Pushing beyond the frontiers

David Lindley

Interactions: A Journey Through the Mind of a Particle Physicist and the Matter of This World. By Sheldon Glashow with Ben Bova. *Warner, New York: 1988. Pp. 297. $19.95.*

ELEMENTARY particle physics fascinates the non-scientist because it tackles simple questions — what is the world made of, and why are there four different forces holding it together? The same appealing simplicity undoubtedly draws scientists of a certain mind to the subject, but their attempts to answer these questions have so far produced a mass of technical detail which tends to obscure the grand design. It is a rare researcher who can spend his days calculating Higgs boson masses or weak coupling angles and still dream at night of the unity of the Universe. Scientists in this venture seem to fall into two sorts; some pioneer the route, solving problems as they arise, while others draw the pieces together and produce the large-scale maps.

To judge from his memoir, Sheldon Glashow is more the pioneer than the mapmaker. His fundamental contributions to understanding the weak interaction and finding how it is connected to electromagnetism are true additions to our knowledge of the world. But having found his territory, Glashow seems disinclined to pause and look around; rather, he moves straight on to the next uncharted spot. As he declares in his final chapter, this puts him in a minority among modern theoretical physicists, many of whom, having staked out their personal vantage point, indulge in lofty and generally fruitless contemplation of the state of the world. But although Glashow's stand for doing science the old-fashioned way may be admirable, it will probably keep him out of the best-seller lists; few casual readers are likely to have the patience to follow him as he recounts the intricate search for neutral currents or bound charm.

The reader's task is made more difficult by the unevenness of the writing, which one is presumably allowed to blame on Glashow's co-author Ben Bova. No effort seems to have been made to pitch the explanations of theories or experimental results at a consistent level. Spontaneous symmetry breaking, for example, is illustrated by recourse to the familiar picture of a marble rolling in the brim of a sombrero, but this is immediately followed with the bald declaration that the shape of the hat is to be thought of as the "potential energy of a quantum field that displays an internal symmetry". Later, an inadequate account of the Higgs mechanism leads into Glashow's assertion that it is a necessary but ugly part of the standard model of particle physics, like "the flush toilet in a stately mansion". The only purpose for this analogy seems to be to set up a feeble joke about Steven Weinberg.

For those who understand the issues, Glashow's commentary can be useful and illuminating. But those hoping for a more fundamental explanation of what particle physics is about will find only a series of progressively more mystifying and frustrating asides.

The book's general inelegance may be a product of its manufacture. In a collaboration of scientist and professional writer, the ideal function of the second party ought to be to convey the main author's thinking without losing his personal style. The subtitle, *A Journey Through the Mind of a Particle Physicist and the Matter of This World*, reinforces this expectation, but it is hard to avoid the impression that Bova has achieved the opposite. The explanatory sections tend to be confusing and impersonal, while the more personal recollections amount to little more than a series of anecdotes from which one can construct a list of the girlfriends and cars possessed by Glashow in his youth.

But there are times, especially in the later chapters, when Glashow's true enthusiasm for science shines through. Speaking of his role in the formulation of Grand Unified Theories and of his distaste for the current vogue for superstrings, Glashow emerges as a man with passionate feelings about the state of theoretical physics and its immediate future. That entire physics departments have become beguiled by theories which propose to explain everything, at the cost of never admitting a practical test, is something he clearly finds antithetical to scientific tradition. Too many physicists, he argues, look to the image of Einstein in his later years, trying to understand the Universe by the pure exercise of intellect; most of us should attempt to emulate more reachable heroes.

In most of this book, Glashow does not come across as a contemplative sort. The early chapters may be comparatively plain because he finds it hard to recollect his enthusiasm for problems solved some time ago and now found in the textbooks. Nor does he suffer from the urge to incorporate what he has learned into grand philosophical schemes. He is a solver of puzzles, an inventor of devices and mechanisms, a journeyman scientist. Although such characteristics place him among the majority of working scientists, they may also mean that much of what he has to say is of only incidental interest to those outside science. □

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Surface areas

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Physics at Surfaces. By Andrew Zangwill. *Cambridge University Press: 1988. Pp.454. Hbk £40, $69.50; pbk £15, $27.95.*

WE NOW know a lot about the physics of bulk solids in their crystalline state. Unfortunately, most of the elegant experimental methods that have told us so much about the mechanical, electrical and thermal properties of such solids are quite insensitive to single-atom layers on their surfaces. This is a region where the periodic potential terminates abruptly, and where the crystallographic structure and chemical composition may be very different from those in the bulk. The properties of such layers are often two dimensional in character, again leading to important differences from the bulk behaviour.

Our understanding of the physics of surfaces still lags behind that of solids, but it has come on apace in the past ten years. Good graduate texts on the subject are still in short supply so it is good to see the appearance of Andrew Zangwill's book to complement Prutton's *Surface Physics* (2nd edn 1983) and Woodruff and Delchar's *Modern Techniques of Surface Science* (1986).

Physics at Surfaces is aimed principally at graduate students in physics, physical chemistry and materials science. The first part is concerned with surfaces that are clean on an atomic scale, the second with well-defined layers of atoms and molecules adsorbed onto such surfaces. The author has consciously opted for breadth rather than depth — the book deals with topics ranging from the thermodynamics of surfaces to phase transitions and elementary excitations, and with applied issues ranging from solid-state electronic devices to catalysis.

Inevitably, given the limitation of space, no single topic has been treated rigorously, and the book will therefore be particularly useful as a general text for a broadly based graduate course. It also provides a useful overview for anyone entering the field of surface science; those requiring a more thorough discussion of specific subjects are guided to further reading by a list of references at the end of each chapter. Such is the scope that it is perhaps not surprising that some small errors have crept in, but they do not seriously detract from the value of this useful and timely book.

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