scribes the quality of the lives of these men and women. Her conclusions that the wives' achievements outside of family roles are far less than those of their husbands, precisely because of the heavy demands of wife and motherhood, seem valid in the case of the women who were prepared by education and experience equivalent to the men at the time they joined their lives in matrimony. However, when she concludes as well that the descriptions therefore demonstrate that the husbands could not have been successful without the contributions of the wives, the familiar argument does not stem from her data. That is, she does not compare the achievements of these men and any other men; the men in this study might well have been as successful as they are with other kinds of wives or as unmarried men or living with roommates or with their mothers and fathers.

There are a few other flaws in the book. Though the author describes her approach as qualitative, she does not provide the interview schedules or the questionnaires she used. And, though she does point out that the women the doctors married were different in various ways from the ones the professors married—the latter had more education and were more likely to be working at the time they met their husbands—she does not consider that the greater participation of the academic husbands in the work of household and childrearing may be related to the fact that 15 of the academic wives are employed more than six hours a week (including two who run small farms), as compared to three of the doctors' wives.

All in all, however, the book should be of some interest to specialists in the fields of women's studies, women and work, occupations and professions, and family life. Social scientists interested in social stratification will find it of interest for the details of differences in life-styles of families who would be ranked equally on the usual stratification measures. The student of social change will find descriptions of the differences in the attitudes and activities of older and younger wives scattered throughout the work.

In sum, though the book reaches no startling conclusions, it is gracefully written and provides some interesting insights into and commentary on the importance of the way we earn our livings for the way we live our lives.

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## Atomic Collisions

**Electron-Molecule Scattering.** Papers from a symposium, New Haven, Conn., Oct. 1977. SANBORN C. BROWN, Ed. Wiley-Interscience, New York, 1980. xvi, 196 pp., illus. $22.95. Wiley Series in Plasma Physics.

This is a delightful collection of papers from authors who possess a wide variety of skills, writing styles, and research philosophies.

A paper by Schulz on vibrational excitation of molecules demonstrates how experimenters and theorists have worked together in the development and testing of simple models through which we now understand many of the qualitative features of low-energy inelastic collisions between electrons and small molecules. This progress has required great improvements in the precision of measurements, the sensitivity of detectors, and the amount of detailed information that can be gathered and analyzed. The current status of laboratory experiments is assessed by Linder, who gives examples of recent studies of many different collision processes. In a complementary discussion of theory, Lane summarizes some of the more significant methods and describes some applications for which comparison between theory and experiment is possible.

A paper by Biondi on atomic processes in planetary atmospheres is biographical in nature and shows how laboratory experiments, ionospheric observations, and theoretical modeling have increased our knowledge of the properties of the upper atmosphere. The history of the study of dissociative recombination is of special interest. This process, in which an electron collides with a molecular positive ion to form an unstable molecule that dissociates into neutral fragments, was postulated to explain the rapid decay of ionization in the ionosphere at sunset and during solar eclipses and in many laboratory plasmas. The new experimental methods designed for the investigation of this process have not only clearly established its importance in controlling the charge density in many ionized gases but have also been adapted to provide valuable diagnostic techniques for atmospheric analysis.

The need for atomic collision data is not confined to ionospheric studies, and Phelps provides an introduction to several other applied fields in which atomic processes are important. There is room in this chapter for only a brief indication of the significance of electron-molecule collisions for gas lasers, energy generation, gaseous electronics, and air quality control.

It is obvious from the five main chapters of the book that much progress has been made in the last 20 years in this branch of atomic collision studies. However, in the postscript to the volume. Massey points out that our knowledge is far from complete and that there is much more work to be done.

There are several other collections of review papers that present more detailed descriptions of current techniques in atomic collision physics and others that cover particular applications of atomic physics in greater depth, but I know of no volume that I would recommend more highly for a balanced overview of research in electron-molecule collisions.

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## Observational Cosmology

**Objects of High Redshift.** Papers from a symposium, Los Angeles, Aug. 1979. G. O. ABELL and P. J. E. PEEBLES, Eds. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). xvi, 340 pp., illus. Cloth, $42; paper, $21. International Astronomical Union Symposium No. 92.

Few subjects are more fascinating than the study of the whole universe, and few symposium volumes are more interesting than this book. It contains the papers presented at an International Astronomical Union symposium on distant galaxies and quasars and the microwave background generally regarded as the remnant radiation from the "big bang."

Some of the most interesting papers deal with the counts of faint galaxies on long-exposure plates obtained with large telescopes. A paper by I. D. Karachentsev is one of the few reports in the Western literature on actual research results from the 6-meter telescope of the Special Astrophysical observatory in the U.S.S.R. Using an electronographic camera from the United Kingdom, Karachentsev obtained films in three colors and was able to count galaxies down to magnitude $B = 25$ and with less accuracy to the fainter limit $B = 26.2$, although stars and galaxies could be distinguished reliably only to $B = 23$. At magnitudes fainter than this, it was safe to assume that nearly every object was a galaxy, not a star. Like J. A. Tyson and J. F. Jarvis, who made counts of galaxies on fine-

grain photographic plates obtained with the Kitt Peak 4-meter telescope, and R. G. Kron, who discusses briefly his counts as a function of color on similar plates, Karachentsev found significant differences between the observational data and the results expected on the basis of the simplest physical models. The galaxy counts clearly contain information about the universe long ago, when the light left the distant galaxies. But the numbers per unit magnitude result from a complicated interplay of galaxy formation rates, luminosity functions, and evolution, and the interpretation of observed counts is by no means single-valued. More information, particularly spectra of individual faint galaxies, will be necessary to distinguish between possible alternative models. Nevertheless, the deep photographs provide tantalizing glimpses out into the unknown.

The objects with the largest observed redshifts we know are the quasars and QSO's, names used interchangeably for quasistellar objects, whether they are radio-loud or radio-quiet, by most of the authors in this volume. In order to study them, and in particular to test whether the apparent cutoff at redshift $z = 3.5$ is real, it is necessary to find faint quasars. P. S. Osmer gives a good review of results already achieved by spectral surveys with objective prisms and "grisms" and of the limits that can be reached by these methods.

In arguing that there is an almost overwhelming case for the reality of noncosmological redshifts in quasars, G. Burbidge hints darkly that others who favor his view have not been invited to speak at the symposium and closes with the declaration that a revolution is upon us whether we like it or not. In the papers immediately before and after his, A. Stockton and R. J. Weymann present observational data that strongly favor the interpretation that the quasars they are studying spectroscopically do have cosmological redshifts.

This is a selection of the papers I found most interesting, not including the several on galaxy and QSO spectroscopy by University of California authors, which I will let the reader discover for himself or herself. The entire wavelength range is covered in the book, together with many theoretical interpretations and speculations. It is a stimulating, interesting, informative volume that I strongly recommend to every student of the universe.

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## Books Received

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