Topic 4 - Bigger and Smarter Telescopes

New Discoveries

Bigger telescopes enable astronomers to discover new bodies in space.

Sir William Herschel built a huge reflecting telescope and discovered the planet Uranus with it in 1773.

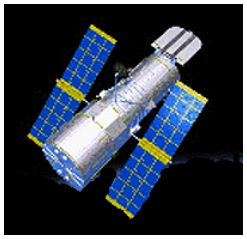
The largest refracting telescope was built at the Yerkes Observatory near the end of the nineteenth century. With it, Gerald Kuiper discovered methane gas on Saturn's moon, Titan, and two new moons of Uranus.

Combining Telescopes (*Interferometry*)

The technique of using a number of telescopes in combination is called interferometry. When working together, these telescopes can detect objects in space with better clarity and at greater distances than any current Earth-based observatory.
http://www.space.com/scienceastronomy/astronomy/interferometry_101.html

The Hubble Space Telescope (HST)
http://hubble.nasa.gov/
http://hubblesite.org/newscenter/

Hubble Facts:
http://hubblesite.org/reference_desk/facts_.and._figures/



*The **HST** makes one complete orbit of the Earth every 95 minutes.*

To improve the views of space, astronomers are able to access images from a telescope in space. Free from the interferences of weather, clouds humidity and even high winds, the **Hubble Space Telescope**, launched in 1990, orbits 600 kms above the Earth, collecting images of extremely distant objects. It is a cylindrical reflecting telescope, 13 m long and 4.3 m in diameter. It is **modular** (parts can be removed and replaced) and is serviced by shuttle astronauts.

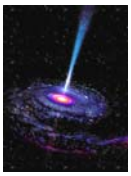
Adaptive Optics

The NTT (New Technology Telescope) is called 'adaptive optics' because computers control the image, always adapting the mirror to changes in the Earth's atmosphere. Astronomers attach adaptive optic technology to older telescopes as well. The computers remove the blurred effect of the atmosphere.

Distance to the Stars

A galaxy is a grouping of millions or billions of stars, gas and dust. It is held together by gravity.

The **Milky Way Galaxy** is the galaxy our solar system is a part of. It is shaped like a flattened pinwheel, with arms spiraling out from the center.



Black holes are actually invisible to telescopes. Their existence is only known by an indirect method – when celestial material comes close to a black hole it becomes very hot and very bright

(Map of the Milky Way)

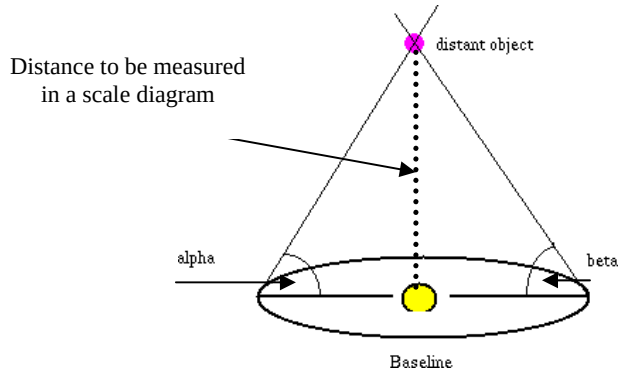
Birth of Stars (Great site showing an animation of how a star is born)
Stars form in regions of space where there are huge accumulations of gas and dust called **nebulae**. **Interstellar matter**, which makes up part of the nebulae, originated from exploding stars.

Telescopes enable astronomers to see further into space and identify distant stars. The problem they still have is how far are they from the Earth? The answer to this question lies in two methods. Triangulation and Parallax are two ways to measure distances indirectly, on the ground, or in space.

Triangulation

Triangulation is based on the *geometry of a triangle*. By measuring the angles between the **baseline** and a target object, you can determine the distance to that object.

To measure the distance indirectly, you need to know the length of one side of the triangle (baseline) and the size of the angles created when imaginary lines are drawn from the ends of the baseline to the object.



There are two activities in the Textbook **p. 390-391, 392** that you can do to practice this skill.

Parallax

Parallax is the apparent shift in position of a nearby object when the object is viewed from two different places. Astronomers use a star's parallax to determine what angles to use when they triangulate the star's distance from the Earth. The larger the baseline, the more accurate the result. The longest baseline that astronomers can use is the diameter of Earth's orbit. Measurements have to be taken six months apart to achieve the diameter of the orbit.