

results for the mercury isotopes. In this light the brevity of section 5 seems most unfortunate.

The discussion on charge radii concludes with a section on experimental results. Here the reader looks forward to some insights into the value and limitations of the different analyses performed on the various data. This section contains a lot of extremely valuable information on the inherent assumptions made in different approaches. However, it stops short of making any comparative evaluation of the different analysis techniques; the reader is left feeling disappointed at having no guidelines as to the reliability of the various data available.

The determination of neutron distributions presents a much greater challenge than was the case for charge radii and is inexorably coupled with strong-interaction mechanisms. This presents difficulties to the writer and, in the present volume, results in a somewhat unbalanced presentation. Much of the space in the sections on neutron radii is devoted to discussion of purely nuclear problems that, although they involve neutron (and proton) distributions, are not sufficiently well understood to yield any useful information about nuclear radii. Nevertheless accounts of nuclear processes that we believe are sufficiently simple to yield some information on neutron sizes (such as elastic scattering, analogue states and stripping reactions) are given comprehensive coverage. The section on hadronic atoms is concise and well presented.

As was the case for charge distributions, the discussion of neutron distributions concludes with a section on the various experimental results. This section is well presented and should prove extremely valuable to the reader. However, it also avoids making a critical comparison of various results.

Despite its shortcomings, this book is a very useful contribution to the literature on nuclear-size effects and should prove valuable to research workers interested in the subject. It will be particularly valuable to graduate students starting work in the area. The book is remarkable in the completeness of its bibliography.

It is doubtful if any reviewer could resist a comment on the printing of this book. A copying process of typescript has been used resulting in a volume that is no better than a well produced preprint, progress report or PhD thesis. This detracts greatly from the book's appeal and should be unnecessary with a price tag of \$39.50.

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developing high-resolution laser techniques to study nuclear radii of radioactive species by measuring the optical isotope shifts.

Physical Processes in the Interstellar Medium

L. Spitzer, Jr.
318 pp. Wiley-Interscience, New York,
1978. \$15.95

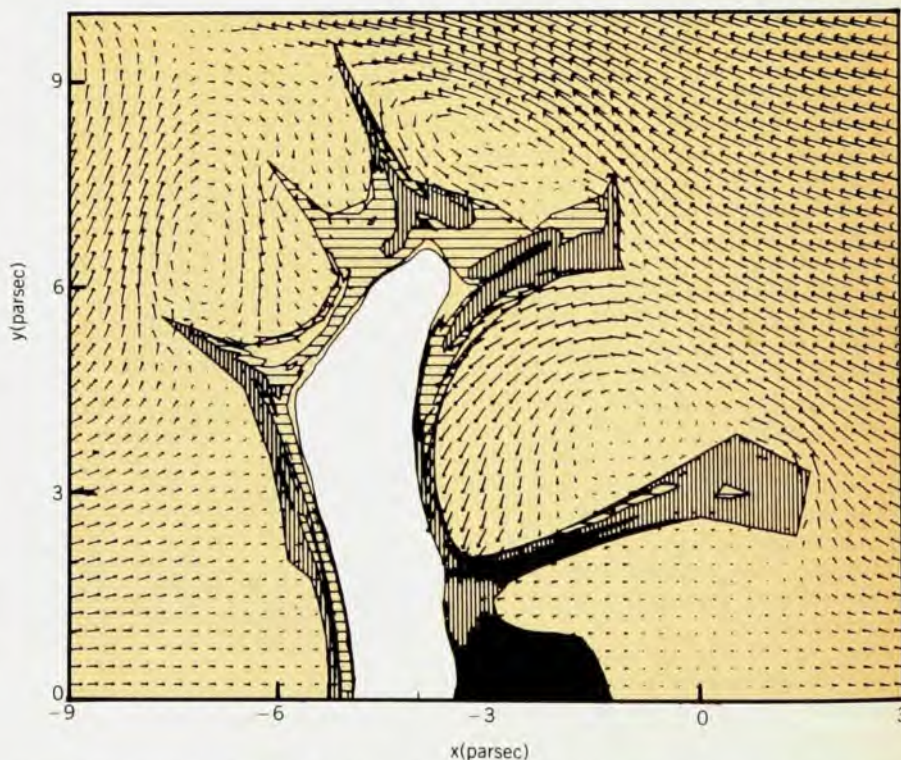
For the past ten years, the leading reference book on the interstellar medium has been Lyman Spitzer's *Diffuse Matter in Space*. Since 1968 our knowledge of interstellar regions has greatly increased, and in his position as leader of the Princeton experiment to perform absorption-line studies with a high-resolution ultraviolet spectrometer on the *Copernicus* satellite, Spitzer has contributed personally to many of the recent discoveries. His new book will probably serve as the definitive reference for interstellar work for some time to come.

Physical Processes in the Interstellar Medium is appropriately named because most of the text is devoted to explaining the physics of the interstellar medium rather than to giving a comprehensive description of current studies. For example, the formation of emission lines from interstellar molecules is considered, but no effort has been made to describe all

the molecules that have been observed or to explain the more elaborate models for radiative transfer now being applied to molecular clouds. Readers should expect insights rather than detailed expositions of current topics.

The first portion of the book describes the microphysics of the interstellar gas. While much of this discussion is an elaboration of portions of *Diffuse Matter in Space*, such as the section on the curve-of-growth, new topics are introduced. As might be expected, Spitzer discusses in some detail the formation, destruction and excitation of H_2 . He also outlines models for other molecules besides H_2 , and he even briefly describes interstellar masers and the anti-inversion of H_2CO .

The middle portion of this book describes interstellar grains. Besides the discussion of topics such as extinction that have been taken from *Diffuse Matter in Space*, Spitzer describes new results, such as how the *Copernicus* observations of the relative gas phase depletions of different elements constrain models for the solid grains. Although infrared astronomy is not discussed at great length, topics such as the ice and silicate features and the radiation from HII regions are given some mention. The final portion of the book describes the macrophysics of the interstellar medium. New material includes such topics as spiral-arm shock waves and accretion. As in *Diffuse Matter in Space*, a final section is devoted



H I cloud compressed by a passing shock. The shaded areas of this map represent density contours of 20, 40, 100 and 200 hydrogen atoms cm^{-3} at a time 5.9×10^6 years after the shock first reaches the cloud, initially a uniform sphere of radius 15 parsecs, centered at $x = y = 0$. Arrows represent the direction and magnitude of the velocity relative to the gas in front of the shock. Rotational symmetry about the x axis is assumed throughout. (From P. R. Woodward, *Astrophysical Journal*, 207, 484 (1976); reprinted in Lyman Spitzer Jr's book reviewed on this page.)

to star formation, but this particular discussion has not shown any great advance over the treatment of ten years ago.

Diffuse Matter in Space contained many statements which, though somewhat speculative at the time, have proven to be very insightful. For example, in 1968 Spitzer wrote with regard to the amount of interstellar molecular hydrogen, "In a relatively dense cloud . . . the radiation in the Lyman bands of H_2 may be entirely absorbed, dissociation may be absent, and an appreciable fraction of the hydrogen may be molecular." Observations have verified this suggestion, and I imagine that readers of *Physical Processes in the Interstellar Medium* will find other, similarly stimulating, ideas. Astronomers interested in either the interstellar medium or related fields will wish to give this book careful study.

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Molecular Symmetry and Group Theory

A. Vincent
156 pp. Wiley, New York, 1977. \$13.50
clothbound, \$5.95 paperbound

This small book offers a programmed self-study on applying elementary group theory to simple problems involving the symmetry, bond structure and vibrations of molecules. It aims at chemistry and physics undergraduates who might gain from using these techniques before being ready to tackle symmetry, groups and representations as part of a formal theory. The emphasis is on learning to use this mathematical tool, rather than on proving its theorems.

There is a definite need for such a book. Every teacher knows how time-consuming the initial transfer of language and of the conceptual short-cut thinking in this field can be. After much drawing of pictures and handwaving, students are usually advised to go through enough examples on their own as the only way to really come to grips with the subject. A good self-study program would be ideal in easing their way.

In this spirit, Alan Vincent, a chemistry teacher at Kingston Polytechnic in England, has put together seven programs. The first five establish the vocabulary and concepts in terms of concrete examples, leading up to Cartesian representations of molecules and their character analysis. The last two apply this analysis to problems in chemical bonding and in molecular vibrations. The only prerequisite is some modern elementary chemistry.

On the whole, the text fulfills its aim. The logic of the step-by-step advance of

each program is good. Each step both advances and draws on past material to build a body of rules and knowledge. A test and a review (called "revision" in the British usage of this book) at the end of each program are a fair summary of the competence expected. Vincent reports good success of the text with English students.

As in using any self-study text, the reader here must be very alert to typos, ambiguities in symbols or equations, and looseness in language. I found some of each (pages 35 and 36 are fully interchanged in my copy!), but with a little

backtracking the proper corrections can be inserted without loss of continuity. I found two other practical shortcomings. With the character tables permanently bound into the book, working each program requires endless page shuffling. A separately available table in a backpocket, such as in F. A. Cotton's *Chemical Applications of Group Theory* (1971)—issued by the same publisher and using the exact same set of tables—would have been very desirable. Secondly, the index of a self-study book must be sufficiently comprehensive to allow a reader to back-track or refresh a memory without much

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