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Time, space and things

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THIRD EDITION

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To Sylvia

PREFACE TO THE FIRST EDITION

This book is an attempt to survey, in simple terms, what physics has to say about the fundamental structure of the Universe. It aims to extract, from a whole range of specialized activities, the basic essential concepts and to present them in plain, non-mathematical language. There are some splendidly bizarre ideas in physics, and it seems a pity to keep them locked up in narrow boxes, available only to a small, esoteric crowd of key-holders. Naturally, in opening the boxes and trying to air the contents without the elegant restraint of mathematics, or without the adumbration of historical context, one runs the risk of pleasing nobody, and laying oneself open to the charge of superficiality on the one hand and incomprehensibility on the other. Nevertheless, the risk is worth taking, qualm-making though it be, if only because there is a super-abundance of specialization, and very little of generalization.

Even within the speciality of physics itself, the student is confronted with so many finely delineated trees that all too often he fails even to appreciate the existence of the wood. Occupied as he is with hacking his way through the thickets of thermodynamics, electromagnetism, quantum mechanics and the rest, he may be forgiven for losing all sense of direction and wishing he could rise above the forest and get his bearings. It was to go some way towards meeting this wish that a short course of lectures was introduced into the undergraduate course in physics at the University of Essex, out of which this book developed. Many concepts, familiarity with which is usually taken for granted at

undergraduate level, have been introduced more or less from scratch. Concepts normally encountered only at postgraduate level have been considered to be intrinsically no more difficult than those we come across at school and have been included without ceremony. If they are difficult to apprehend, the difficulty is largely one of plain unfamiliarity. If they were left out, this book would not achieve the aerial view of physics it grasps for.

I feel with Mark Twain:

> There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact.

I would like to think that some of that fascination is transmittable to the general reader, who wants to catch up on his physical Universe; to students of the humanities and social sciences, who wish to be generalists; and to sixth formers, who are contemplating specializing in physics. I would also like to think that the book may prove useful to teachers of physics at all levels, and to university students reading physics, as part of their background reading. Having said that, I am all too aware of the difficulties in writing a book which has something to say to both generalist and specialist. I am equally aware that there are far too few attempts to do so among professional scientists. The cultural gulfs between the intellectual disciplines have never been wider. It is impossible to over-specialize; but never to generalize, is not only possible, it is usual. Those cultural gulfs are unaesthetic, and, at times, downright dangerous; and, if this book goes any part of the way towards bridging them, it will have achieved at least one of its objects.

Colchester, July 1974 *B.K. Ridley*

PREFACE TO THE SECOND EDITION

Being essentially about concepts, this book is not, perhaps, in danger of going rapidly out of date as scientific frontiers are pushed back. Nevertheless ideas have to bite on something, and some of the creatures inhabiting time and space have certainly acquired novel features in the eight years since the publication of the first edition. As companions of the electron and other leptons in the role of truly fundamental things, the quarks have acquired a good deal of reality, and a wealth of rather endearing properties. The quantum world now looks even more extraordinary as new experiments reveal the existence of long-range correlations. The push towards the unification of everything has led inexorably to one of the wildest concepts of all. And then there has been an explosion in the production and study of low-dimensional matter in connection with semi-conductor electronics. All of these, and one or two others besides, merit a display because of their delightful irridescence. Finding a place for them in this, the second edition, has involved a little re-writing, resulting in a slight expansion of the book as a whole. But the essence of the book remains as it was before, and I hope as accessible and readable to specialist and non-specialist alike, as the first edition happily turned out to be.

Colchester, August 1983 *B.K. Ridley*

PREFACE TO THE THIRD EDITION

Much of the text (and *all* of the ethos) remains unchanged in this new edition, but I could not resist the opportunity to add a new chapter (*Boojums*) and another appendix (*Elementary transactions*). The new chapter highlights some of the difficult conceptual problems embedded within modern theoretical physics which are too infrequently addressed – at any rate, for my taste. The new appendix is disgracefully flippant. There is also some updating which includes brief mention of strings and chaos, and there are corrections of some numerical misprints. In general, the text has benefited significantly from a critical reading by Aaron Ridley, a contribution much appreciated by me. I am also indebted to Ann Spencer for, and not a little intrigued by, her illustration of a possible near-sighting of a Boojum. I hope the book remains as accessible to the non-specialist as the previous edition happily turned out to be.

Thorpe-Le-Soken, April 1994 *B.K. Ridley*