TRACKING THE MYSTERIOUS SKY

By Mary Ann Taylor & Annie Laura Smith

Long before people learned to read and write, eyes watched the mysterious sky. Shepherds and hunters used the position of the sun, moon, and stars for guidance. In Babylonia, holy men recorded the names of stars on clay tablets, and these records marked the beginning of astronomy. The Greek words *astron* meaning "star" and *nemein* meaning "to name" were combined to provide the word astronomy.

Italian mathematician Galileo Galilei (1564-1642) adapted a device that was stronger than the human eye to observe the sky more closely. Greek poet and theologian, John Demisiani gave the Italian name *telescopio* (from the Greek word "to see at a distance") to the instrument Galileo used. Use of the telescope to study the sky allowed celestial maps to be drawn. Astronomers studied the motion of planets and comets after English physicist Isaac Newton (1642-1727) developed the laws of motion and the law of universal gravitation. Telescopes improved and photography evolved.

Astronomy is the science that deals with everything in the space around and beyond Earth. That space is called the universe. The use of light waves helped astronomers to study the visible portion of the universe more closely.

The universe is a magnetic spectrum of both visible and invisible objects. Optical telescopes observe only those objects that emit electromagnetic radiation in the presence of light. In 1940, radio astronomy opened a new window to the universe. Radio telescopes detected

electromagnetic radiation emitted by stars and galaxies. These stars and galaxies either did not emit light or were too far away to be seen with optical telescopes. Through the use of radio telescopes, astronomers and scientists explored deeper into space.

NASA has launched a new generation of space telescopes, the Great Observatories. These include the Hubble Space Telescope (HST), the Compton Gamma Ray Observatory (CGRO), the Chandra X-ray Observatory (The Advanced X-ray Astrophysics Facility - AXAF), and the Spitzer Space Telescope, formerly known as the Space Infrared Telescope Facility (SIRTF). Space Explorers will be able to observe and study the magnetic spectrum filled with star clusters, clouds of gas, masses of energy, hot spots, exploding stars, black holes, and voids of the unknown. The new generation telescopes will take explorers from the closest stars to the outer rim of the universe.

This magnetic spectrum around and beyond Earth crackles, beckons, and echoes with waves caused by cosmic events like exploding stars and matter being sucked into black holes. These varying wavelengths are picked up by powerful telescopes. The new generation telescopes detect radio, infrared, visible, ultraviolet, X-ray, and gamma-ray wavelengths. Radio wavelengths tell scientists about cool clouds in space. Infrared wavelengths are clouds warmed by stars forming within the cloud or dying stars. Stars like our sun are studied through visible wavelengths. Hot spots or hot stars are detected through ultraviolet wavelengths. X-ray wavelengths detect ultra-high temperatures when matter falls on dead stars. Gamma-ray wavelengths pick up sudden bursts like exploding stars.

The Hubble Space Telescope (HST) was launched in April 1990 with the expectation that it would be the most outstanding telescope since Galileo's. These hopes were short-lived when

the first images that came back to earth were out of focus. NASA sent a repair crew into space in December 1993 to correct the telescope's optics. This mission was successful and now the Hubble transmits images of the objects several billion light years away with high resolution. High resolution means better, clearer pictures. The Hubble covers the visible and ultraviolet portions of the magnetic spectrum. It will expand the volume of observable space several hundred times.

In April 1991, the Compton Gamma Ray Observatory (CGRO) was placed in orbit. Its job was to scan the sky for gamma rays, invisible energy masses — radiation that reveals the most energetic phenomena in the universe — stars exploding and stars being born. Four instruments were mounted on the CGRO. The Burst and Transient Source Experiment (BATSE) observed the sky for low-energy gamma rays, bursts or flares. The Oriented Scintillation Spectrometer Experiment (OSSE) measured and timed gamma rays from sources as close as our sun to active galaxies a billion or more light years away. The Imaging Compton Telescope (COMPTEL) was similar to a camera taking pictures. It recorded the gamma ray bursts and reconstructs the image. The Energetic Gamma Ray Experiment Telescope (EGRET) scanned the sky for the highest gamma rays. Its main job was to examine quasars. The CGRO was deorbited and fell back into the Earth's atmosphere in 2000.

The Chandra X-ray Observatory (The Advanced X-ray Astrophysics Facility - AXAF) telescope was launched in July 1999. The Chandra X-ray Observatory studies X-ray portions of the magnetic spectrum rather than visible light or gamma rays. These images will allow scientists to analyze some of the greatest mysteries of the universe. Chandra will spend at least five years in an elliptical (oval-shaped) orbit, which will carry it one-third of the way to the

moon. This observatory will probe depths of the cosmos that were previously not visible through conventional viewing. Comets in our Solar system and quasars at the edge of the universe will be observed. Scientists hope these X-ray images will answer questions such as what and where is the "Dark Matter" of our universe? What is the powerhouse driving the explosive activity in many distant galaxies?

The fourth and final observatory in NASA's Great Observatories is the Space Infrared Telescope Facility (SIRTF), recently named the Spitzer Space Telescope. It was launched in August 2003. This is the largest diameter infrared telescope ever put into space, and it will follow the Earth around the sun. The Spitzer Space Telescope will span the infrared part of the magnetic spectrum with a thousand-fold increase in sensitivity. It will have capabilities to sense the heat of dark, faint or hidden objects. It will study low-temperature environments such as dusty interstellar clouds where stars are forming and the icy surfaces of planetary satellites and asteroids. Infrared telescopes will have capabilities of detecting other solar systems, and viewing the most distant galaxies at the edge of the universe.

Together, NASA's Great Observatories will provide an even bigger picture of the expanding universe. Questions will be answered. New questions will be asked. The data recorded by the eyes tracking the mysterious sky will give Space Explorers a better understanding of the universe's origin and evolution.

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