Book Reviews

The Astronomer's Universe. Bart J. Bok. Melbourne University Press, Melbourne; Cambridge University Press, New York, 1958. xi + 107 pp. Illus. + plates. $3.75.

This book is based on four lectures on modern astronomy given by Bart J. Bok at the Australian National University in October 1957 and repeated at the School of Physics of the University of Sydney in January 1958. The lectures were on an elementary level and were descriptive in nature. The book is intended for readers with little previous knowledge of astronomy.

Bok covers four topics: (i) The solar system, (ii) The stars as individuals, (iii) The Milky Way galaxy as a stellar system, and (iv) The ages and evolution of the stars.

Without question, astronomy is today passing through a renaissance. As Bok states in his opening sentence, "Astronomy is on the move." This is due mainly to new instrumentation and to the beginnings of a theory of stellar evolution which permits the ordering of many of the observational facts of stellar systems.

Developments since 1946 have lent an excitement to astronomy which is basically different from and far removed from spectacular rocket technology and possible space travel. Present-day astronomy at last seems to be reaching toward an understanding of the formation and evolutionary processes of the universe as a whole. Astronomers seem to be on the verge of learning something fundamental about form, order, and change in the world at large. This is a quest for something far greater than mere technological achievement, which, unfortunately, is the aim and end result of much of the current waste of talent and money in the name of space research. It is a quest for real understanding of the *nature* of things. Astronomers, using large telescopes *on the ground,* have already begun to understand the processes of star formation, the subsequent history of stars as they live out their fuel supply, the formation of the chemical elements, and the connected history of galaxies made up of evolving stars.

It seems to me that any popular book on astronomy must carry part of this story to its readers. A generation ago the minds of the young people who became our present-day astronomers were stirred by the popular books of Jeans and Eddington, such as *The Mysterious Universe, The Nature of the Physical World, The Expanding Universe,* and *Stars and Atoms.* Unfortunately, no new books of equal caliber are available even though our knowledge of astronomy is much greater today than it was 20 years ago. Currently there is much popular writing aimed at awakening the imagination to the glamor of space-flight technology. But this is not astronomy. Unless basic astronomy is shown to be as exciting as artificial satellites, the young people who are our potential scientists will grow up with a desire to light wicks under rockets rather than to operate 200-inch telescopes.

Although Bok, widely known as one of the most versatile and stimulating teachers of astronomy, has shown his ability as an author in his previous book *The Milky Way* (written with his wife), his present book falls short. It bears the marks of hasty composition and carelessness with regard to details. It leaves a final impression of being principally a collection of facts, often thrown together without underlying direction. Facts in popular writing must be ordered if they are to tell a story. The "plot" seems to be missing. The facts, in themselves, are sometimes interesting, and indeed they are of the sort necessary for a modern synthesis of the universe. But the synthesis is not made.

The first section of the book deals with the atmospheres of the planets, the origin of the solar system, and the nature of the solar atmosphere. A description of the chemical constitution and temperatures of planetary atmospheres is given and the widely accepted conclusion is reached that no other planet in the solar system is suitable for human life. The theories of the origin of the sun and the solar system are traced from Laplace's nebular hypothesis, through the collision theory of Chamberlain and Moulton, to the revised nebular hypothesis of Von Weizsäcker.

The second chapter, "Stars as individuals," describes distance determinations, the H-R diagram, binary stars, mass determinations, variable stars and novae, and finally defines the two population types of stars. This chapter and the fourth chapter show signs of hasty preparation. In a popular book one certainly cannot insist on precise statements, but correct statements can be expected. For example, Figure 1 on page 27 implies that subdwarfs are population I stars, but there is strong evidence that they are halo objects of population II. Bok also repeats the modern trend that ignores the early Mount Wilson work on spectroscopic parallaxes upon which all the subsequent work in this field has been based. He states that "the techniques of spectral-luminosity classification have been developed especially by Lindblad and his students in Sweden, by Morgan and associates in America, and by Chalonge and his group in Paris." All this is true, but the original discovery of the method and the basis upon which Lindblad and Morgan have built was entirely a Mount Wilson project carried out by Adams and Joy. And in another section the statement is made that "the origin of stellar variability must be sought in the deep interior of the star and the basic cause of the variability lies probably in some imperfect balance of the energy generating processes in the star's interior." This view is not held by most astrophysicists. Rather, all evidence seems to point to a *surface* instability of the ionization zone of some critical element as the cause of stellar variability.

The third chapter on the Milky Way system is perhaps the best written of the four. Radio astronomy and the 21-centimeter line of hydrogen are described in some detail. The interstellar gas and dust and the current data on the spiral structure of the galaxy are discussed. Here Bok is in his element and the chapter is good.

The fourth and final chapter tells of the newest and, perhaps, most important current trend in astronomical research—the expanding universe, the cosmic time scale, and stellar evolution. Again several points are reported in this chapter which professional astronomers

would like to see more fully explained. For example, the discussion of the cosmic time scale, does not mention the fact that a world model *must be assumed* before an age can be assigned to the expanding universe from our knowledge of the present expansion rate. Furthermore, the most important method of dating stars in our galaxy—the use of H-R diagrams of galactic clusters—is not mentioned. Also, Figure 6 on page 87, which shows the evolution of stars of solar mass, is somewhat misleading because stars of 1.2 masses are very probably not operating on the carbon cycle as shown, but rather generate energy by the proton-proton chain. For this reason, it is quite likely that these stars do not have a convective core. If a convective core were present the characteristic Hertzsprung gap would occur in the diagram. Its absence is a notable feature of the H-R diagram for globular clusters. Finally, it is nowhere mentioned that the track shown in Figure 6 is for a star with very low metal abundance such as the stars in globular clusters. Stars with a normal chemical composition (like the sun) will have evolutionary tracks which differ greatly from the track shown.

Bok's book, although not as detailed or as carefully written as many professional astronomers might wish, should appeal to the lay reader, especially if it is used in conjunction with more comprehensive books such as *The Milky Way* (Bok and Bok) or the other works listed in the extensive bibliography at the end of *The Astronomer's Universe.*

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The Population Ahead. Roy G. Francis, Ed. University of Minnesota Press, Minneapolis, 1958. x + 160 pp. $3.75.

"Man knows more than he thinks he does," says Roy Francis, the editor of this symposium volume. Unfortunately, it is often difficult to apply what is known to some of the acute social and economic problems confronting the modern world, because a good deal of the existing store of knowledge is not really in the public domain. Though not under security wraps, it is virtually inaccessible because it is presented in the strange jargons of scientific specialization. It may be food for pedantic thought, but it is not "Gerberized" to titillate the intellectual palate of the layman. Francis' solution for this problem is "the desegregation of knowledge." Such a term, to be sure, is not now current: "in today's lexicon one 'segregates' on the basis of skin color, not of academic hue." The segregation of ideas, by preventing knowledge from being an effective power for reform or reorientation, can be devastating in its effects.

An area gravely befogged by segregated knowledge is that of population dynamics. The human race is in the midst of an explosion of people the like of which has never occurred before. The rate of this explosive increase—1.5 percent a year—would not impress a financier. Yet it means that when next week's edition of *Science* is distributed, there will be nearly a *million* more human beings on this earth than there are today. In the book under review, P. K. Whelpton notes that if the one-third of a billion human beings presumed to have been living at the time of Christ had increased since that time at a mere 1.5 percent a year, the present population of the planet would be more than a million persons per *square foot* of the earth's land surface. Clearly, this far outdoes the mediaeval concern over balancing angels on the head of a pin.

The Population Ahead is a laudable attempt to desegregate knowledge regarding the population question, which is now cooped up behind the conceptual curtain raised by social scientists, economists, nutritionists, demographers, geographers, and anthropologists. In 1957, the University of Minnesota's Center for Continuation Study (a sort of perpetual idea-desegregating apparatus that ranges widely over many domains of knowledge) brought together a panel of experts and *begged* them to talk in plain English to each other and to a participating audience of several hundred. The result was by no means an intellectual Little Rock. Everybody was eager to live and let live, and there was a very free exchange of ideas, but some of the audience may have been on the verge of conceptual anoxemia. The wide range of views presented does throw considerable light on the population problems, even though the focus is not always sharp.

The question which stood out as the theme of the conference was, "What constitutes an optimum population?" Though opinions vary greatly, this is a question which deserves far more thought than it is now getting. Even in most fortunate America, it is by no means an academic question. The idea is abroad that by 1975 two-thirds of the population of the United States (perhaps 235 million) will be living in the 165 to 170 standard metropolitan areas, and that this will necessarily be a good thing. Well, will it be or not? Is there a more favorable distribution of people, and what might be done to bring about such a distribution in a free society? These are the questions that are not asked, perhaps because nobody wants to look straight at them.

One thing is certain: population is definitely everybody's business, and the most complete desegregation of knowledge is necessary if what man knows about this subject is to be put to work short of disaster. If the population explosion continues at the present rate, something will have to give. And some of the things which will inevitably give, and before very long—in the United States as well as everywhere else—are the level of living and freedom of thought and action and initiative. Ancel Keys is sure that the earth can provide a survival diet for a good many billion people. Before we test that conclusion let us try to reach some decisions regarding the kind of planet we want to live on.

The varied ideas of nine experts, plus the supporting commentary by a somewhat larger chorus, that make up this symposium volume hardly give a microscopically clear image of the problem. But the book contains more than a K-ration of food for thought.

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The Earth beneath the Sea. Francis P. Shepard. Johns Hopkins Press, Baltimore, 1959. xii + 275 pp. Illus. $5.

Francis Shepard's newest book deals with the vast area, three-fifths of the earth's surface, which lies under the sea. He writes in a simple, direct style which requires no specialized vocabulary from the reader, yet he covers salient aspects of all of the basic geologic problems one encounters beneath the sea. Laymen will find this book well worth reading. In it they will find discussion of many things which are readily observable near the sea—coastal erosion and engineering, currents, waves, and coral reefs. The more exotic phenomena, such as submarine mountains and canyons, are treated in an equally readable manner.

Scientists active in marine research