System; (VI) Gestalt and Universals; (VII) Cybernetics and Psychopathology; (VIII) Information, Language, and Society. A panoramic view of the whole is given in the 33-page introduction, which ends with a pessimistic view of the future of human society and a note of discouragement concerning the possibility of developing an exact science of economics or sociology. The reader who is neither a mathematician nor an engineer may profitably skip from the introduction to Chapter IV, on first reading. Chapters II–IV are of particular interest to the mathematician and the electronic engineer; and Chapter III is of interest to the student of theoretical statistics, in view of its new approach to the notion of the amount of information in a series of data.

The text of the American edition, which appears to be a reproduction of the Paris edition (either by use of the same plates or by photographic means), unfortunately contains a fairly large number of typographical errors. The present volume is also without an index. It is to be hoped that these shortcomings will be rectified in future editions of the present volume and given due consideration in the publication of other volumes of the projected series.

Cosmic Science and the Social Order

Harlow Shapley, *Harvard Observatory*

THE MARIA MITCHELL of a century ago and the Albert Einstein of the present come together naturally in a joint review because along with their concern for sanity in social affairs neither slackened in ardor for knowledge of the universe. Maria Mitchell followed well-established lines in her astronomical work, but broke new ground in advocacy of higher education for women. Einstein broke new ground in the interpretation of the universe, then joined the hard fight for the lives and rights of free men.

The books under review[1] are the story of the life and work of a New England spinster of the middle of the 19th century, and the story of a portion of the deep and revolutionary thought of a master mind of this first half of the 20th century. Both volumes are readable and thought provoking.

In her volume, *Sweeper in the sky,* Miss Helen Wright has completed a study to which she has devoted many years. Herself a former student of astronomy in Vassar College, where Maria Mitchell, 80 years ago, spent some of the most fruitful years of her life, Miss Wright explored most thoroughly the earlier career of this outstanding woman scientist—this native of historic and romantic Nantucket Island, where her banker-scientist father guided her early astronomical studies and explorations. The Nantucket of those days was something of a cultural center, visited by the famous poets, writers, and scientists, and the Mitchells did much to make the local culture.

Sweeper in the sky is a volume of charm and unusual interest, largely because it deals with significant phases of mid-19th-century America. The lives and principles of the orthodox Quakers of Nantucket, and

the young girl scientist's gradual, struggling withdrawal from the credal inflexibility of that religious group, make a fascinating tale.

From being a quiet, intense observer of the stars, Maria Mitchell rose suddenly to international fame through the discovery of a comet in 1847. The comet soon disappeared, but her fame remained. She was

[1] *Sweeper in the sky.* Helen Wright. New York: Macmillan, 1949. Pp. vii + 254. $4.00.

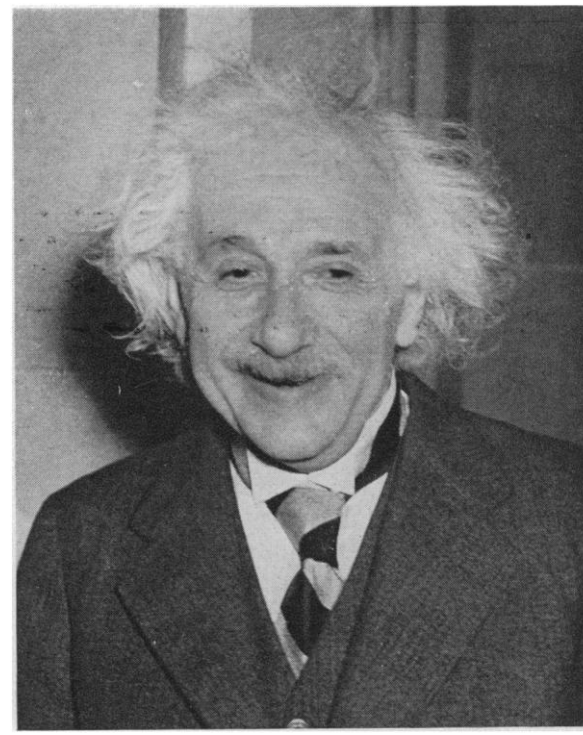
The universe and Dr. Einstein. Lincoln Barnett. New York: William Sloane, 1948. Pp. 127. $2.50.

elected in 1848 the first woman member of the American Academy of Arts and Sciences, and remained the only woman member throughout the 19th century. It was not until 1943 that the somewhat stiff gentlemen of that ancient organization, which started with George Washington and John Adams in the early membership, yielded to the ferment that had quietly been planted by Maria Mitchell and her sister intellectuals; the Academy then elected four women to membership. In 1850 Maria Mitchell was elected to the AAAS—another first.

That one ordinary comet, discovered with the small telescope on Nantucket Island, brought Maria Mitchell the prestige that her spirit and abilities merited. Without the recognition and responsibility, her career might have been obscure. If she had not been the first to detect the comet, it would have been picked up by another—in fact, it was independently discovered by Father da Vico of Rome a few days later. But the astronomers and public of old, as of now, attach a rather spurious importance to the individual who anticipates his colleagues by a few hours or days in seeing (or photographing) and officially reporting a new comet. Frequently we hang his name on the comet, and nowadays give him the Donahue Comet Medal, established and operated by the Astronomical Society of the Pacific. A century ago the King of Denmark established himself as a patron of the sciences, arts, and publicity by bestowing his royal blessing, and a medal, on the first discoverer of a new telescopic comet. Maria Mitchell got that medal and many congratulations from important people of the era. She was embarrassed by the acclaim, of course, but her family, her town, and her country were proud.

Just one hundred years ago this month, the Denmark King's medal was put on display at a meeting of the American Academy of Arts and Sciences. At that same meeting there were discussions, by Benjamin Pierce and others, of the motions of the recently discovered major planet, Neptune. That was an exciting decade, astronomically—there was the monstrous comet of 1843, the discovery of Neptune, and the founding at Harvard of the first large astronomical research institution in America—probably these events helped to enhance the wide fame of the studious lady of Nantucket. Her trip abroad (she traveled at times with Nathaniel Hawthorne and family) was scientifically a triumphal tour. She was rated along with Mary Somerville, the British mathematical astronomer and science writer, as the top woman scientist of the mid-century. On her travels she carried the first photograph of a star—a latchkey provided her by the Bonds of the Harvard Observatory.

It was natural, of course, that the hard-thinking, industrious and shy Maria Mitchell was asked to join the faculty of the new Female College founded at Poughkeepsie by Matthew Vassar. All those who are interested in the early history of that pioneer educational enterprise will find *Sweeper in the sky* an instructive introduction. They will also like the tales of the Nantucketers and will chuckle over the foibles of the religious and intellectual leaders of Maria Mitchell's time and admire their virtues. The reader of Lincoln Barnett's *The universe and Dr. Einstein* will not find many chuckles in his small volume. They



are, however, going to find something that to many appeals more deeply. They are going to find, for the first time in their inquisitive lives, that they really can "catch on to what this here relativity business means." Mr. Barnett, a journalist who has graduated into professional authorship, favored me with part of his manuscript, asking if I would not check up on this and that. A good many manuscripts come my way, and I confess that Mr. Barnett's pages were about to receive the kindly treatment that is customary, I am afraid, when laymen handle cosmogony, or the nature of universal forces, or the theory of relativity. But the first paragraph revealed that the author has understanding and a facility of explaining the well-nigh inexplicable. He has done the best job I have seen in presenting partially the nature of the relativistic universe, and the history of Einstein's thoughts as the still incomplete picture unfolded in his mind.

Mr. Barnett, with degrees from Princeton and Columbia, has turned directly to the masters at those institutions, to Hermann Weyl, Valentin Bargmann, H. P. Robertson, and William W. Havens, Jr. But I venture to suggest that the clarity of the presentation of Einstein's universe did not come from the masters—they know too much!

In his introduction to the volume, Einstein says that "the main ideas of the theory of relativity are extremely well presented. Moreover, the present state of our knowledge in physics is aptly characterized. The author shows how the growth of our factual knowledge, together with the striving for a unified theoretical conception comprising all empirical data, has led to the present situation which is characterized —notwithstanding all successes—by an uncertainty concerning the choice of the basic theoretical concepts." Einstein also warns against the sort of popularization that "succeeds in being intelligible by concealing the core of the problem and by offering to the reader only superficial aspects or vague allusions, thus deceiving the reader by arousing in him the deceptive illusion of comprehension."

Perhaps Mr. Barnett's readers may believe they comprehend more than is possible from a volume which must put its only mathematical symbolism in a brief appendix. But whether or not they are somewhat deceived by the clarity of the presentation, those who have never looked thoughtfully into the problems of the nature of the world in which they live are going to turn from this volume a bit startled and starry-eyed; and many will wish it were twice the length so that some of the ideas too briefly touched upon could have been spread out and illuminated. They will want to know more of the development of some of these surprising concepts—of the primordial field, the structure of space, atomic transmutation, and the fundamental mystery, still defying us, of clearly and unambiguously linking up the nature and forces of the microsomes with the nature and forces of the subatomic.

The portrait of Maria Mitchell, used as an illustration in Sweeper in the sky, *was painted by H. Dassel in 1851. Dr. Einstein's photograph is reproduced here by permission of Science Service.*