larger monetary damages. Proponents of the jury, including social scientists, are committed to the normative order symbolized by the jury. This commitment colors their evaluation of the research.

The long-term future of the jury is uncertain. In this country, there is a constitutional right to trial by jury, but in the last two decades the composition and functioning of the American jury have been eroded. Elsewhere the jury is disappearing. Over four-fifths of all jury trials in the world are held here. Even in England, which gave us the jury, civil jury trials are virtually nonexistent and criminal jury trials are not commonplace. Thus, the ultimate question to be addressed in judging the jury is: If so many other democratic countries exist and thrive without the institution of the jury, why can we also not live without it or live with it in diminished form?

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Life of a Physicist

Kapitza. Life and Discoveries. F. B. KEDROV. Mir, Moscow, 1985 (U.S. distributor, Imported Publications, Chicago). 199 pp., illus. $6.95. Outstanding Soviet Scientists. Translated with revisions from the Russian edition (1979) by Mark Fradkin. John Crowfoot, Ed.

Peter Kapitza was known as much for his life and personality as for his physics, and in this rather chatty book Kedrov devotes more attention to the former than to the latter. The main chapters in Kapitza's life are covered here—his childhood and student years in St. Petersburg, his 13 years with Rutherford in Cambridge, his setting up of the Institute of Physical Problems in Moscow in the mid-1930's, his years of virtual house arrest after the war, and his later life as a grand old man of physics. Kedrov also describes briefly Kapitza's research in low-temperature physics and on controlled thermonuclear fusion. This book was first published in Russian some years before Kapitza's death in 1984, but it has since been brought up to date.

Kapitza was incapable of saying or writing anything uninteresting, and consequently this book, with its excerpts from his letters, reports of conversations with him, and anecdotes about him, makes for lively reading. It contains no great revelations, however. Kedrov does not mention that when Kapitza stayed in the Soviet Union in 1934 it was because he was prevented from leaving the country. Nor does he refer to Kapitza's courage in going to the Kremlin in 1938 and declaring that he would leave his new institute if Landau was not released from prison. Kapitza's threat worked, but it could just as well have resulted in Kapitza's arrest as in Landau's release.

Kapitza was dismissed from the directorship of his institute in 1946. Kedrov reports that a commission was appointed in 1946 to find defects in Kapitza's wartime work on the production of liquid oxygen, and it found them. The real reason for Kapitza's removal from the institute, however, was apparently his refusal to work on the Soviet atomic bomb project. Unfortunately Kedrov is not able to explore this issue. Still, he has the sense not to try to cover up those things he cannot write about.

This is a readable book and conveys some feeling for Kapitza and his eventful life. But it does not really do justice to the various stages of Kapitza's extraordinary career. Nor does it ask the interesting questions about his readjustment to Soviet life after the mid-1930's and his ability to function in that society as a prominent scientist with an independent mind and sometimes critical tongue.

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Electronic Structure Methods

Comparison of *Ab Initio* Quantum Chemistry with Experiment for Small Molecules. The State of the Art. RODNEY J. BARTLETT, Ed. Reidel, Dordrecht, 1985 (U.S. distributor, Kluwer, Hingham, MA). x, 513 pp., illus. $79. Based on a symposium, Philadelphia, Aug. 1984.

This volume takes its title from a symposium held two years ago at the national meeting of the American Chemical Society. The invited talks at this symposium (attended by the reviewer) nicely demonstrated the dynamic interplay between experiment and theory in modern chemical physics. Six of the invited speakers at the symposium have contributed papers to this volume. The remaining ten papers are for the most part by theorists engaged in accurate ab initio electronic structure calculations.

The first three papers deal with the properties of dimers and larger clusters of transition metal atoms. The paper by Weltner and Van Zee reviews the results of recent electron spin resonance studies of small transition metal clusters, and that of Walch and Bauschlicher emphasizes the role of *ab initio* electronic structure calculations in characterizing the bonding in the dimers. The latter will be of considerable value to researchers trying to understand the bonding in these species. Smalley's paper demonstrates the utility of supersonic cluster beams for studying the chemisorption and reactivity of H_2 and N_2 on transition metal clusters containing up to 30 atoms. These complex systems, which are beyond the capability of current *ab initio* methods, underscore the need for developing new approaches to the electronic structure problem in many-electron systems.

Other closely related papers are those of Peterson *et al.* and Dykstra and Lisy on the structure and bonding in "hydrogen-bonded" molecular dimers. The former authors focus primarily on the results of rotational and infrared microwave double-resonance spectroscopy, the latter on the application of high-quality electronic structure calculations coupled with vibrational analysis. The paper by Peterson *et al.* is particularly timely in that it summarizes the evidence that the ammonia dimer is not hydrogen-bonded.

Three of the papers deal with the properties of excited states of diatomic molecules. That by Werner and Rosmus provides a comprehensive review of the radiative properties of diatomic molecules and their ions, with emphasis on the results obtained with the multiconfiguration self-consistent field (MCSCF) and configuration interaction (CI) methods. Kurtz *et al.* demonstrate the utility of the antisymmetrized geminal power (AGP) wavefunction for the calculation of transition energies and moments. Bernheim *et al.* review the experimental and theoretical data available for the excited states of Li_2.

The papers by Dunning *et al.* and Truhlar *et al.* show the strong interplay between electronic structure theory and collision theory for predicting reaction mechanisms and rates. The former paper provides a good example of the role that theoretical methods now play in elucidating the dynamics of complex chemical reactions such as the oxidation of hydrocarbons. Bunker discusses the beautiful laser magnetic resonance studies carried out at Ottawa on the ground electronic state of CH_2 and also shows how these studies when coupled with theoretical calculations allow for an accurate determination of the structure and the energy separation between the lowest singlet and triplet electronic states of this molecule.

In other papers Ermler *et al.* present their results for the vibrational levels of H_2O as determined from *ab initio* potential energy surfaces, Langhoff *et al.* provide a comprehensive review of theoretical dissociation energies of ionic diatomic and triatomic molecules, Nakatsuji discusses the use of ab

initio methods for interpreting nuclear magnetic resonance spectra of transition metal complexes, Tripathi and Smith compare experimental and theoretical results for the cross sections for x-ray and high-energy electron scattering from molecules, and Monkhorst discusses the utility of the geminal method for going beyond the standard one-electron basis sets used in most quantum chemistry approaches.

The papers in this book illustrate the wide range of problems that can be tackled with modern electronic structure methods. They should be useful to physical chemists and others working in the areas of molecular spectroscopy, structure, and reactivity. The book should be particularly valuable as a source of supplemental readings in graduate-level quantum chemistry courses.

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Interstellar Matter

Molecular Astrophysics. State of the Art and Future Directions. G. H. F. DIERCKSEN, W. F. HUEBNER, and P. W. LANGHOFF, Eds. Reidel, Dordrecht, 1985 (U.S. distributor, Kluwer, Hingham, MA). xxiv, 744 pp., illus. $89. NATO Advanced Science Institutes Series C, vol. 157. From a workshop, Bad Windsheim, West Germany, July 1984.

In 1937 Dunham and Adams detected three absorption lines toward a star at optical wavelengths that were later identified as belonging to the CH radical and that provided the first evidence of an interstellar molecule. By 1940 two other molecules were identified optically, CH^+ and CN. Despite numerous suggestions concerning other potential molecules in interstellar space, it was not until 1963 that another molecule, OH, was reported with the discovery of absorption at centimeter radio wavelengths. Within five years ammonia, water, and formaldehyde had been detected with radio techniques at centimeter wavelengths. Millimeter-wave radio astronomy developed about 1970 and led to the rapid discovery of many molecules in the interstellar medium, and today over 60 have been discovered.

The importance of these molecules goes way beyond the novelty of their detection or the curiosity of their existence in the hostile environment of interstellar space. They are unique, and often the only, probes of the physical and chemical conditions in a wide variety of astronomical objects. The objects and processes they have been used to study include interstellar clouds in our Galaxy and in external galaxies, galactic structure, nucleosynthetic evolution in the Galaxy, protostars, circumstellar shells, star formation, stellar jets, comets, and astrophysical masers. Finally, through their absorption and emission of radiation, they can influence the thermal and ionization properties and the dynamical evolution of the objects in which they are found.

The study of astronomical objects through observations of molecules, or the modeling of the effects of the molecules on their environment, requires a detailed understanding of a wide variety of physical and chemical processes involving the reactions of molecules with radiation, atoms, and other molecules. In the low-temperature environment in which most molecules are found, optical studies have primarily been limited to absorption features. Such studies have therefore been restricted to those positions which happen to lie along a line of sight to a background star. The development of radio millimeter and submillimeter molecular astronomy has enormously expanded the studies of molecular clouds, galactic structure, and star formation because the molecules emit at radio wavelengths even at low temperatures. The radio telescopes can be used to map out the emission of the molecules and thus the structure of the entire object under study. Molecular processes and the observations of molecules in space are the subject of *Molecular Astrophysics: State of the Art and Future Directions*.

The book is divided into three parts, Astrophysical Observations and Models, Theoretical and Experimental Laboratory Studies, and Contributed Papers. The first two parts, which make up the bulk of the text, are a series of lectures by various investigators in different research areas. The first part could be used as an introduction to molecular processes in interstellar environments and the nature of molecular observations. It will be of particular value to graduate students and newcomers to the field. The longest lecture, by Rydbeck and Hjalmarson on radio observations, is one of the more interesting of its kind that I have read on this topic. The authors not only cover the history of the subject but explain many of the basic properties of molecules, molecular spectra, and their observational interpretation.

The second part of the book is much less general and requires a more specialized background on the part of the reader. It deals with laboratory and theoretical work on molecular spectra, ion-molecule reactions, photoprocesses, and collisional excitation. Here again, the general reader can learn much, although more effort is required. I found useful the lecture by Winnewisser *et al.* on spectroscopy and the discussion by Buck of rotational excitation in molecular beam experiments.

It is in the last section that the reader encounters examples of the state of the art in laboratory work. The highlight of this section is a pair of papers, by Rowe *et al.* and Böhringer and Arnold, discussing measurements of ion-molecule reactions at temperatures down to 8 K and 18 K, respectively. This development is crucial to understanding and modeling the chemistry of interstellar clouds, whose temperatures typically lie in the range 6 to 20 K. The authors found a number of reactions to have a temperature dependence in this range considerably different from that indicated by measurements above 80 K. For example, the reaction of the ammonia ion with molecular hydrogen is much larger at 8 K than at 100 K, which may be important for understanding the production of ammonia in interstellar clouds.

There are only a few contributions that do not live up to the high standards of the work as a whole, and even these contain useful discussions. A minor detraction from the volume is a small section on contributed oral papers consisting only of abstracts. I did not find these at all informative.

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Books Received

Alternatives to Animal Use in Research, Testing, and Education. Office of Technology Assessment, Washington, DC, 1986 (available from the Superintendent of Documents, Washington, DC). viii, 441 pp., illus. Paper, $16.

Beatrice (Hill) Tinsley, 1941–1981, Astronomer. A Tribute in Memory of an Outstanding Physicist. Scott Whineray, Ed. Massey University and New Zealand Institute of Physics Education Committee, Palmerston North, 1985. 97 pp., illus. Paper, $5.

Between Pacific Tides. Edward F. Ricketts, Jack Calvin, and Joel W. Hedgpeth. Revised by David W. Phillips. 5th ed. Stanford University Press, Stanford, CA, 1985. xviii, 652 pp., illus. $29.50.

Beyond Analytic Philosophy. Doing Justice to What We Know. Hao Wang. MIT Press, Cambridge, MA, 1986. xii, 275 pp. $17.50. A Bradford Book.

Biological Oxidation of Nitrogen in Organic Molecules. Chemistry, Toxicology and Pharmacology. John W. Gorrod and L. A. Damani, Eds. VCH, Deerfield Beach, FL, and Ellis Horwood, Chichester, England, 1985. 445 pp. illus. $58. Ellis Horwood Health Science Series.

The Body. Anthony Smith. 3rd ed. Viking, New York, 1985. xii, 548 pp. $25.

Chemotherapy of Parasitic Diseases. William C. Campbell and Robert S. Rew, Eds. Plenum, New York, 1986. xxviii, 655 pp., illus. $79.50.

Chromatography and Separation Chemistry. Advances and Developments. Satinder Ahuja, Ed. American Chemical Society, Washington, DC, 1986. viii, 304 pp., illus. $54.95. ACS Symposium Series, 297. Based on a symposium, Philadelphia, Aug. 1984.

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