Re-emergence in the solid state

Andrew K. Jonscher

Solid State Physics, 2nd Edn revised. By J.S. Blakemore. Cambridge University Press: 1985. Pp.506. Hbk £40, \$27.95; pbk £9.95.

SOLID state physics is a major branch of modern physics and is well served by textbooks at various levels of sophistication. Blakemore's text, which was first published in 1969 and again in 1974 by Saunders, may be regarded as one of the classics in this field, and I have long made use of it in undergraduate and introductory postgraduate teaching. It is good, then, to see the book back in print, especially because it is now available in Britain as a reasonably priced paperback and is thus within the financial reach of students.

This "revised" edition is only slightly

changed from the second edition of 1974. Essentially it is a corrected reprint, though the bibliography has been enlarged and a few other amendments have been made. However the book has stood the test of time reasonably well. It is eminently readable and, given the limitations of space and the breadth of possible subjects to be included, the choice of material remains well balanced.

The treatment does not include crystal-growing techniques and there is hardly a mention of p-n junctions, let alone of any other semiconductor devices. These are notable omissions. In the same vein there is nothing on quantum wells or two-dimensional electron gas effects, both of which are exciting and educationally valuable topics. One hopes that Blakemore will be persuaded to produce a fully up-to-date edition in the near future, but until that time the present book is well proven and altogether highly commendable. □

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Thinking small

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Fundamental Particles: An Introduction to Quarks and Leptons. By Brian G. Duff. Taylor & Francis: 1985. Pp.122. Pbk £12, \$22.

Elementary Particles, 2nd Edn. By I.S. Hughes. Cambridge University Press: 1985. Pp.349. Hbk £27.50, \$49.50; pbk £9.95, \$19.95.

UNTIL a few years ago, particle physics was becoming more and more bogged down in detail. Now, both on the experimental and theoretical fronts, there have been enormous breakthroughs. From the experimentalists, using machines that caused particle-antiparticle annihilation to occur, came the discovery of the W^+ and Z^0 particles which confirmed theoretical ideas on the unification of two of the four fundamental forces in nature. The existence of gluons and quarks has been placed on a stronger footing and the quark-gluon concept has helped greatly in the interpretation of the available data. Theoretical work has led to a new, and most important, a simpler, understanding of the nature and the beginning of the Universe.

In the light of these successes, it is truly amazing that there are so few general books in this field, and that the implications for areas as various as religion, metaphysics, the existence of life and the Universe are discussed so rarely at a level appropriate for the layman and the student. Almost all the published material on

elementary particles is at a high academic level, describing complicated and *ad hoc* theories, and often with the main point lost in excessive detail. When the results could not be interpreted in a simple fashion it was hard to have it otherwise. But now the new experimental and theoretical results have blown away the cobwebs and opened up the prospect of the appearance of enlightening books on these topics.

Fundamental Particles by the late B.G. Duff falls into this category, and is a joy to read. It may not be accessible to all enquiring sixth-formers but at least it is a valiant attempt to reach them. While it is a short book, it lacks only more of the same material and fully captures all the current excitement. For that reason undergraduates and even seasoned researchers will find it well worth setting aside a couple of hours to read it.

Elementary Particles by I.S. Hughes is a second edition of a textbook written basically before the simplification became so apparent. An attempt has been made to update the contents with reasonable success, but the result is still a sober academic account of the field. This is a book for the serious student, similar to *Introduction to High Energy Physics* by D.H. Perkins, and is the ideal follow-up to Duff's *Fundamental Particles* which should have instilled in its readers the desire to learn in more detail about the fundamental advances that now characterize particle physics. □

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Waves of learning

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Electromagnetic Waves. By E.R. Dobbs. Routledge & Kegan Paul: 1985. Pp. 145. Pbk £4.50, \$9.95.

Maxwell's Equations and their Applications. By E.G. Thomas and A.J. Meadows. Adam Hilger: 1985. Pp.54. Pbk £2.95.

Problems and Solutions in Electromagnetic Theory. By C.M. Lerner. Wiley: 1985. Pp.614. Pbk \$34.95, £35.75.

Electromagnetic Wave Theory. By James R. Wait. Harper & Row: 1985. Pp.308. \$42.50, £49.

IN THEIR penultimate year as undergraduates, physics students generally take a long course on electromagnetism, using vector analysis and leading up to Maxwell's equations. These can then be taken as the starting point for work in the final year. There is much to be said for starting the final year with a series of lectures giving a broad overview of the main applications of Maxwell's equations, and Dobbs's *Electromagnetic Waves* provides an excellent choice of topics for a short course of this kind. The exposition is extremely clear and, even though many of the topics are fairly standard, they are generally discussed with fresh insights. Also included are problems for the student to solve. The book can be thoroughly recommended for the type of course for which it is written.

Maxwell's Equations and their Applications by Thomas and Meadows is restricted to 54 pages of text. It is a good idea to summarize the equations without long detours into topics such as AC theory. The stated aim of the book is "to explore the physical meaning of the equations and to bring out the relationship between this physical content and its mathematical representation".

The equation $\nabla \cdot \mathbf{E} = \rho/\epsilon_0$ is developed from Coulomb's law. The magnetic pole concept is used to develop $\nabla \cdot \mathbf{B} = 0$ after the authors define "a magnetic intensity $\mathbf{B}$ corresponding to the electric intensity $\mathbf{E}$ ". This approach is not as popular as it once was. Commenting on the Lorentz force, Thomas and Meadows say that " $\mathbf{v} \times \mathbf{B}$ represents a kind of additional electric field which acts on a charged body in motion". Magnetostatics is developed from the Biot-Savart law in the differential form for a current element, which cannot be checked experimentally, while Ampère's circuital theorem is derived for the case of a long, straight wire only.

The equation $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$ is developed from experiments on electromagnetic induction, and, as an example of induction, on page 27 the authors consider "a cylindrical volume within which there is