Collisions

Atomic and Molecular Collisions. HARRIE MASSEY. Taylor and Francis, London, and Halsted (Wiley), New York, 1979. xviii, 310 pp., illus. $34.95.

The study of collisions involving electrons, atoms, molecules, and photons was initiated around 1900 and has proceeded fitfully since then. During the last 15 years, activity in the field has grown tremendously, owing to the development of new techniques for both experimental and theoretical work, the influx of many young researchers, and the demand for collision data by scientists and engineers in related fields, such as astrophysics, plasma physics, aeronomy, and laser development.

Sir Harrie Massey was a pioneer in an earlier expansion phase (around 1930) in which some of the qualitative effects of quantum mechanics were elucidated and the bases for accurate measurements and calculations were formed. Since then he has played many roles in the development of the subject, but he is perhaps best known for his textbooks.

In this book Massey provides a survey of the field that should be suitable for senior undergraduates, graduate students contemplating research in atomic collisions, and scientists in other fields who wish to obtain an overview of this field. Although the preface suggests that the book could be read with profit by a first-year undergraduate, it is doubtful whether many such students outside Britain would be able to work through the book.

The first four chapters of the book contain an outline of the basic physics of particles and waves, employing both classical and quantum descriptions, and of atomic and molecular structure. These chapters should be most useful in reinforcing knowledge obtained elsewhere by the reader, and they introduce several topics that are not discussed in most introductory courses or textbooks but are particularly important in current research.

The major portion of the book is devoted to descriptions of the most important types of atomic collision processes and the techniques by which the cross sections or reaction rates can be calculated or measured. On the theoretical side, detailed mathematical analysis is avoided but the essential features of the classical and quantum theories are explained and contrasted. Particular attention is given to those processes for which simple models have been developed to give a semiquantitative understanding of the relationship between observed cross sections and the fundamental interactions. For example, Massey shows how classical theories can be used in the description of orbiting effects whereas semiclassical versions of quantum mechanics are needed in the analysis of rainbow scattering and fully quantal treatments are required in understanding the Ramsauer-Townsend effect, resonant scattering, and the effects of the indistinguishability of identical nuclei in symmetric atom-atom collisions.

The book contains detailed descriptions of some of the pioneering experiments in the field and of recent experiments that make full use of modern techniques in electronics and optics. Typical results are shown in order to illustrate the great amount of detailed information that can now be gathered and to demonstrate the degree of agreement, or disagreement, between theory and experiment. The examples chosen for the book show the versatility that is needed in studying the various different aspects of a single collision process. There are also several useful discussions of the mathematical analysis that is required in the deduction of basic data from complex experiments and of some of the pitfalls that can lead to spurious results.

In the final chapter some of the effects of atomic collisions in the earth's atmosphere, the solar corona, and interstellar space are described. Other applications of atomic physics, such as in the development of gas lasers and the detection of pesticides, are discussed parenthetically elsewhere in the book.

The book contains no problems and no references. Its strength lies in the breadth of coverage and the insight that the author brings to the subject. It gives an excellent introduction to the field and should be required reading for students at universities that do not provide graduate courses in atomic collisions.

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Exemplars of Engineering

Robert Maillart's Bridges. The Art of Engineering. DAVID P. BILLINGTON. Princeton University Press, Princeton, N.J., 1979. xvi, 148 pp., illus. $17.50.

The Britannia Bridge. The Generation and Diffusion of Technological Knowledge. NATHAN ROSENBERG and WALTER G. VINCENTI. MIT Press, Cambridge, Mass., 1978. x, 108 pp., illus., + map. $12.50. Society for the History of Technology Monograph Series, No. 10.

Arch Bridges and Their Builders, 1735–1835. TED RUDDOCK. Cambridge University Press, New York, 1979. xiv, 254 pp., illus. $67.50.

Bridges hold a compelling interest for historians of technology and for many practicing engineers and architects because their function is simply to carry loads, unencumbered by other demands such as one finds in buildings. In this sense they are pure structure and provide an unequaled opportunity to examine the historical development of design, construction, and analytical methods. They are, even so, much more than engineering works, because they often represent the result of great social enterprise and hence reflect societal values and because, as an art form, they epitomize concern for esthetic expression. Thus, bridges have come to have not just a physical meaning but a metaphysical and even mystical symbolism.

The three books being reviewed each deal exclusively with bridges, but each deals with the subject in quite a different way.

Billington's *Robert Maillart's Bridges* is the result of the author's sustained interest in the life and works of Maillart and also of a broader concern, of which he has become the leading exponent, with the relationship between art and engineering on the one hand and the role of analysis in the creative process of design on the other. In a remarkable way Billington has brought these concerns to bear in this book. What was intended originally to be a comprehensive biography of Maillart, a Swiss pioneer in reinforced concrete design, was redirected to become a consideration of the bridges erected by Maillart from 1896 to 1940.

Maillart was graduated from the Swiss Federal Institute, one of Europe's leading engineering centers, in 1894, just at the time when reinforced concrete was beginning to find widespread application in both bridges and buildings. Maillart was to devote his career to perfecting techniques and a design philosophy for this one structural material.

In dealing with new structural materi-