NEW PATHWAYS IN SCIENCE

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by

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PREFACE

THIS volume contains the Messenger Lectures which I delivered at Cornell University in April and May 1934. Chapters II and VIII have been added; the remaining chapters correspond to the twelve lectures of the course. It was one of the conditions of the lectureship that the lectures should be published.

Except for a small book on the Expanding Universe, my last spell of writing was about six years ago, when *Stars and Atoms* (1927), *The Nature of the Physical World* (1928) and *Science and the Unseen World* (1929) practically exhausted all that it was then in my mind to say. A scientific writer is placed in a difficulty by his earlier books; either his new book will appear as a rather disjointed addendum to them, or he must perfunctorily go over again a great deal of matter which he has no wish to rewrite. Being unwilling to adopt the second alternative, I determined to make what I could of whatever had come to my mind in the last six years. Accordingly I spoke at Cornell on a variety of topics, using as a nucleus the material contained in a number of addresses and lectures which I had had occasion to deliver since 1929, and adding other subjects to which I had been giving attention. The general plan was that each lecture should have a separate theme, except that Indeterminism was spread over two lectures. The choice of subjects has allowed a certain amount of continuity of treatment; but there has been no attempt to provide a systematic introduction to modern scientific thought. Perhaps the biggest gap is the absence of any account of the elementary ideas of the theory of relativity;

I could not bring myself to go over again the ground covered in Chapters I, II, III, VI, VII of *The Nature of the Physical World* altering the treatment and illustrations merely for the sake of alteration.

In the opening lecture I try to explain the philosophical outlook of modern science, as I understand it, and show how the scientific picture of the world described in physics is related to the "familiar story" in our minds. Chapter II is an interpolation containing a summary of our knowledge of atomic physics, etc., which some readers may find necessary for an understanding of subsequent chapters and others may find useful as a reminder. Then follow four lectures which have something in common; they are concerned with the consequences of the statistical type of law, first introduced into physics in the subject of thermodynamics, which has in recent years completely driven out the older causal type of law from the foundations of physics. The last of these four lectures, on Probability, has besides its application to statistical law a more elementary interest.

Then follows a complete change of subject, and the next four lectures are devoted to astrophysics. Starting with the sun and familiar stars, we advance to greater distances till we reach the system of milliards of galaxies which constitutes the universe. This last subject has been treated more fully in my recent book *The Expanding Universe*; I here give a much shorter account. In this lecture (Chapter X) we meet the elusive "cosmical constant" which takes us back to the fundamental conceptions of physics again for the next two chapters. Chapter XI is, I realise, much too severe for this kind of book; I can only plead that the subject which has occupied me for the last five years, almost to the exclusion of any other research, was bound to spill over into any course

of lectures I might give. The next lecture, on Theory of Groups, was something of an experiment; but it, more nearly than any other part of the book, touches the key-note of scientific philosophy.

The chapter "Criticisms and Controversies" may by its title lead the reader to expect a comprehensive series of answers to the multitudinous points raised by critics and reviewers, and by many who have contributed valuable discussion of the views which I have advocated. I think that a little reflection will show that this was impracticable with any reasonable allotment of space. If a criticism can be answered briefly and decisively it seems scarcely worth while to inform the world in general that so-and-so has raised it. If it is more arguable, a lengthy explanation and discussion of it is usually necessary. For the most part I am content to think that if my contentions are of value they will find their proper level without continual parental intervention to save them from determined opponents—and sometimes from over-enthusiastic friends. But I would express here my gratitude for many articles by philosophers and others courteously discussing my writings. Sometimes I have appreciated the justice of the criticism, and it has had its due influence in maturing my views. Often I would have liked to write a reply in the hope of advancing an understanding on both sides; but such a reply requires at least as much time and care as an independent article, and with rare exceptions I have had to let the opportunity go by. In the concluding lecture I return again to the philosophical outlook of Chapter I, but this time I refer to that part of "the problem of experience" which the methods of physics do not profess to treat. Parts of this lecture are taken from an address which I gave in a broadcast symposium on Science and Religion.

As usual, notwithstanding my efforts to simplify things, I have to impose a rather heavy strain on the attention of the reader. Since the chapters are to a considerable extent independent, the difficulty tends to increase towards the ends of the chapters. There is hope of a respite when the next chapter begins.

These lectures carry for me happy memories of the weeks which I spent in Cornell University. To the friends who welcomed me, and to the large audiences who encouraged me, I dedicate them gratefully.

A. S. E.

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