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Astronomy and Astrophysics in the United States

A recently issued report* on astronomy begins: "Nature offers no greater splendor than the starry sky on a clear, dark night. Silent, timeless, jeweled with the constellations of ancient myth and legend, the night sky has inspired wonder throughout the ages."

For most of human history, leadership in studying the heavens has resided elsewhere, but during the 20th century the United States has been the world center of astronomy. This preeminence has been due to good financial support and the imaginative creation of innovative observing equipment. The capabilities of excellent optical telescopes, developed during the first half of this century, were later extended by equipment designed for observing throughout the electromagnetic spectrum. Leading supporters of the development of optical telescopes were the Carnegie Institution of Washington, with its 2.5-meter telescope at Mount Wilson, and the Rockefeller Foundation, which gave the California Institute of Technology funds to build the 5-meter telescope at Mount Palomar. More recently, the National Science Foundation has become a major funder of ground-based astronomy, while NASA has provided excellent facilities in space. The United States has led in exploration of the solar system. In addition, it has launched space vehicles that have permitted observations which could not be achieved from the earth because of absorption of radiation in the atmosphere. The Space Telescope, to be launched in 1985, will be free from atmospheric inhomogeneities that blur sources of light and will be capable of high resolution of objects.

By 1970, generous support of American astronomy had led to many discoveries, including Hubble's expanding universe, time and celestial distance scales, quasars, x-ray sources, high-energy celestial gamma rays, the cosmic microwave background radiation, and polyatomic molecules in interstellar clouds. Discoveries during the 1970's included neutron stars accreting matter from nearby companion stars, hot intergalactic gas whose mass rivals that of the galaxies themselves, vast regions of interstellar gas heated to hundreds of thousands of degrees by shock waves from supernova explosions, and a gravitational lens effect observed as the splitting of light from a distant quasar as the light passed through an intervening galaxy.

The contributions of American astronomy are important and impressive. However, leadership cannot be maintained by resting on our laurels. Continuing preeminence of the United States will be dependent on well-trained people, who are provided with superior equipment.

The astronomical community has made a careful and searching study of opportunities and needs for support for the 1980's. Through extensive consultation and deliberation, a consensus has been achieved. The major new equipment recommended includes (i) an advanced X-ray Astrophysics Facility operated in space; (ii) a Very-Long-Baseline Array of radio telescopes; (iii) a New Technology Telescope, 15 meters in diameter, for ground-based studies in the optical and infrared regions of the spectrum; and (iv) a Large Deployable Reflector in space. All of these proposals would substantially extend the capabilities of astronomy. For example, the Very-Long-Baseline Array would have an angular resolution 100 times better than that of any other image-forming telescope at any wavelength. It would yield detailed radio images of quasars, the nuclei of galaxies, and features of interstellar molecular clouds and other astronomical objects. The first and third items above would be important for many studies, perhaps the most interesting being the examination of extremely distant objects whose radiation was emitted early in the history of the universe.

The report is well constructed and readable. It states well the case for additional expenditures for astronomy. Because of current budgetary problems, its recommendations may not be quickly accepted. However, it is designed to be relevant to the 1980's and at least part of it will surely be ultimately implemented.—PHILIP H. ABELSON

*Astronomy and Astrophysics for the 1980's, volume 1, Report of the Astronomy Survey Committee (National Academy Press, Washington, D.C., 1982).