Two minds on the solid surface £28

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Modern Techniques of Surface Science. By D. P. Woodruff and T. A. Delchar. *Cambridge University Press: 1986. Pp. 453. £50, $89.50.*

STUDY of solid surfaces has a prominent place in a wide range of fields — heterogeneous catalysis, metallurgy, materials science and semiconductor processing, for example. Over the past 20 years such research has grown enormously, stimulated by the availability of ultra-high vacua (of about 10^{-10} torr) which have made it possible to prepare and maintain atomically clean surfaces and to investigate their structure, composition and properties.

There are now a large number of techniques for surface studies, and the aim of Woodruff and Delchar's book is to present the physical principles, strengths and limitations of each so that researchers can choose which of them, alone or in combination, will be most appropriate to their needs. In addition, recent trends in applications are discussed, giving the reader a feel for the general progress in the area concerned and its contribution to other fields.

Most of the techniques described are useful primarily in the study of well-defined, single-crystal specimens which are prepared and characterized within ultra-high vacua. For this reason, the book is addressed to those whose main interest is in fundamental surface science. Those working in applied fields will, however, also find it useful because it deals with the underlying principles on which all surface analytical techniques are based.

The book is arranged into nine chapters, the first of which briefy reviews the need for an ultra-high vacuum, the preparation of clean surfaces and the analytical methods which follow. Chapter 2 deals with surface crystallography and electron diffraction. It begins with the nomenclature used to specify surface structures, and moves on to accounts of the fundamentals of electron diffraction and (in more detail) the techniques of LEED (low energy electron diffraction). The mathematical formalisms for the extraction of surface structural information from experimental LEED patterns are introduced, and there is a succinct discussion of RHEED (reflection high energy electron diffraction).

Chapter 3 covers electron spectroscopic methods, with clear summaries of the similarities and differences between them and of the phenomena on which they are based. Chapter 4 describes techniques depending upon the interaction of ions with surfaces, and Chapter 5 those methods based on the desorption of adsorbed surface species. Field emission and field ionization at metal surfaces are covered next, together with the associated techniques, and then (in Chapter 7) methods for measuring the surface work function and its relevance to adsorption systems. The penultimate chapter introduces the methods based on the interaction of atomic and molecular beams with surfaces, and the authors conclude with a presentation of the techniques which are used to determine the vibrational spectra of molecules adsorbed on surfaces.

The book is intended for senior undergraduates or graduates in physics or chemistry. One shortcoming for this audience is that there are no sample problems to test the reader's understanding. Suggestions for further reading appear at the end of each chapter, however, while the figures are many and have been well chosen.

Modern Techniques of Surface Science covers all of the important techniques in current use, and is helpfully different from most of the other introductory texts on the subject in its emphasis on theory rather than applications. Further, the book is characterized by the continuity that stems from there being only two authors, and in this respect it is markedly better than similar, multi-author works. □

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All about Isaac

A. Rupert Hall £26

The Newton Handbook. By Derek Gjertsen. *Routledge & Kegan Paul: 1986. Pp.665. £25. The publisher is unable to say whether or not this book is available in the United States.*

TO THE making of books on Newton there is no end. But Mr Gjertsen's alphabetically arranged handbook is one of the most original in plan and not the least useful in execution. It is neither bibliography nor biography, neither exposition nor criticism, yet it contains elements of all of these and offers not only a view of Newton but of newtonianism. Mr Gjertsen will tell you what Alfred Noyes (and George Bernard Shaw) wrote about Newton; whether Newton was chaste or not, and his niece too; how many portraits of Newton were painted, and what fluxions or Leucatello's balsam are. I am only sorry that he has no separate alphabetical entry — there are some 550 in all — for *Ballistics*, or *Diana's Doves* or *Malebranche*.

Aficionados may easily develop the devising of yet more headings into a parlour game. *Diamond* is there ("One of the most often repeated anecdotes about Newton...") but not the story of Newton and his cats. *Apples and Apple Trees* do earn a heading: sadly, the most famous apple since Eve's, a Flower of Kent, is described as flavourless (and it is not bright red). Most of the things one needs to know about Newton's life and writings are to be found in the book, neatly compressed, and I for one mean to have this useful work of reference always to hand.

Mr Gjertsen has thoroughly worked through the extensive newtonian editions, books and articles of recent years and includes notes on the more notable authors of them. He has also made good use of the invaluable bibliography by Peter and Ruth Wallis. He is therefore up-to-date in analysis and interpretation, and is well informed about the manuscript sources from which so much has been harvested.

Inevitably, because of the vast amount of material to be sifted, summarized and arranged there are errors. The presentation of mathematics is not invariably happy (examples pp.150–151 and 214–215); it is misleading (p.215) to omit the late date (early 1690s) of Newton's dot notation for fluxions, correctly noted on p.338. Less seriously, the ownership of a ton and a half of gold and a quantity of silver appears to be attributed to Newton at absurd valuations (p.277): what is at stake is the Mint Master's percentage on these weights of precious metal. Sometimes proper names, such as those of Michael Sendivogius and Valentine Greatrakes are improperly rendered; and to write of "Classical physicists..." (p.269), when Greek philosophers are meant, provokes a shudder. The treatment in various places of newtonian matter-theory is curiously inadequate and Stephen Hales is wholly omitted. The reprints of Hessen's notorious essay on the economic interpretation of the *Principia* (1931) might have been recorded.

One could go on, but though mistakes of this sort suggest that cross-checking to the original sources is prudent, they do not seriously weaken one's sense that Mr Gjertsen is a well-informed and trustworthy cicerone to the complexities of newtonian scholarship. I have found his summaries of the present state of scholarly thinking accurate and on the whole consistent. With a little patience (as regards topics, the index could be richer) the reader can find his way into any theme, and discover the primary and secondary sources bearing upon it. More one cannot ask. □

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