Condon and G. H. Shortley. It was the new generation of nuclear physicists who recognized the power and potential of Racah's work.

Robert D. Lawson has contributed to furthering our understanding of nuclear spectroscopy for nearly three decades. His *Theory of the Nuclear Shell Model* is a welcome addition to the earlier books on the subject. Although Lawson writes at the outset that his book is written at a level intermediate between the texts of Mayer and Jensen and of de-Shalit and Talmi, "an intermediate mix between theory and experiments" would have been a more appropriate description. In fact, the level is not more elementary than that of de- Shalit and Talmi. As I mentioned, Jensen is largely phenomenological, while de-Shalit and Talmi develop the shell theory with only a handful of physical examples. The new book, on the other hand, intersperses applications to examples of nuclear data among the developed formalism, in line with Lawson's intention to have it serve as a "how-to" text. It is a matter of taste whether this is an appealing format for study or whether the division of individual chapters into text, illustration and appendix, as done by Bohr and Mottelson, makes for easier reading. I am perhaps a particular guinea pig because I read the book as