

places, to the effect that one can only falsify hypotheses, he also recommends Kant's theory of hypothesis "as being very much in the modern style". But Kant, in the context of the passage referred to here (page 49), remarks that the probability of a hypothesis grows with increasing explanatory success.

Of course, there are possible replies and objections to such a position, but this consideration brings me to my last point. Medawar is prone to contrast the tentativeness of science with a putative doctrinaire attitude of "the philosophers". Quite the contrary. The record of inductive and deductive writing is one long sequence of claims and counter-claims; in short, of criticism. At every stage, the philosophers' and the scientists' philosophical comments are the primary data for further critique. It is one of the virtues of this book that its clarity makes it an excellent vehicle for a "primary source" in the philosophical process of continuous criticism.

GERD BUCHDAHL

## COSMIC ENORMITY

### The Earth in the Universe

Edited by V. V. Fedynskii. Translated from the Russian. (Geographical Series.) Pp. v + 402. (Israel Program for Scientific Translations: Jerusalem. Distributed by H. A. Humphrey: London, March 1969.) 120s.

MORE than half a century ago K. E. Tsiolkovskii proved that it was possible to build rockets which could attain escape velocity and overcome the forces of gravity. This pioneer of modern space travel wrote: "The Earth is the cradle of the mind—but you cannot live in the cradle forever". This book is about our first faltering steps from the cradle into the realms of the interactions between the universe and the Earth. It is obvious that the physical form of the Earth has been drastically affected by the mechanism which formed it and also by the influence of the Sun and the other bodies in the solar system. What is not so obvious is the variable effect that these bodies have on human, animal and plant life. Apart from the daily, lunar and yearly periodicities, the 11.1 year variability of the Sun and also the 170 million year period of the Sun's motion around the galactic centre have a profound effect on life, climate and geology. This book was first published in Moscow in 1964 and contains a collection of thirty papers on the cosmic properties of our environment. The theme of this collection is that we must stop considering ourselves as an isolated system and must broaden our outlook and think of mankind as part of a solar system which itself is part of a galaxy in a universe of galaxies. We must extend our minds to the cosmic enormity of our environment and look for the effects which the cosmos has on the planet Earth.

The book is divided into five sections. The first contains a brief review of modern conceptions of the structure of matter and the nature of physical fields, especially gravitation. The second deals with the structure and evolution of the universe and contains papers on extragalactic astronomy, the observation of the positions and recessional velocities of galaxies and the possibility of unknown forces acting on distant galaxies. A possible mechanism for the origin of the solar system and the problems of solar evolution are discussed. The structure and development of the Earth are dealt with in the next section with special reference to the interactions between the variations in the rate of rotation of the Earth and the motions occurring in the terrestrial crust, the connexions between diurnal rotation and geological and climatic processes, methods of measuring the structure of the terrestrial crust and the variation in diurnal rotation due to the position of the Sun in the galaxy. The section ends with a discussion of submarine troughs, palaeomagnetism and hypsographic curves. Section four of the book is

entitled "Solar Activity and the Earth". The Sun is a weakly variable star with a principal period of 11.1 years. In years of peak solar activity tremendous chromospheric flares in the ultraviolet and X-ray regions of the solar spectrum produce streams of solar particles which not only affect the electric and magnetic fields of the Earth but also the biosphere and life. Section four contains papers on the relationships between solar activity and physiological characteristics, the production of white blood cells and animal reproductivity. Section five presents a study of the biosphere and the ways in which this is affected by physical fields. Papers included are concerned with the abundance of organic matter in the universe, magnetotropism in plants and the effect of negative oxygen ions, deionized air, ultraviolet radiation and radioactivity on life.

We must thank the translators for this excellent book and for opening the eyes of our less linguistically blessed colleagues to the wonderful work being done in the Soviet Union. This book will help to foster interdisciplinary interest and cooperation, both of which are essential if this fascinating branch of science is to progress.

DAVID W. HUGHES

## DUSTY PROBLEMS

### Diffuse Matter in Space

By Lyman Spitzer. (Interscience Tracts on Physics and Astronomy, Vol. 28.) Pp. xiii + 262. (Interscience (Wiley): New York and London, April 1969.) 108s.

PROBLEMS relating to the diffuse interstellar material have assumed a rapidly increasing importance in recent years. This is the result, at least in part, of the development of new observational techniques, notably in the radio, infrared and ultraviolet wavebands, which have permitted a closer scrutiny of the several components of the interstellar medium. The discovery of the molecules water, ammonia and formaldehyde by their radio transitions in interstellar space is scarcely months old; even more recent have been discussions and arguments concerning the chemical characterization of the interstellar dust particles based on infrared spectral features. The discovery of large fluxes of infrared radiation from nebulae and galaxies, and the possible connexion between this radiation and interstellar dust grains have added further interest to this subject.

Professor Spitzer's book could hardly have appeared at a more opportune moment. Beginning with an introductory chapter summarizing the early evidence and arguments for the presence of interstellar matter, the book goes on, in the next two chapters, to discuss the observational data pertaining to the main components of the diffuse matter. The relevant observational data are presented in a concise form which would prove a useful introduction to this subject. In many places the discussion of the observational material and also of the properties of dust grains may appear a little too sketchy; but this deficiency is compensated by referring the reader to a representative bibliography of review articles and original papers.

The rest of the book is devoted almost entirely to discussion of selected theoretical problems. In two chapters which comprise over half the volume of the book Spitzer describes the interactions between various components of the diffuse interstellar matter, and also the dynamical behaviour of this matter; a final chapter is devoted to the problem of star formation from interstellar matter. These chapters, which chiefly embody the author's own contributions to this subject, are written with a rare clarity and insight.

This excellent book is to be commended to all those concerned with interstellar problems as well as to the more general student of astronomy. It will prove an