

## HST 10th Anniversary GSFC Remarks

10 April 2000

By my reckoning, the Hubble Space Telescope is one of the three most important optical telescopes in history, along with Galileo's first telescope and the 100-inch Hooker telescope on Mount Wilson, California.

Galileo created his first telescope in 1609. He had heard of the design principle demonstrated by an Dutch spectacle maker, and he fashioned the telescope with his own hands in about two weeks. During the first year when he observed the phases of Venus, he established beyond any doubt that the Earth and the other planets orbited the Sun. His proof of Copernicus' assertion forever changed humankind's understanding of its place in the universe.

The 100-inch telescope on Mount Wilson was commissioned in 1920. A great debate raged as to whether the nebulae we now call galaxies were part of the Milky Way or represented separate "island universes" of which the Milky Way was only one. Edwin Hubble's discovery of variable stars in the Andromeda nebula gave him the distance to that nebula, proving it was far outside of our own galaxy, the Milky Way. When he announced his discovery at a meeting of the American Astronomical Society in \_\_\_\_\_, the world suddenly knew that the universe was vastly greater than anyone had previously imagined.

A decade later, Edwin Hubble discovered that galaxies at increasingly larger distances were rushing away from us at ever increasing speeds. The universe is expanding, and we are part of an evolving cosmos. It was a revolution in cosmology similar to Copernicus' statement that the Sun was the center of our planetary system.

It is fitting that the first large space telescope is named in honor of Edwin Hubble. The Hubble Space Telescope has touched every major field of astrophysics. It has established the presence of giant black holes in the nuclei of galaxies, long suspected but difficult to prove by other means. It has taken the deepest picture of the universe and uncovered the most distant galaxies in the Hubble Deep Field. It has shown that galaxies in the past were smaller and less regular than galaxies today. Using the same kind of variable stars the Edwin Hubble discovered to measure the distance to the Virgo cluster of galaxies, it has refined our knowledge of the age of the universe to unprecedented accuracy.

We increasingly rely on space observatories for new discoveries about the universe. Freed from the confines of the Earth's atmosphere, spacecraft can expand our view of the universe in a way that Galileo's first telescope aided the human eye. Eventually, we will make almost all of our observations from space. This shift may take a few decades, but it is inevitable.

The future holds great promise for the advance of our understanding. With the Next Generation Space Telescope, we will see to the "edge of light" to the time when the first

stars and galaxies were born after the Big Bang. We will be able to detect the light from other planetary systems. It should be possible to sense the spectral signatures of planetary atmospheres in other star systems and look for the traces of extra-terrestrial life. This kind of observation is now an engineering problem, thanks to the use of spacecraft.

Galileo's telescope took two weeks to build. The 100-inch Hooker telescope took about two years. The Hubble Space Telescope took more than ten years to build. It required the skill of many engineers and managers, the foresight of politicians, and the vision of astronomers to realize its great accomplishments. It is a tribute to that extended Hubble team - the designers, builders, managers, scientists, and politicians - that it has succeeded so well today.

More importantly, the capabilities we will build to succeed Hubble are likely to produce a rash of new discoveries well beyond what we currently imagine. I am certain that the universe holds many more surprises to keep us humble about our role. For humankind, it is certain that the future of discovery is in space.