

Camp Eberhart Astronomy Program

AstroCamp Telescope Award

Welcome to the Telescope Award. When you have earned this award you will know all about the different types of telescopes and how to use the ones at AstroCamp at YMCA Camp Eberhart.

1. **What is the primary purpose of a telescope?**

To gather light or other types of electromagnetic radiation from celestial objects like the Sun, Moon, stars and other deep sky objects. Once collected, astronomers can either view the object with an eyepiece or capture its image using digital cameras.

2. **What is the secondary purpose of the telescope?**

To magnify the image of celestial object so that it becomes larger and can be studied in greater detail.

3. **Give a brief history of the optical telescope.**

Italian astronomer/scientist Galileo (1564-1642) was one of the first to view the many wonders of the night sky with a telescope. His telescope, which has a positive objective lens and a negative eyepiece lens, is called the **Galilean** telescope and is thought to have been invented by Dutch lens maker Hans Lippershey in 1608. In 1611, German Johann Kepler used a positive eyepiece lens inventing the **refracting** telescope. Englishman Chester Hall built the first **achromatic** refractor in 1729. In 1662, Englishman Sir Issac Newton used a mirror to gather the light from celestial objects and the **reflecting** telescope. In the same year, Guillaume (gee-ohm) Cassegrain of France used 2 mirrors to gather light and the **Cassegrain** telescope was born. The final variation is a combination of lenses and mirrors in what is known as a **catadioptric** or **Schmidt-Cassegrain** telescope.

Reflecting telescopes have a great advantage in that they are **achromatic**, meaning they bring all colors to the same focus.

4. **Explain the danger of pointing a telescope at the Sun.**

NEVER LOOK AT THE SUN THROUGH AN UNFILTERED TELESCOPE!!! Blindness or other irreparable damage will occur from looking at the Sun with an unfiltered telescope. Always use a solar filter or a projection plate to observe the Sun's image from a telescope.

5. **Why should you never use a white flashlight around a telescope that is in use at night?**

Light from a flashlight that is shined into a telescope not only is an annoyance but can cause an observer to lose their night vision and temporarily blind them.

6. Describe both types of telescope mounts and their advantages and disadvantages.

- a. **Altazimuth:** Like a camera tripod, moves horizontally & vertically. While this mount is the simplest, lightest & least expensive, it can't follow the movement of the stars. A Dobsonian mount is of this type.
- b. **Equatorial:** Like an altazimuth but tipped so that the vertical axis points at Polaris and so follows the movement of the stars. Is generally heavier and more expensive.

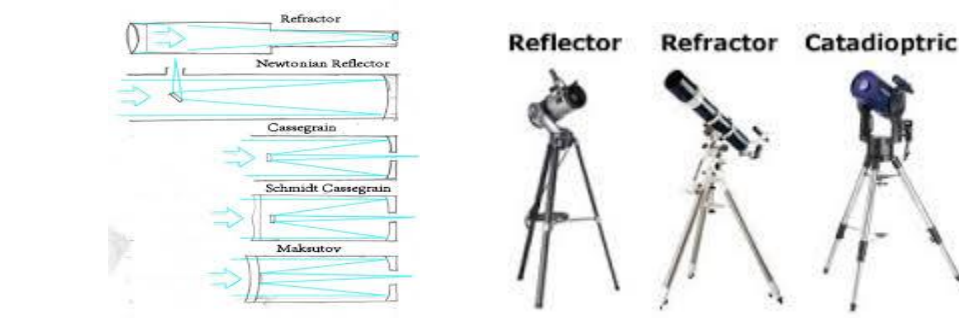


7. Name 8 types of telescopes, explaining how each is different. Name one telescope or observatory for each kind:

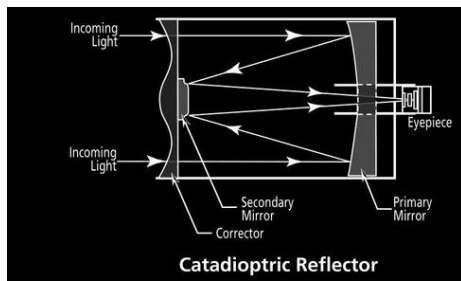
Telescope Type	Description	Examples
Refracting	Lenses gather light	Galileo's telescope Lick Observatory, Mt. Hamilton CA (36 inches) Yerkes Observatory, Williams Bay, WI (40 inches)
Reflecting	Mirrors gather light	Newtonian reflector is one popular type. Hale Telescope, Palomar Observatory, CA (5 meter /200 inches) Kitt Peak Observatory, Mayall Telescope (4 meter/158 in) Keck Telescope, Mauna Kea, Hawaii (10 meter/400

		inches) Hubble Space Telescope (2.4m)
Catadioptric	Mirrors and lenses gather light	Schmidt-Cassegrain, Maksutov and Schmidt-Newtonian telescopes
Radio & millimeter/submillimeter	Gathers radio radiation	Arecibo Radio Telescope, Puerto Rico (305 m (1,001 ft)) Jansky Very Large Array, New Mexico (27 dishes of 25m ea) Green Bank Telescope, WV (100m) Atacama Large Millimeter/submillimeter Array (ALMA), Chile (Array of 66 12m and 7m dishes)
Infrared	Gathers infrared radiation	NASA Infrared Telescope, Mauna Kea, Hawaii Sofia Airborne Observatory, Herschel Space Observatory (3.5m) Wide-field Infrared Survey Explorer (WISE .4m) Spitzer Space Telescope (.85m) James Webb Space Telescope (JWST 6m)
Ultraviolet	Gathers ultraviolet radiation	ASTRO, carried in Space Shuttles ROSAT Low Earth Orbit Satellite (.85m) SOHO high earth orbit Galaxy Evolution Explorer (GALEX .5m)
X-Ray	Gathers X-ray radiation	Einstein Observatory ROSAT Low Earth Orbit Satellite (.85m) XMM-Newton Compton X-Ray Space Observatory Chandra Space Telescope NuStar
Gamma Rays	Gathers gamma ray radiation	Fermi Gamma Ray Space Telescope Swift Gamma-Ray Burst Mission (.3m) INTERNATIONAL Gamma-Ray Astrophysics Laboratory (INTEGRAL) Astrorivelatore Gamma ad Immagini LEggero (AGILE)

8. Name the 3 types of visual light gathering telescopes and explain how each works.



9. Name the parts of a reflector & refractor telescope.



10. Explain the difference between an altazimuth & equatorial mounting.
11. Demonstrate how to set up, use and take down a reflector & refractor telescope.
12. Explain how to SAFELY view the Sun, sunspots and solar eclipses on a projection screen with a reflecting telescope.
13. At night, use a telescope to:
 - a. Locate 3 stars
 - b. Locate 1 galaxy & 1 nebula & 1 star cluster
 - c. Using manual adjustment, keep an object in view for 5 minutes