Book Reviews

Lovell's Gregynog Lectures and Project Ozma

The Exploration of Outer Space. Sir Bernard Lovell. Harper and Row, New York, 1962. viii + 87 pp. Illus. $3.

Sir Bernard Lovell, director of the Jodrell Bank Experimental Station (Manchester, England), which operates the world's largest radio telescope (a paraboloid antenna with an aperture of 250 feet), was invited to give the four Gregynog lectures at the University of Wales in October 1961.

This book, which is largely based on the lectures, is extremely well written, and its first four chapters contain much useful information on optical and radio astronomy. These chapters are: "The techniques of investigation," "The solar system," "The structure of the universe," and "The origin and evolution of the universe." However, much of the information duplicates what can be found in many other books and articles. Is it really necessary or desirable to glut the market with so much essentially identical material?

The fifth chapter, entitled "Some reflections on ethics in the cosmos," was not one of the lectures, but had appeared previously, in a modified form, in the *Sunday Times* (London) and in the New York *Times*. In this chapter Lovell states that during the summer of 1961 he had become "increasingly obsessed with the dangers of certain developments in space research" and perhaps also with the danger of "the big bomb." At the present time Lovell feels more optimistic about the world situation. His reason seems to be this—"the tremendous accomplishment of man in science" has induced mankind to pour so much money into activities like the "man on the moon" project, the Venus probe and the Mars shot that virtually no nation can now afford the expense of waging nuclear war."

But his argument is only partly convincing (man *may* become more ethical as a result of those activities). The power to order a nuclear holocaust now rests with the top statesmen of various nations. Some of them are highly educated persons whose ethics would prevent them, except in an emergency, from causing a world disaster. But I have never heard of either the education or the ethics of Stalin. And, although Hitler caused a *Götterdämmerung* of his friends under the flagstones of Berlin, that was not what he wanted. What he really wanted, and his wish was often expressed in his speeches, was to take with him to the grave all that remained of Germany in defeat together with as many of his enemies as possible!

In this connection Lovell also discusses the possibility of life on other worlds, and he reproduces Cocconi's letter to him, which contained Morrison and Cocconi's suggestion that the Jodrell radio telescope be used to search for intelligent radio messages from space. Lovell, as director of Jodrell, decided against undertaking the experiment—and I agree with every word he says about it.

But when I was director of the American National Radio Astronomy Observatory (Green Bank, West Virginia) and had the power to stop what has become known as Project Ozma, I did not do so. Since I have recently retired it is appropriate to explain why I decided to let the project continue. There were essentially four reasons: (i) The project was in progress when I went to Green Bank. (ii) To discourage Frank Drake, the exceptionally able scientist who made the observations, would have been a tragedy. (iii) The project created tremendous popular interest and induced the Nobel prizewinner Melvin Calvin and many other competent scientists to work on problems of life. (iv) I hoped that the search for intelligent radio messages might lead to the discovery of real "radio stars" known as flare stars. On the surface of the sun, radio flares and optical flares occur coincidentally. The sun and other solar type stars are really flare stars, and the radio flares might be observable.

Lovell had a much larger telescope and would have used a longer wave length—both to his advantage. But he had no optical observatory nearby. And if the flares exist, they should be observed in both ways for positive identification. My computations showed that the Green Bank instrument was only marginal, but luck, perhaps great luck, might have led to a very important discovery. Actually Lovell has also observed several flare stars. But, because he could not obtain optical confirmations, he has published next to nothing about this work. In the February 1963 issue of *Sky and Telescope* several Australian radio and optical astronomers report that radio flares lasting only a few minutes have probably been found. It will be interesting to see whether these results are confirmed.

OTTO STRUVE

Berkeley, California

Russian Translation

Theory of Ground Water Movement. P. Ya. Polubarinova-Kochina. Translated from the Russian edition by J. M. Roger de Wiest. Princeton University Press, Princeton, N.J., 1962. xix + 613 pp. Illus. $10.

The mathematical description of various ground-water flow patterns created in response to different boundary conditions is this book's chief purpose. Some space, however, is given to such topics as soil structure, porosity, capillary phenomena, and the construction of laboratory models. Although practical examples are chosen from civil engineering rather than petroleum engineering, the general orientation and level of the mathematics used are similar to those in M. Muskat's book, *Flow of Homogeneous Fluids through Porous Media.* Unlike Muskat's book, however, considerable emphasis is given to problems of unsteady flow.

A current fad among scientists in the United States is to decry our ignorance of Russian research. This is certainly justified in the case of ground-