Topic Page: observatory

Definition: **observatory** from *Philip's Encyclopedia*

Location of telescopes and other equipment for astronomical observations. Large optical telescopes are housed in domed buildings, usually sited well away from the smoke of cities. Radio observatories are open sites containing one or more large radio telescopes. The largest radio-telescope dishes have been built in natural mountain hollows: the Arecibo Observatory in Puerto Rico is 300m (975ft) across.

Image from: **Brahe, Tycho The Danish astronomer's model of the...** in *Astronomy Encyclopedia*

Summary Article: **observatory**
From *The Columbia Encyclopedia*

scientific facility especially equipped to detect and record naturally occurring scientific phenomena. Although geological and meteorological observatories exist, the term is generally applied to astronomical observatories.

The Astronomical Observatory

The function of the astronomical observatory is centered around the telescope. In addition to visual and photographic observations of astronomical bodies and phenomena, perhaps the most valuable use of the telescope is in connection with the spectroscopic study of starlight. The total light from a star is separated into its various wavelengths (see spectrum), and the intensity of each is measured. The temperature and chemical composition of stars can be obtained by this method, as well as information about stellar motion and magnetic fields. Using computers, astronomers can measure the spectra digitally recorded by spectrographs and photometers. Observatories specializing in solar astronomy usually have coronographs and spectroheliographs. Atmospheric limitations on telescopic observations include weather conditions, air turbulence, air glow, pollution, and any source of extraneous illumination. To minimize such conditions optical observatories are generally located at high altitudes in sparsely populated areas.

See articles on specific observatories.

Development of the Astronomical Observatory

Early civilizations, such as those of Babylon, China, and Egypt, recognized the regular and periodic nature of heavenly motions and established primitive observatories to maintain astronomical records. The main purposes of these early observatories were to regulate the calendar and predict the changes of season. Because it was believed that unusual occurrences, such as comets and eclipses, foretold future events on earth, the early observatories also served a religious function, and most of the ancient astronomers were priests. Later observatories were established to compile accurate star charts and an annual ephemeris that would be of use to navigators in determining longitude at sea. For some 600 years, beginning in the 13th cent., Roman Catholic churches included solar observatories to measure the movements of the sun and so determine the correct date for Easter.

The instruments in use before the invention of the telescope include the sextant, quadrant, astrolabe, and armillary sphere. These are all calibrated sighting devices for determining the angular positions of stars and planets. The armillary sphere was the most sophisticated of these instruments. It was composed of a number of rings corresponding to great circles on the celestial sphere and was used to

determine both the right ascension and the declination of a star. The last great observatory of the pretelescopic era was built by Tycho Brahe at Uranienborg, on the island of Ven, Denmark.

The invention of the telescope in the early 17th cent. revolutionized observational astronomy in two ways. First, the positions and motions of celestial bodies could be measured much more accurately with telescopes than with the earlier instruments. Such data provided a source of precise time signals. Second, the telescope could be used to analyze the physical nature of celestial bodies themselves. Until the 19th cent., telescopic images were inspected visually by highly trained observers who made drawings of what they saw. The development of dry-plate photography, which permitted long exposure times, however, offered a much more sensitive method of recording images. In the late 20th cent., electronic digital detectors utilizing charge-coupled devices (CCDs) superseded the use of film; a CCD can detect the arrival of a single photon of light. A recent development is the extension of astronomical observations to wavelengths outside the visible spectrum. Most important has been the development of radio astronomy, the study of radio waves emitted by celestial bodies.

Because the atmosphere interferes with astronomical observations from the ground, the ideal location for an observatory is beyond the earth's atmosphere. Since the late 20th cent., there has been an increasing emphasis on space-based observatories (see observatory, orbiting). Several artificial satellites have been equipped with telescopes for infrared, visible, ultraviolet, and X-ray observations. The International Ultraviolet Explorer (IUE) satellite, launched in 1978, is an 18-in. (0.45-meter) space telescope for ultraviolet studies. Launched in 1983, the Infrared Astronomy Satellite (IRAS) discovered some 246,000 infrared sources, as well as several stars around which planetary systems appear to be forming. Skylab was a manned orbiting space observatory (see space exploration). The largest space-based observatory is the Hubble Space Telescope, launched in 1990. Other observatories include the Compton Gamma-Ray Observatory, launched in 1991, and the Chandra X-ray Observatory, launched in 1999. ROSAT [*RO*entgen *SAT*ellite], a joint German-U.S.-British project launched in 1990, studies both X-ray and ultraviolet wavelengths never before imaged from space. It has detected a new class of bright stars that shine only in the ultraviolet part of the spectrum. The Cosmic Background Explorer (1989–93) studied microwave background radiation that no star or other known object could emit—it is believed to have come from the creation of the universe (see cosmology).

The computer age has also impacted observatories in several ways. Instead of being cast in one piece, reflecting telescope mirrors can be constructed of numerous small segments that move under computer control to focus the light and create an image equivalent to that of a much larger telescope. This has made it economically possible for observatories to reach further and further into the cosmos. Computers have also made it easier to construct and retrieve information from archival data bases. Computer networks are under construction that will make it possible for these archival databases to be made available to other observatories so as to create a virtual observatory, with gains in productivity and cost-effectiveness for the observatories that participate in it.


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