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978-0-521-18079-5 - The Physics of Metals, 1. Electrons

Edited by J. M. Ziman

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PHYSICS OF METALS

1. ELECTRONS

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J. M. ZIMAN



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PREFACE

By convention a *Festschrift* is a collection of pretty 'essays' by a miscellany of scholars, presented to an older and greater scholar at some significant milestone of his life. The present work conforms to this convention only in that it was conceived as a tribute to Professor Sir Nevill Mott upon the occasion of his 60th birthday.

The prime intention was to write a modern version of 'Mott and Jones'—a comprehensive and up-to-date account of the Theory of Metals and Alloys. But much has been discovered in 30 years, and this would have stretched to many thousands of pages. We therefore decided to concentrate on the two major topics where our interests mainly lie—the electronic structure and electrical properties of metals, on the one hand, and the mechanical properties of solids on the other. In the end, each topic grew and diverged into a separate book.

The present volume is, therefore, an account of current understanding of the electron theory of metals, with particular reference to band structure, Fermi surfaces and transport properties. Although each chapter is quite long, and deals explicitly and in detail with a separate topic, considerable unity of approach has been achieved by interchange of manuscripts and many cross-references between chapters. For the authors are by no means a miscellaneous lot; at one time or another they have all been professional colleagues of Mott at Bristol or at Cambridge, and therefore share with him, and with one another, many scientific interests and points of view. We had no difficulty in agreeing upon a general plan for the book and writing our separate contributions in a co-operative spirit.

Since there exist many excellent elementary books, there seemed little point in trudging once more over the familiar ground of Bloch states, Brillouin zones, Debye temperatures, Burgers vectors, etc., before reaching the line of battle. This book is intended for research workers and advanced students who have already mastered Mott & Jones (1936), or more recent works such as those of Peierls (1955), Wannier (1959) or Ziman (1964*a*). On the other hand, the emphasis (as in so much of Mott's own work), is on the *physics* of situations rather than on elaborate mathematical devices, so that no great knowledge of the subtleties of advanced quantum theory is required of the reader.

In a genuine 'monograph' the author always has difficulty in

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deciding what topics to include; in a collaborative work this problem often settles itself, not very satisfactorily, by default. We tried, for example, to write on all aspects of the study of the Fermi surface, but in the end have said very little about magneto-acoustic phenomena; again, on the vast topic of superconductivity, which ought to come within our title, we are all silent.

But rather than attempting a vague review of the 'state of the art' over a wide field, perhaps it is more useful to give a coherent, detailed account of a limited range of topics, building solid foundations of well-established knowledge as a basis for further progress. In the end, each contributor apologized for the length of his chapter, as if surprised at the amount of learning which he had acquired and was able to impart, on his chosen topic.

The length and solidity of the contributions helps explain the long delay between the conception of the work and its final publication. It is unfortunate in a ceremonial sense that the book will appear only just after Mott's 63rd birthday; but as a scholarly treatise it may well have benefited by this leisurely growth. It is regrettable that several chapters, being completed earlier than others, may not be totally contemporary in their references to recent work—but this is a trivial defect in such authoritative writings.

Despite their labours, the authors of these two volumes will not receive any royalties, which will all be paid over into a trust fund to encourage study and expertise in foreign languages amongst professional scientists. This arrangement, which was suggested by Mott himself, corresponds most felicitously with his own interest in languages and with the wide international circle of his friendships.

It is our duty to record grateful acknowledgement to authors and publishers who have given permission for the reproduction of various diagrams in this book. It is an especial pleasure to say how much we are indebted to Dr Michael Berry, of the University of Bristol, who has undertaken the considerable and responsible task of collating the manuscripts, inserting cross-references, preparing the bibliography and subject index, and generally seeing the book through the press.

J. M. Z.

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SIR NEVILL MOTT

MOTT, *Sir Nevill (Francis)*, Kt. 1962; F.R.S. 1936; M.A. Cantab.; Cavendish Professor of Experimental Physics, since 1954; b. 30 Sept. 1905; s. of C. F. Mott, late Dir. of Educn., Liverpool, and Lilian Mary Reynolds; m. 1930, Ruth Horder; two d. Educ.: Clifton College; St John's College Cambridge. Lecturer at Manchester University, 1929–30; Fellow and Lecturer, Gonville and Caius College, Cambridge, 1930–33; Melville Wills Professor of Theoretical Physics in the University of Bristol, 1933–48; Henry Overton Wills Professor and Director of the Henry Herbert Wills Physical Laboratories, University of Bristol, 1948–54. Master of Gonville and Caius College, University of Cambridge, 1959–66. Hughes Medal of Roy. Soc., 1941, Royal Medal, 1953; corr. mem., Amer. Acad. of Arts and Sciences, 1954; President, International Union of Physics, 1951–57; President, Mod. Languages Assoc., 1955; Pres., Physical Soc., 1956–58; Mem. Governing Bd. of Nat. Inst. for Research in Nuclear Science, 1957–60; Mem. Central Advisory Council for Education for England, 1956–59; Mem. Academic Planning Committee and Council of University of Sussex; Chm. Ministry of Education's Standing Cttee. on Supply of Teachers, 1959–62; Mem., Inst. of Strategic Studies; Chairman: Nuffield Foundation's Cttee. on Physics Education 1961; Physics Education Cttee. (Royal Society and Institute of Physics) 1965. Foreign Associate, Nat. Acad. of Sciences of U.S.A., 1957; Hon Mem. Akademie der Naturforscher Leopoldina, 1964. Hon D.Sc. (Louvain, Grenoble, Paris, Poitiers, Bristol, Ottawa, Liverpool, Reading, Sheffield, London). Publications: *An Outline of Wave Mechanics*, 1930; *The Theory of Atomic Collisions* (with H. S. W. Massey), 1933; *The Theory of the Properties of Metals and Alloys* (with H. Jones), 1936; *Electronic Processes in Ionic Crystals* (with R. W. Gurney), 1940; *Wave Mechanics and its Applications* (with I. N. Sneddon), 1938; *Elements of Wave Mechanics*, 1952; *Atomic Structure and the Strength of Metals*, 1956; various contribs. to scientific periodicals about Atomic Physics, Metals, Semiconductors and Photographic Emulsions. Address: The Cavendish Laboratory, Cambridge. Club: Athenaeum.†

A candidate for an academic appointment is expected to provide his *curriculum vitae* and a list of publications: but what really counts are the reports of his referees. It would not be proper to attempt to assess in public the scientific work of a scholar who is still so active, nor to say anything about his style of thought and technical skill. But the list of published books and papers which is included with this volume would not explain the influence that Mott has had over the thinking of a whole generation of physicists and metallurgists. The historians of science will never know of those timely meetings, arranged informally to discuss some current scientific problem, out of which sprouted new subjects and new ideas. They cannot catalogue those

† Reproduced with thanks from *Who's Who*, 1968.

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long sessions of gentle quizzing, where many cherished opinions melt away and new theories formulate themselves. They cannot record the strong questioning voice, teasing simple clarity out of high flown complexity at the conference session, nor can they document the enormous correspondence, hand or typewritten, on all manner of scientific, cultural and educational topics, with all manner of friends, colleagues and acquaintances. They cannot measure the influence of his books and scientific writings, nor the impetus he has given to the writings of others, as an editor of journals and of monograph series.

The contributors to these volumes wish to express, on behalf of all those, from all parts of the world, who have enjoyed his companionship and leadership, as colleagues and as visitors at Bristol and at Cambridge, how much they owe to Nevill Mott—to his friendship, his kindness, and his understanding both in scientific and human affairs, and his encouragement and stimulation in their scientific endeavours.

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