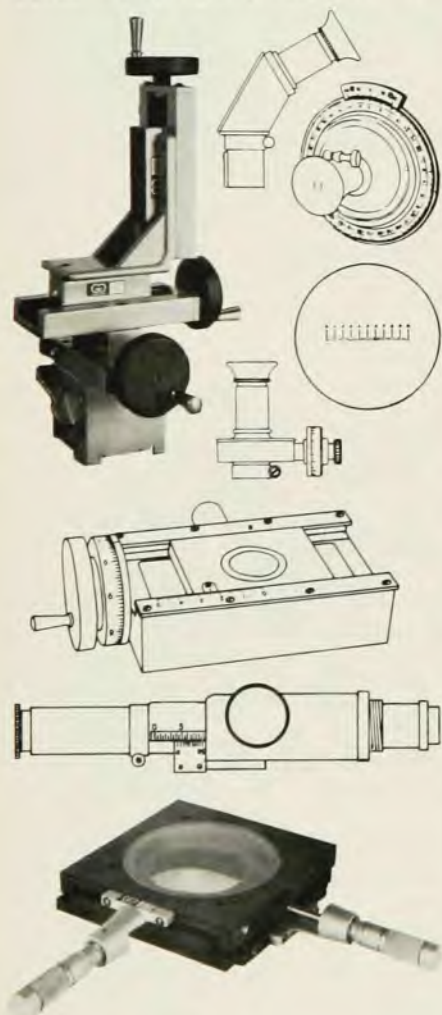


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cept indirectly to some extent by noting obvious omissions.

The central part of the book is the second entitled "The Theory of Atomic Spectra" containing roughly 200 pages. It begins with a chapter on angular momenta in which Racah methods are introduced followed by a chapter in which the methods are applied to operations that are sums of one- or two-electron operators, and in particular to spin-orbit and the Coulomb interaction between electrons. The usual LS , jj , and intermediate coupling schemes are discussed, but there is also a section on jl coupling, which is not discussed in Condon and Shortley, but is important for the inert gases and higher excited states of certain atoms.

Sobel'man's work suffers a peculiar consequence of the fact that he did not wish to introduce group theory in order to make the book intelligible to a wider circle of readers whose background consists of "knowledge to the extent of the ordinary university course of quantum mechanics." He chose to omit treatment of some of the more complicated configurations, such as those involving unfilled f shells, because group theory would have been necessary for explanations. The peculiar consequence is that not many new configurations beyond those in Condon and Shortley are treated in detail in the tables. These are essentially d^4 , d^5 , and d^6 . Of course all results are obtained with greater ease and generality using Racah methods.

Those whose interests are in rare-earth and actinide-ion spectra will of course not find much of what they need in this book because f^n configurations are not discussed. In fact I found no mention whatsoever of the research field of the spectra of ions in crystalline fields which involve transition elements (d^n configurations) as well as rare earths (f^n configurations). Although this field blossomed in the 1960's there was still a considerable amount of published work by 1961. The Stark effect is treated, however, but only out to quadrupole terms in the Hamiltonian (quadratic in the cartesian coordinates of electrons in the field). The higher-degree terms found necessary for crystalline fields are not presented.

The third chapter of the second part is concerned with the hyperfine structure of spectral lines and includes the usual nuclear magnetic dipole and electric quadrupole interactions with the atomic electrons but not the nuclear magnetic octapole. A nice feature is the discussion of isotope effects including both nuclear mass and volume effects. This is followed by a chapter on relativistic corrections.

The Zeeman and Stark effects are somewhat inappropriately included in

the third part, which is entitled "Excitation and Radiation of Atoms; Elementary Processes." This part is largely concerned with (a) interaction of atoms with an electromagnetic field including multipole radiation and the calculation of oscillator strengths (he also discusses electric dipole line strengths under various coupling schemes), (b) the broadening of spectral lines, a welcome inclusion of an important topic to all kinds of spectroscopy and only barely discussed in Condon and Shortley, and (c) collisional excitation of atoms, mostly by electrons. Collisional excitation is not usually found in a book on atomic spectra. Sobel'man's selection of topics in this chapter of the edition in English is based on topics he considers of interest to spectroscopists rather than to specialists in the theory of atomic collisions. Sobel'man has contributed to this field himself as well as to the theory of line widths.

On the whole this is a good book to have. Perhaps if an atomic spectroscopist were shipwrecked on a desert island with only one theory book, this might be the one most worth having. On a desert island one would not mind the lack of adequate referencing. It would be even more useful if it had a list of the 128 tables and 84 figures and if the author had been more complete in citing references. Tables of experimental results, for example, rarely state the origin of the information, so there is no easy way to check into it or even to find out how recent it is. If one is in the market for a text such as this, one will have to decide between this one and J. C. Slater's *Quantum Theory of Atomic Structure*, volumes 1 and 2, which is of the same vintage.

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Aeronomy

P. M. Banks, G. Kockarts

2 parts: 430 pp.; 355 pp. Academic,
New York, 1973. Part A, \$28.00; Part
B, \$24.00

Many readers of PHYSICS TODAY may not know what is meant by "aeronomy." To quote the authors of this two-volume survey, both distinguished theoretical aeronomers, "Aeronomy is the scientific discipline devoted to the study of the composition, movement, and thermal balance of planetary atmospheres." Phenomena studied by aeronomers include atmospheric photochemistry (the ionosphere and the ozone layer, for example), auroras and airglow, and the densities, temperatures and winds in the upper atmosphere.

Our understanding of the physics and chemistry of the upper atmosphere has increased enormously in recent decades as techniques have been developed to measure atmospheric properties directly, using sounding rockets, balloons and satellites, and remotely by radio and optical means. In addition to rapid progress, the field offers its devotees unusual diversity, with opportunities to work on problems of plasma physics, atomic and molecular collision processes, spectroscopy, fluid dynamics and reaction kinetics.

Very few aeronomers have taken time off from their research to write books in the field, and I know of only one other volume that undertakes a survey of most of aeronomy. This is *Fundamentals of Aeronomy*, by R. C. Whitten and I. G. Poppoff. In my opinion, P. M. Banks and G. Kockarts have provided a book that will be of greater value to the practising aeronomer. Whitten and Poppoff, however, have written a better textbook.

Banks and Kockarts have provided a thorough and consistent treatment of most of terrestrial aeronomy (the other planets are not treated). Rather than simply reproducing results from the literature, they have made an unusual effort to use the same data for calculations throughout the book. The result is a comprehensive compilation of mutually consistent data and computational results that is unique and very valuable.

Unfortunately, the index is inadequate, and some of the nuggets are quite hard to find. The text is no pleasure to read. Too much is lacking in the way of explanation and definition for the book to be useful to students. On the other hand, readers familiar with the material are likely to be bored. As a review of the literature the book fails also, but it was not intended to be a review.

I therefore recommend this book highly to those active in the field as a compilation of up-to-date information that is not available in any other source.

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Propagators in Quantum Chemistry

J. Linderberg, Y. Öhrn
147 pp. Academic, London, 1973. £3.50

Jan Linderberg and Yngve Öhrn, both well known theoreticians, present in this relatively small book *Propagators in Quantum Chemistry* an amazing amount of information about the possible use of propagator techniques in

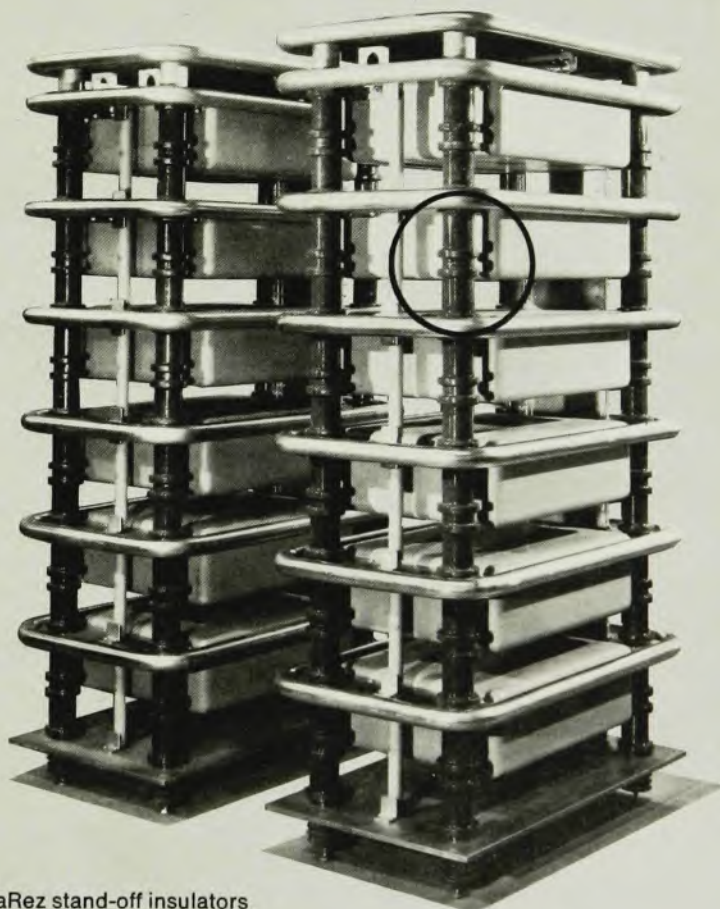
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