

SCIENTISTS and ENGINEERS

Dynamic new subsidiary of **Ford Motor Company** is now in initial stages of expanding military and commercial programs.

Positions are at ASI's interim Glendale facility and will also be at ASI's new Research Center now under construction at Newport Beach in Southern California. Work in an intellectual environment as stimulating as the locations are ideal—close to most of Southern California's cultural, educational, and recreational centers.

Outstanding growth opportunities for qualified engineers and scientists who are U. S. citizens are open in the following fields:

OFFICE OF ADVANCED RESEARCH

THEORETICAL RESEARCH — Hydrodynamic and radiation processes in tenuous gases at very high temperatures, ionization produced by soft X-radiation, hydrodynamics of solids at high pressures including studies of equations of state, infrared properties of the atmosphere and of hot gases, conversion of chemical energy into sound and the condensation rate of supersaturated vapors. Theoretical physicists are needed to work in these fields. Specific experience is not necessary. However, a general background in theoretical and mathematical physics is required.

You are invited to address inquiries to M. H. Johnson, Advanced Research Staff at our Glendale, California address.

Other unusual opportunities are open for qualified engineers and scientists in the following areas:

SPACE TECHNOLOGY DIVISION

Astrodynamics • Space Environment • Theoretical Physics • Electronics • Radar • Information Links • Automatic Controls • Mathematics

COMPUTER DIVISION

Input-Output Equipment
Storage Units • Display Devices

TACTICAL WEAPON SYSTEMS DIVISION

Aerodynamics • Hydrodynamics • Electro-optics • Guidance and Control

Qualified applicants for the above three divisions are invited to send resumes and inquiries to Mr. K. A. Dunn, 1234 Air Way, Bldg. 21, Glendale, California. Phone CHapman 5-6651.

AERONUTRONIC SYSTEMS, INC.

a subsidiary of FORD MOTOR COMPANY
NEWPORT BEACH, GLENDALE, SANTA ANA
AND MAYWOOD, CALIFORNIA

to such matters as the amount of CO_2 , the production of oxygen, the heat content of the earth, its probable internal temperature distribution, the effects of convective cells in the liquid core in producing a fairly uniform temperature, and the transmission of heat to the surface by conduction through the crustal layers. He points out the role of radioactivity in maintaining the interior of the earth at a high temperature. In the last chapters he deals with the relations of volcanic activity and orogenesis, and related problems.

The book is well written, and brings out many interesting points. It should certainly be read by all persons interested in the subject. Needless to say, it contains many controversial ideas, and many professional geophysicists will disagree with various interpretations. His point of view differs quite radically, for example, with that developed by Urey both about the origin and also about the subsequent physical-chemical history of the moon. Likewise his analysis of geomagnetic effects differs from that of Chapman. But his arguments are stimulating and interesting to follow, and this is a subject which is very new so that there does not exist a great body of data whose interpretation has met with widespread agreement.

1958 Heat Transfer and Fluid Mechanics Institute: Preprints of papers (U. of California, Berkeley, June 1958). 264 pp. Stanford U. Press, Stanford, Calif. \$8.50. *Reviewed by C. M. Ablow, Stanford Research Institute.*

As is pointed out in the preface, this group of preprints is only to be considered a basis for discussion with final versions of the papers appearing in appropriate journals. However, the quality of the individual papers is uniformly high and their reproduction, by a photographic process, is clean and legible so that the volume presents an attractive collection of the latest work in its field.

Two of the papers are listed as survey articles. That of R. K. Landshoff gives a short but comprehensive coverage of the subject matter, theoretical and experimental tools, and fields of application of magnetohydrodynamics. The article serves best as an index to its extensive but well-selected bibliography.

The paper on the "Drag of a Sphere Moving in a Conducting Fluid in the Presence of a Magnetic Field" by K. P. Chopra and S. F. Singer exemplifies the use of dimensional analysis in magnetohydrodynamics, for various cases of conducting or magnetized spheres moving in a plasma are tractable when the equations can be simplified because some nondimensional groupings may be very large or small.

The partial differential equations of motion in a magnetic laminar boundary layer are shown to be reducible to ordinary equations in a similarity parameter in the paper by P. S. Lykoudis under rather severe assumptions on the nature of the fluid and its flow. The three magnetohydrodynamic papers do show the analytic side of the subject to be very difficult with

SIGNIFICANT SCIENTIFIC ELECTIONS

V
A
N
N
O
S
T
R
A
N
D

INTRODUCTION TO NEUTRON PHYSICS

by L. F. Curtiss, *Consultant to the Director, National Bureau of Standards.*

The main subject of this first book in the new *Van Nostrand Nuclear Science Series* is neutron bombardment and how to measure, detect, produce and control it. Emphasis is placed on experimentally demonstrated facts and on the methods by which data were obtained. 370 pp. About \$8.50

CRYOGENIC ENGINEERING

by Russell B. Scott, *Chief, Cryogenics Engineering Laboratory, National Bureau of Standards.*

An introduction to low temperature engineering covering development and improvement of processes and equipment, determination of the physical properties of materials used, and practical application of cryogenic techniques. 425 pp. \$5.60

NUCLEAR REACTOR EXPERIMENTS

by the Staff of Argonne National Laboratory, *J. Barton Hoag, Editor and Contributor.*

This important laboratory book brings together for the first time forty-nine experiments that deal with most nuclear reactor work, covering both the theory and the practice of fission reactor measurements. 480 pp. \$6.75

NUCLEAR REACTOR METALLURGY

by Walter D. Wilkinson and William F. Murphy, *International School of Nuclear Science and Engineering, Argonne National Laboratory.*

Here is the metallurgy of uranium, plutonium, thorium, beryllium, and zirconium, with information on their ore processing, metallography, fabrication and radiation effects. An important chapter on "Nondestructive Testing of Nuclear Reactor Components" has also been included. 382 pp. \$5.60

SOURCEBOOK ON ATOMIC ENERGY, 2nd ed.

by Samuel Glasstone, *Consultant to the Atomic Energy Commission.*

The second edition, brought completely up-to-date, summarizes the accomplishments of recent years in research and development. An entire new chapter has been added on nuclear reactors for research and power. 648 pp. \$4.40

THE ELEMENTS OF NUCLEAR REACTOR THEORY

by Samuel Glasstone and Milton C. Edlund, *Physicist at Oak Ridge National Laboratory.*

This widely used book is a comprehensive account of the basic principles of nuclear theory dealing with such topics as neutron reactors, the properties of neutrons, and the relationships that determine the various nuclear reactor rates and products. 360 pp. \$5.50

ASTRONOMY

by Robert H. Baker.

In this lively new seventh edition, latest data and viewpoints are given on artificial earth satellites, new telescopes, ephemeris time, the theory of stellar evolution, radio astronomy, photoelectric photometry, white dwarf stars, the two bright comets of 1957, and the various interpretations of the expanding universe. Ready in February

SEE THESE AND OTHER OUTSTANDING BOOKS AT OUR EXHIBIT.

D. Van Nostrand Company, Inc.

120 Alexander Street

Princeton, N. J.

ELECTRONIC ENGINEERS AND PHYSICISTS

**PARTICIPATE IN OUR GROWING
PROGRAM OF**

Infrared Instrumentation and Systems

**FOR GUIDED MISSILES
AND SATELLITES**

**WORK ON SUCH HIGH
PRIORITY PROJECTS AS:**

- **Meteorological
Reconnaissance**
- **Satellite
Stabilization**
- **Missile Guidance
and Tracking**

*We have openings for qualified physi-
cists and electronic engineers at all
levels in the fields of:*

**Transistor Circuitry
Infrared Systems
Low Frequency Electronics
Vacuum Deposition Techniques**

Submit resumes or call Personnel Department

BARNES ENGINEERING COMPANY
30 Commerce Road, Stamford, Connecticut
Fireside 8-5381

few positive results in spite of its well-explored foundation in ordinary hydrodynamics.

The other survey article, by H. K. Emmons, entitled "Theoretical Aerothermodynamics", lists the general equations for flow, reaction, and transfer processes in fluids together with an indication of methods of solution. It is shown that present techniques permit the analytic solution of combustion problems in which only the chemical kinetics are simplified, by neglecting the temperature dependence of reaction parameters, for example. It goes without saying that a collection of such solutions would greatly enhance our understanding of combustion processes.

Solutions to some combustion problems along the above lines are exhibited in the study of combustion in a laminar boundary layer by J. P. Hartnett and E. R. G. Eckert and in the similar work on the flow of a reactive gas along a decomposing wall by E. K. Knuth.

More general studies almost without simplifying assumptions are that giving "Criteria for Thermodynamic Equilibrium in Gas Flow" by M. Rudin and that on "Wave Propagation in a Reacting Mixture" by B. T. Chu. In the latter it is shown that a wave front proceeds into undisturbed gas at a fixed sound speed even though, since the wave initiates a reaction, its amplitude decays so that only the passage of the variable speed reaction front is measurable.

The section on reactive fluids also includes a demonstration by M. Gerstein and A. E. Potter that even the use of greatly simplified reaction kinetics permits prediction of flame quenching distances in fair agreement with experiment.

Of the three papers in the fluid dynamics section, one by R. G. Deissler and M. Perlmutter contains a systematic analysis of compressible laminar and turbulent vortex flows which may be considered not oversimplified models for flows in a Ranque-Hilsch tube. These tubes have received a good deal of attention in the last few years providing as they do a separation of a gas flow into hot and cold streams without the use of machinery. The other two fluid dynamics papers by R. R. Mills and S. Corrsin and by S. W. Yuan and A. Barazotti report on experiments with turbulent flow in the presence of a contraction or of injection at the wall.

The studies in the heat transfer section of the collection all report on experiments approximately verifying earlier theoretical or empirical results. That of R. Hartunian, A. Russo, and P. Marrone concerns shock tubes and that of S. Globe and D. Dropkin natural convection heating. The paper by F. Kreith and D. Margolis investigates the effect of swirl in a pipe on heat transfer and gives a qualitative explanation for the observations.

The paper by P. H. Rose, M. C. Adams, and R. F. Probst reports on the heat transfer at the nose of blunt bodies moving through partially dissociated air and includes a correlation of experimental evidence with their semiempirical theoretical explanation. The

WILEY

BOOKS



*Ready in February — a modern, balanced treatment
of both mathematical and descriptive aspects*

THE PHYSICS OF ELECTRICITY AND MAGNETISM

By William Taussig Scott, *Smith College*. Offering a full descriptive treatment of the subject, this new book uses vectors, integrals, and derivatives to build up the reader's physical intuition on a logically sound basis. Simple mathematical proofs are used for the fundamental theorems needed to understand the electromagnetic field and Maxwell's equations. The author treats basic theory in a rigorous way, using the physicist's rather than the mathematician's

concept of rigor. He introduces concepts one at a time and develops each with examples before the next is introduced. The modern atomic viewpoint is employed throughout. These and other important features make the work highly useful for reference and for a new, fresh viewpoint on a standard subject. *Ready in February. Approx. 600 pages. Illus. Prob. \$8.50.*

A checklist of other important Wiley titles . . .

TOPICS in ELECTROMAGNETIC THEORY.

By D. A. Watkins, *Stanford University*. Provides a logical, unified treatment of topics of interest to students and workers in the field of electromagnetic theory and microwave electron tubes. 1958. 118 pages. \$6.50.

ADVANCED MECHANICS of FLUIDS.

Edited by H. Rouse, *State University of Iowa*. A sequel to Rouse's *Elementary Mechanics of Fluids*, this book presents a rigorous and coherent approach to the analytical techniques of research, and incorporates the most recent developments in the field. 1958. 444 pages. Prob. \$9.75.

PHYSICAL LAWS and EFFECTS.

By C. F. Hix and R. P. Alley, *both of General Electric Co.* Provides a convenient compilation of both familiar and unfamiliar laws and effects. One of a series written by General Electric authors for the advancement of engineering practice. 1958. 291 pages. \$7.95.

The SCIENCE of PHOTOGRAPHY.

By H. Baines, *Kodak Ltd., London*. An authoritative and comprehensive survey of both processes and methods used in modern photography. 1958. 319 pages. \$7.50.

PROGRESS in SEMICONDUCTORS.

Volume III. Edited by A. F. Gibson, *Radar Research Establishment, Malvern, U.K.*; R. E. Burgess, *University of British Columbia*; and P. Aigrain, *Université de Paris*. With 8 contributors. The third volume of a yearly international review of the semiconductor field. 1958. 210 pages. \$8.50.

SEMICONDUCTOR ABSTRACTS.

Volume IV — 1956 Issue: Abstracts of the Literature on Semiconducting and Luminescent Materials and Their Applications. Prepared jointly by members of the Solid State Devices Division and the Physical Chemistry Division of Battelle Memorial Institute. Edited by C. S. Peet, *Battelle Memorial Institute*. A publication in the Electrochemical Society Abstract Series. *In press.*

PLANNING of EXPERIMENTS.

By D. R. Cox, *University of London*. Examines the ideas underlying modern work on the statistical aspects of experimental designs. One of the Wiley Publications in Statistics, Walter A. Shewhart and S. S. Wilks, Editors. 1958. 308 pages. \$7.50.

HANDBOOK of CHEMICAL MICROSCOPY

—Volume I, Third Edition: Principles and Use of Microscopes and Accessories; Physical Methods for the Study of Chemical Problems. By the late E. M. Chamot and C. W. Mason, *both of Cornell University*. 1958. 502 pages. \$14.00.

INTRODUCTION to FUNCTIONAL ANALYSIS.

By A. E. Taylor, *University of California, L. A.* 1958. 423 pages. \$12.50.

NOISE in ELECTRON DEVICES.

Edited by L. D. Smullen, and H. A. Haus, *both of M.I.T.* With 6 contributors. A Technology Press book, M.I.T. 1958. Approx. 432 pages. Prob. \$12.00.

Send for examination copies.

JOHN WILEY & SONS, Inc.

440 Fourth Avenue, New York 16, N. Y.

JANUARY 1959

TOP LEVEL PHYSICIST TO HELP DIRECT KEY RESEARCH PROGRAM IN MICROWAVE FIELD

Microwave Associates, Inc., invites qualified physicists to discuss an unusual opportunity to direct a research group involved in the control of microwave energy by gas discharges or ferrites.

The man we seek should be well founded in the interaction of microwave energy with gas plasmas or ferrites. He must be prepared to generate new ideas and approaches to meet today's "beyond the state of the art" problems. Further, he must guide the work of his associates in this area.

Excellent high power and low power instrumentation is available to investigate these phenomena over a wide frequency spectrum — 500 mc to 35,000 mc.

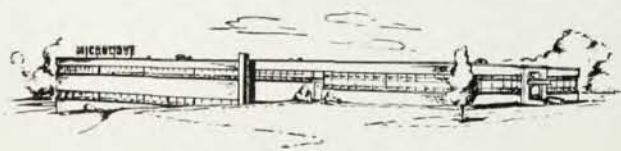
Associated with this research group will be an aggressive development group which can rapidly translate these new ideas into practical devices.

Opportunities for your continued growth are excellent — Microwave Associates has enjoyed exceptional progress over the past several years and occupies a well established position in the field.

You are invited to a confidential exploratory discussion of your future with us. Contact Dr. Jerome Kornreich for suitable arrangements.



MICROWAVE ASSOCIATES, INC.
BURLINGTON, MASSACHUSETTS • Telephone: Browning 2-3000



report by A. J. Vitale, E. M. Kaegi, N. S. Diaconis, and W. R. Warren covers a similar experimental investigation. In contrast, S. M. Bogdonoff and I. E. Vas have conjectured that great reductions in heat transfer to a blunt body in hypersonic flow are possible if the flow is separated by a spike extending ahead of the body. Their experiments verify this provided the flow remains laminar. The problem of finding materials able to serve as practical spike tips is still open.

A. J. Hanawalt, A. H. Blessing, and C. M. Schmidt compute the temperatures of leading edges in very high-speed long continued flight and point out the practicality of insulated surfaces so that it is radiation that balances the aerodynamic heating. For short periods surface melting can be a useful heat sink as is pointed out by the calculations of S. M. Scala and G. W. Sutton.

The van Karman-Polhausen approximate integral method of boundary layer analysis is shown by P. A. Libby to give satisfactory agreement with more exact and exacting theoretical computation schemes for laminary hypersonic flow.

In summary, if this collection is a fair sample of the latest research it is evidence of an orderly advance, for all the papers can be readily subsumed under a few headings: combustion, dissociated gas dynamics, flow of real fluids. This means either that most investigators have recognized and attacked the few major problems of our time or perhaps that there is a more centralized control of basic research in this country than we should like to admit.

The Exploration of Space by Radio. By R. Hanbury Brown and A. C. B. Lovell. 207 pp. John Wiley & Sons, Inc., New York, 1958. \$6.50. *Reviewed by H. Mendlowitz, National Bureau of Standards.*

In a field which started just about a quarter of a century ago, a well-written book of an introductory character is quite welcome. Actually, although the field of radio-astronomy is about twenty-five years old, the major advances in techniques and accumulation of data took place in the last decade. The authors themselves have made important original contributions in this field. It is not very often that those people who make significant advances in research in a scientific field can also be effective in presenting their work to those not acquainted with the field. Hanbury Brown and Lovell have been able to put together a rather nice book to serve as an introduction to the uninitiated without giving him the feeling that he is being "talked down" to.

The authors start with a short chapter to give the reader some background material in astronomy and then continue with an introduction of the subject by discussing properties of radio waves and the techniques of radio astronomy. After this the meaty part of the subject is discussed. This includes such topics as galactic and extragalactic radio emissions, the importance of the hydrogen 21-cm emission line in the study of interstellar space, and solar radio waves. One of the