FAR FUTURE (D4)
Human Exploration Beyond Mars/Interstellar Precursors Missions (1.-D4.3)

Author: Mr. vaibhav kotla
India, kotlavaibhav9@yahoo.com

ASTRONOMICAL ADVANTAGES OF FUTURE SPACE OBSERVATORIES

Abstract

In a ground based telescope the angular resolution would be limited only by diffraction, rather than by the turbulence in the atmosphere, which causes stars to twinkle and is known to astronomers as seeing. During the late 1940's ground-based telescopes were limited to resolutions of 0.5–1.0 arc seconds, compared to a theoretical diffraction-limited resolution of about 0.05 arc sec for a telescope with a mirror 2.5 m in diameter. Secondly, a space-based telescope could see much sharper images and also observe in infrared and ultraviolet light, which are strongly absorbed by the atmosphere.They also don't have to deal with light pollution and weather, which ground based telescope might have to deal with.

As with ground based observatories, future space observatories will require increasingly large apertures in order to address the latest questions concerning the nature of our universe and the origin of the galaxies, stars, planets and life itself. Nearly a dozen 8-m to 10-m telescopes are currently in operation on the ground, and designs are being developed for telescopes with apertures 30, 50, and even 100 meters in diameter. Space-based telescopes will inevitably follow this trend in order to take advantage of their freedom from atmospheric effects, diurnal thermal cycling, and limits on their field of regard. The apertures of space telescopes are limited by the size of launch vehicle's payload fairings, however; so segmented deployable optics are currently required for telescopes with apertures larger than approximately 4-meters

The Hubble Space telescope launched in 1990 was one of most powerful telescope launched into space.Before the launch of HST, estimates of the Hubble constant typically had errors of up to 50

A major scientific advantage of space telescopes is that being above the atmosphere means that they can more easily observe different wavelengths of light that are harder to work with from the ground. On the ground, we can observe frequencies within the radio and optical range. Outside of that, the atmosphere can rapidly hurt the signal. Space telescopes don't have this problem. So areas of the electromagnetic spectrum like ultraviolet, x-ray, and gamma ray are easier to observe from space.

But there are some disadvantages. The larger the mirror, the harder and costlier it becomes to send it into orbit. Hubble, for example, is 2.4 meters wide. But on the ground, we are only limited by design. As we become better at designing telescopes, we figure out ways to make them bigger and bigger. We have hit the 10 meter mark Keck in Hawaii, and designs have been developed for building a telescope of 100 meters across and OWL which was later scaled down to 60 meters before being set aside to focus on the 42 meter E-ELT. Telescopes that use multiple, coordinated mirrors have also been built, and that design is a popular idea for building larger diameter scopes. By building scopes of this size, theoretically we could overcome enough of the atmospheric problems that image would be diffraction limited.

It should be noted that currently, Keck is not the largest anymore. SALT in South Africa is 11.0 meters, and LBT is currently in construction. LBT will have two 8.4 meter scopes used in tandem that will be equivalent to a 11.8 meter telescope.Estimates show that the LBT will be able to observe ten times sharper than the Hubble Space Telescope.The planned repairs to the Hubble should allow the telescope to function until at least 2013, when its successor, the James Webb Space Telescope, is due to be launched. The JWST will be far superior to Hubble for many astronomical research programs, but

will only observe in infrared, so it would complement but not replace Hubble's ability to observe in the visible and ultraviolet parts of the spectrum.

One advantage of ground based telescopes is availability. There are a growing number of larger telescopes on the ground, and a huge amount of smaller ones, currently operating. But there are limited number of space telescopes. This means that competition is stiff for the use of those telescope for research by astronomers.The ATLAS Telescope scheduled to be launched into the Sun-Earth L2 lagrange point would be launched by the proposed Ares V cargo launch vehicle to be used for Project Constellation, which is due to come online in 2020.The 16-meter version, on the other hand, would employ a folding segmented mirror similar to that proposed for the JWST. The Advanced Technology Large-Aperture Space Telescope (ATLAST) is a proposed 8 to 16-meter (320 to 640-inch) optical space telescope that if approved, built, and launched, would be a true replacement and successor for the Hubble Space Telescope with the ability to observe and photograph astronomical objects in the optical, ultraviolet, and Infrared wavelengths, but with substantially better resolution than the Hubble.

The Terrestrial planetary finder scheduled to be launched 2012 is a long baseline interferometer space mission and is a part of NASA's Origins program. This is a group of telescopes linked together across a "baseline". By gathering data with several telescopes linked in this way, very precise position measurements can be made. The TPF will concentrate on detecting terrestrial planets like our own outside our solar system and orbiting other stars. By studying near infrared spectral lines, astronomers can also detect several molecules which can indicate how earth-like these planets are.Another long-term space mission which has been identified by NASA is a far-infrared interferometer, covering infrared wavelengths not included in the TPF mission. This mission, which has not yet been give a name, would study the earliest and coolest phases of star and planetary disk formation and observes in the range of 7-20 microns which is the best range for searching for Earth-like planets.

The Darwin (space infrared interferometer project)which is scheduled to launch after 2015 is aldo to search for Earth-like planets around nearby stars, and to search for signs of life on these planets by studying infrared spectral lines in their atmospheres. Darwin would also be used as a general infrared astronomy observatory. The Darwin project would consist of about 6 individual telescopes combined as an interferometer about 100 yards across and would orbit between Mars and Jupiter, beyond the zodiacal dust which radiates infrared light at the wavelengths which will be used to search for planets.But the competition is stiff for the use of these space telescope for astronomers and scientists.