

text. The error inherent in the Hartree-Fock model for the many-electron molecular system is usually referred to as the correlation error. This deficiency in a simple model is employed as a basis for analyzing the details of chemical bonding and spectra. Hurley starts out by discussing the more obvious corrections, namely those which are necessary in order to give qualitatively correct behavior at dissociation. This discussion leads to an instructive comparison of the molecular-orbital and the valence-bond methods and to detailed applications to diatomic and polyatomic molecules. The treatment, although abstract in nature, is very close to actual calculations. In particular, I find the discussion of the dissociation of the ethylene molecule into two methylene radicals very instructive.

A chapter entitled "The Correlation Problem" makes up the bulk of the text (190 pages). Hurley's discussion of reduced-density matrices and natural orbitals draws heavily on the work by Per-Olov Löwdin during 1955-59. The problem of selecting a determinantal basis for a superposition-of-configurations calculation is treated in great depth, but the discussion lacks references to work published after 1970.

Particular emphasis is given to the electron-pair theories, for the calculation of correlation energies. Separated-pair theory, independent-pair theory and their extensions are worked out with numerous examples of applications to molecular systems, particularly for the ground state.

It should be valuable for the quantum chemist to get the alphabetical zoo of methods (IPA, IPEA, IPNO-CI, IPNSO and so on) sorted out. Hurley's presentation explains the sometimes subtle differences between these schemes in a clear and elegant manner using consistent notation.

The works by Harold Conroy and by Niclas C. Handy and the late S. Francis Boys using interelectronic coordinates are also briefly reviewed.

I do not mean this as any criticism, but it should be noted that some of the important recent work on electron correlation in molecules is not mentioned in this text. For instance, the work on the calculation of excited states, excitation energies, ionization energies and various transition properties using bracketing functions, many-body perturbation theory, Green's function theory and the EOM methods are not mentioned. Still, the text is a very valuable and welcome account of what goes on in the world of electrons in molecules.

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research interests have included such topics as the electronic structure, properties and spectra of atoms; molecules and solids, and quantum-mechanical properties of matter.

Asymptotic Structure of Space-Time

F. P. Esposito, L. Witten, eds.

442 pp. Plenum, New York, 1977. \$42.50

There are few working on the frontiers of gravitation physics and relativity today who will not find this book a valuable guide in their investigations, and of those who rather want simply a flavor of the latest in the field, there are few who will not get from the volume at least some impression of the topics of central interest today.

I can imagine many who will buy *Asymptotic Structure of Space-Time* simply for Robert Geroch's more than 100-page treatise of the same title. Others will read it for Leonard Parker's 120-page paper, "The Production of Elementary Particles by Strong Gravitational Fields," and still others will find indispensable the work by E. T. Newman and K. P. Tod on the calculus of spin weight functions, not to mention the ensuing development of that topic contributed by other distinguished authors further on in the volume.

One could only hope that the editors will take the good outcome of the present enterprise as stimulus to edit an annual series of books on recent developments in general relativity.

JOHN A. WHEELER

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Science Development: The Building of Science in Less Developed Countries

M. J. Moravcsik

262 pp. Pasitum, Bloomington, Ind., 1975. \$6.00 in Europe, Australia, Canada, the US and Japan—free elsewhere on individual request

This book is the first one in English about science in underdeveloped countries. The number of papers devoted to this problem has been growing steadily; however this is the first systematic attempt to cover a whole range of problems in the field. The author, Michael Moravcsik, is an American physicist who has spent several years in less-developed countries. He has drawn his information from his own experience and from almost 500 papers, which are quoted in an impressive bibliography. He has been trained as a physicist, but the field belongs in my opinion to the social sciences: Science policy should be considered a part of political science. This is, therefore, not just

a book for physicists or natural scientists, but for social scientists and for all those interested in the harmonic and rational development of the less-developed countries, including the scientists of the developed countries who might be willing to help in this development by contributing their particular expertise; the numbers of these last, unfortunately, have been so far very small.

The importance of the subject can hardly be overestimated. Science policy is needed if a scientific and technological system is going to develop in the less-developed countries. Such a policy is a necessary tool for building up their higher education (and their educational systems in general), public health and production, and thus for breaking away from their underdeveloped dependent situation. The importance of the subject is not appreciated in the advanced countries, as is witnessed by the fact that Moravcsik got no support for writing his book and did not find it easy to publish. On the other hand, at least in two Spanish-American countries, Argentina and México, a strong interest has arisen in this subject. Two symposia were held in 1973 and 1974, in Buenos Aires and Mexico City. The initiatives were totally local, and no foreign participants were invited, not for chauvinistic reasons but because the means available and organizing capabilities were modest. Five anthologies on the subject of science and technology development were published in 1974 and 1975 in Buenos Aires and Mexico City. (The four published in Buenos Aires were edited by Oscar Varsavsky, Jorge A. Sabato, Francisco Suárez and Gregorio Klimovsky, the last with the rather misleading title of *Ciencia e ideología*; Luis Cañedo edited the Mexican volume.) As a result of the current purge of Argentine intellectuals, the anthology edited by Varsavsky has become a collector's item, and many of the authors probably share the fate of most Argentine scientists—slaughtered, kidnapped, fired from their jobs or forced to emigrate. These facts show quite clearly how difficult and tragic life might be for intellectuals in underdeveloped countries.

The best of Moravcsik's work is his description of the real situation of science and scientists in the underdeveloped countries. This is a subject on which a number of authors—such as John Ziman, Antoine Zahlan, Philip Altbach, N. Singh and others—have written good papers, sometimes in journals not widely read. Moravcsik's merit lies in his having put together all this valuable information in a more systematic way and for a larger audience. The book gives a good list of obstacles to science development: formalist teaching, scientists prejudiced against experimental work, scientists with a "non-functional" understanding of science and narrow ranges of competence that make them a kind of dead wood in

new from NORTH- HOLLAND

Proceedings of the International Conference on Magneto-Optics

(ICMO 1976) Zürich, Switzerland, September 1-3, 1976.

edited by P. WACHTER, *Laboratorium für Festkörperphysik, ETH Zürich, Switzerland.*

SPECIAL ISSUE OF THE JOURNAL PHYSICA, Volume 89 B & C.

1977 x + 301 pages

Price: US \$38.95/Dfl. 95.00

ISBN 0-7204-0737-0

The conference was organized in order to bring together three groups of scientists: those working on fundamental and theoretical aspects of magneto-optics, researchers using magneto-optics as a tool to investigate new materials, and those who are concerned with industrial applications of magneto-optics. The aim of the conference was further to present an up-to-date survey of the possibilities of this important subject.

These proceedings contain all 58 papers presented at the conference (8 invited and 50 contributed papers), as well as the opening address of the conference chairman. The 9 session titles and 8 invited papers are listed below:

CONTENTS: Preface. Conference committees. Contents List. **Opening Address** by G. Busch: On the history of magneto-optics. **Invited Papers: Session 1: Semiconductors and Insulators.** The interband Faraday effect - A comparative analysis of germanium and silicon (F. R. Kessler). Spectroscopic applications of magneto-optics to inorganic materials (B. Briat, M. Billardon, and J. Badoz). **Session 2: Rare Earth Compounds.** **Session 3: Metals and Semimetals.** Vacuum ultraviolet magneto-optical studies of ferromagnetic metals using synchrotron radiation (J. L. Erskine). **Session 4: Theory.** **Session 5: High Magnetic Fields.** Magneto-optical studies of graphite intercalation compounds (D. D. L. Chung and M. S. Dresselhaus). **Session 6: Dimensionality and Critical Components.** Optical investigations on magnetic and structural phase transitions of $(\text{CH}_3\text{NH}_3)_2\text{CuCl}_4$ and $(\text{C}_2\text{H}_5\text{NH}_3)_2\text{CuCl}_4$ (G. Heygster and W. Kleemann). **Session 7: Light Scattering.** Magnetic phonon splitting in rare earth trichlorides (G. Schaack). Recent work on InSb spin-flip Raman laser (R. L. Aggerwal). **Session 8: Techniques and Applications.** Integrated optics and thin film technology (P. K. Tien). **Session 9: Resonance and Others.** List of Contributors: Analytic Subject Index.

Progress in Optics Volume XV

edited by E. WOLF, *Department of Physics and Astronomy, University of Rochester, New York.*

1977 xvi + 364 pages

Price: US \$50.95/Dfl. 125.00

ISBN 0-7204-1515-2

The rapid advances continually taking place in all branches of science and technology make it impossible for anyone to keep fully abreast of all developments. This is also true in the broad field of optics where there is a recognized need for an authoritative and up-to-date source of information.

"Progress in Optics" has been widely acclaimed by reviewers as fulfilling this need. Each volume in the series consists of a number of review articles covering different areas, written in English, and prepared by leading experts. The volumes already published include contributions by two Nobel Laureates and reflect the great advances that have been made in the past fifteen years, both in traditional areas of optics and in areas opened up by the development of the laser.

Recent volumes have dealt with such topics as: field correctors for astronomical telescopes, interferometric testing of smooth surfaces, quantum detection theory, coherence and statistical properties of light, self-focusing and self-induced transparency, modulation techniques in spectrometry, speckle patterns, optical waveguides, mode locking in gas lasers, imagery through the turbulent atmosphere, etc. From time to time, articles dealing with related fields such as X-ray structure determination and electron optics are also included.

Some Reviewers' Comments on Previous Volumes:

"This volume..... maintains the high quality that we have come to expect from this series..... The entire series forms a valuable reference set on the library shelf."

Laser Focus

"The reviews are written authoritatively and will certainly be welcomed by researchers in the respective fields."

Applied Physics

"The latest volume in this well-established series lives up to the traditions and high standards of the previous volumes..... It is this great diversity of topics which makes this series so valuable to all serious students of optics."

Optica Acta

CONTENTS: I. Theory of Optical Parametric Amplification and Oscillation. (W. Brunner and H. Paul). II. Optical Properties of Thin Metal Films (P. Rouard and A. Meessen). III. Projection-Type Holography (T. Okoshi). IV. Quasi-Optical Techniques of Radio Astronomy (T. W. Cole). V. Foundations of the Macroscopic Electromagnetic Theory of Dielectric Media (J. van Kranendonk and J. E. Sipe). Author Index. Subject Index. Cumulative Index - Volumes I - XV.

The Solid-Vacuum Interface IV

Proceedings of the Fourth International Symposium on Surface Physics, Eindhoven University of Technology, The Netherlands, 23-25 June, 1976.

edited by A. VAN OOSTROM and M. J. SPARNAAY, *Philips Research Laboratories, Eindhoven, The Netherlands.*

1977 viii + 530 pages

Price: US \$75.50/Dfl. 185.00

ISBN 0-7204-0711-7

The aim of this conference was to help improve our understanding of the influence of atomic and geometrical structure on the electronic properties, and the influence of structure and surface composition on the chemical reactivity of solid surfaces. Considerable attention was given to both new theoretical and new experimental results.

In their lectures, the six invited speakers demonstrated the importance of such understanding and the progress which has been made in this respect. In so doing, they cover a large part of the field of current activities in solid surface research. The complete texts of these lectures are included here.

Several of the 36 contributed papers selected for publication in this volume describe modern experimental surface analysis techniques in considerable detail. Such techniques include UPS, LELS, LEED and ISS. Two other important topics were the semiconductor surfaces of some group III-V compounds and the reactivity of metal surfaces.

The new results and findings presented in this book will be of great interest to research workers, particularly those concerned primarily with semiconductors and catalysis.

Invited Papers: Theoretical descriptions of surface state photoelectron spectroscopy (J. C. Phillips). On the correlation of geometrical structure and electronic properties at clean semiconductor surfaces (W. Mönch). Desorption methods as probes of kinetics and bonding at surfaces (T. E. Madey and J. T. Yates, Jr.). Electron spectroscopy applied to the study of reactivity at metal surfaces - a review (R. W. Joyner). Direct observation of individual atoms on metals (G. Ehrlich). Multiple ion scattering (A. L. Boers). Author index. Subject index.

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or

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The Netherlands

scientific institutions and in education, and a lack of trained technicians. He insists correctly that the basic problem is one of trained manpower; the problem of material means is not the essential problem. He gives some correct arguments on the brain-drain problem and especially on the lack of a critical elaboration regarding the problem of science development in an indifferent and sometimes even hostile environment. He criticizes correctly the international bureaucracies like UNESCO.

Moravcsik's errors and omissions, unfortunately, are also important. There are errors about the general scheme of science development, shortcomings regarding themes that are inadequately presented or not touched on at all and wrong views about the place of science and scientists in society, especially with respect to scientists' possible political role. There are even points in which the author falls into triviality and naiveté.

On the problem of science development itself, the author does not see that the emphasis on basic research, generally unrelated to any local needs, that prevails in underdeveloped countries is a result of cultural colonialism plus bad local tradition. Also, his viewpoint on science development is absolutely elitist. Moravcsik relies on the star system and thinks that an adequate science development could be implemented by good public relations, which are understood as devices for keeping good relations with the "politicians." This means that people such as the Argentine Nobel laureate Bernardo Houssay or Abdus Salam in Pakistan raise local morale, particularly that of the local scientists; therefore the organizations in charge of science planning should be formed by highly qualified scientists. If Pakistan spends ten times more on nuclear research than on research on textiles or fishing, it is because the scientists interested in these latter subjects do not have an outstanding spokesman like Salam. However it can be argued that Houssay, apart from his own contribution to science and the role he played in educating his students, played a deplorable role for the development of Argentine science when he was president of the National Research Council—in his servility to semi-Fascist rulers like General Onganía, and in his total lack of solidarity with his victimized colleagues. On the other hand, Sabato, who called himself "a third-rate physicist," played a very positive role.

Neither does it occur to Moravcsik that the problem of inadequate distribution of funds may result from a structural problem and may not have to do with public relations. There might be an implicit or explicit development model being followed in most underdeveloped countries, a model in which there is no place—or at least no important place—for the development of an autonomous scientific and

technological system. Also, Moravcsik assumes that one might develop a science policy restricted to "policy within science" while leaving outside the discussion "policy with science," or what to do with science. Varsavsky argued for the opposite point of view, namely that one had to start with a policy for the use of science and from this policy develop a "policy within science." The policy for the use of science has to be developed from a model of development for the country one wishes to construct. From this model, which implies essentially a political problem, one would have to define a policy for technology and a policy for science.

The most significant shortcoming of Moravcsik's work, in my opinion, lies in the fact that he sees science in a vacuum. If science develops in a vacuum, unrelated to real needs and not tied to a general development policy, which means a policy that would stop the waste of human and natural resources, then science will be of little use. For instance, whatever benefits Mexico might have from the development of science will be worse than neutralized if by the year 2000 Mexico City has a population of 25 or 30 million; whatever benefits the development of science produces in Nigeria might be more than offset by an irrational transportation system that produces losses of hundreds of millions of dollars each year, and so on.

Other shortcomings are the importance given to recognition by the international scientific community (that is, the scientific community of the advanced countries) and the lack of importance attached to recognition by the local society. Importance is given to the need to talk to politicians, while nowhere is it said that it is important to shape an informed public opinion or that politicians might misuse science for arms production while forgetting about important social needs—they have done so in advanced countries and are starting to do so in Argentina, Brazil and India. There is an implicit view that scientists should keep their mouths shut about human rights—which they need as much as the general population—in order to avoid alienating the politicians; this appears to me to be a doubtful proposition. An important event, the purge of Argentine scientists in 1966 and the subsequent expulsion of some of them from Chile in 1970 (under the Christian-Democratic government of Frei) under the ridiculous accusation of spying, is given just a few passing—and misleading—words. The situation of science in India is treated with groundless optimism, while in China scientists appear to live in terror of the hordes of Red Guards. Political activity in the universities is treated in a rather prejudiced way; Moravcsik does not take into account the real situation of universities and their place in society in less developed countries.

One could criticize other aspects, such

as the lack of any reference to the social sciences in spite of insistence on the need of science-policy studies, which are seen as arising in a vacuum. However Moravcsik's book has some good points, and it is the only book available in English on its important subject, which is still at an early stage of development. More work is needed by social and natural scientists from both advanced and underdeveloped countries.

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Smoke, Dust and Haze: Fundamentals of Aerosol Behavior

S. K. Friedlander
317 pp. Wiley-Interscience, New York, 1977.
\$16.95

All gas-phase suspensions of particulate matter are aerosols. Though aerosols are very common under both natural and artificial conditions, usually their systematic treatment is overlooked because they arise in essentially independent domains such as air pollution, combustion, inhalation toxicology, interstellar grains, industrial-effluent cleaning, planetary atmospheres, metallic-cluster catalysis research and so on. Indeed, the very term "aerosol" has been appropriated in such a way as to obscure its relationship with anything but atmospheric air-pollution concerns. Quickly, however, the reader of this excellent senior- or first-year-graduate-level text will recognize the catholic nature of the material treated.

Sheldon Friedlander of Caltech is probably America's pre-eminent investigator of aerosols, by virtue of his theoretical and experimental work conducted in a variety of areas since the 1950's. As we should expect from the author of any book, he presents the material in a framework that reflects his personal synthesis of the field. Friedlander places his greatest emphasis upon the essential fluid-dynamic component of aerosol behavior and on solutions of the aerosol evolution equations, areas in which he has made important contributions. Chapters concerned with these subjects go into some detail, and a student unaccustomed to the parlance of fluid dynamics may have some difficulty without the necessary background material (readily accessible to any senior in physics). Aerosol kinetic theory, nucleation and thermodynamics all are treated in a somewhat more elementary fashion and should be entirely accessible to seniors. Instrumentation for aerosol measurement is introduced in a general way; the discus-