

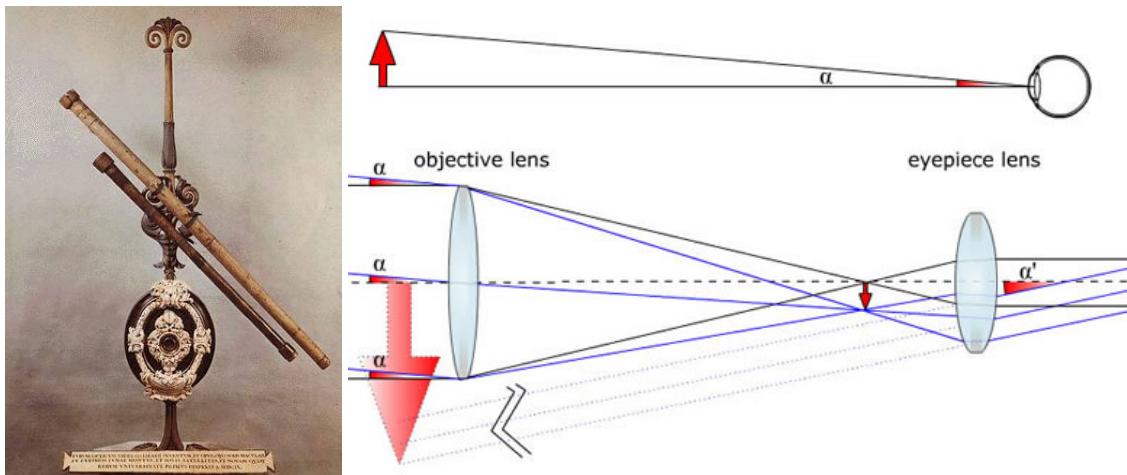
# The Tools of Space Exploration Lab 1

## Telescopes

Today you are going to construct two completely different telescopes. The first being a refractive telescope and the second a reflective telescope.

### The refractive Telescope

The very first telescopes were believed to have begun to appear around the year 1608 and were credited to opticians Hans Lippershey and Zacharias Janssen as a type of spyglass. These early refracting telescopes consisted of a convex objective lens and a concave eyepiece and the telescope simply slid inside itself to focus. Galileo greatly improved upon this design and is often credited as being the first to invent the first astronomical telescope.



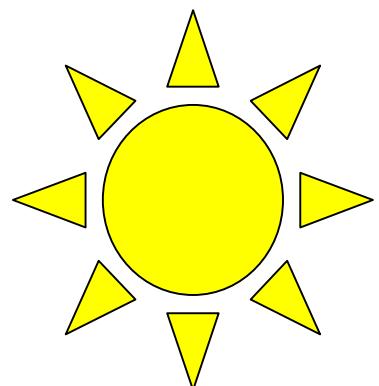
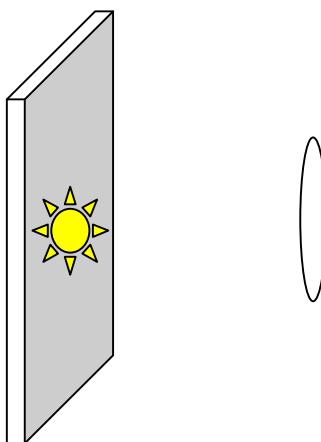
To construct a simple Galilean Telescope, all you really need is two convex lenses.

### Materials

Two Convex Lenses

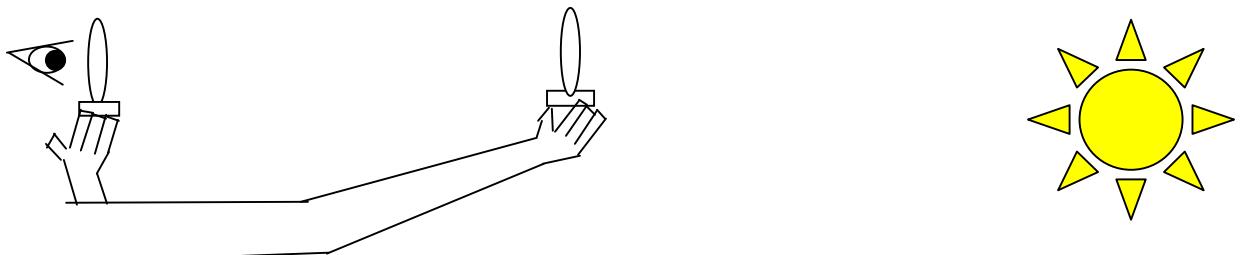
### Procedure

First, familiarize yourself with some of the lenses available. Using a window or other bright source, cast an image onto a blank sheet of paper. See below:



Secondly, choose two lenses of two different focal lengths. One lens should project an image further away from the paper than the other.

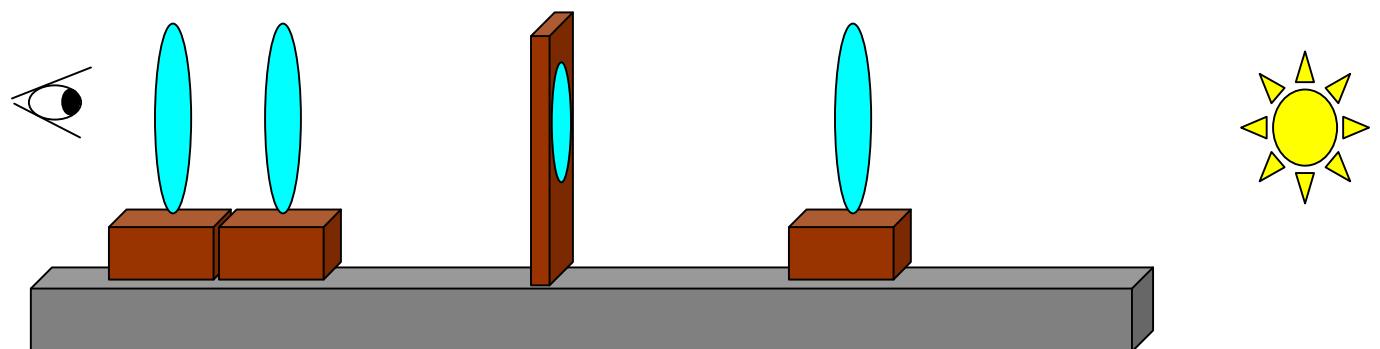
Next, hold the lens with the longer focal length at an arms length away and hold the other lens close to your eye as shown below.



Finally, bring the lens at arms length in while holding the other lens near your eye until the distant object comes into focus.

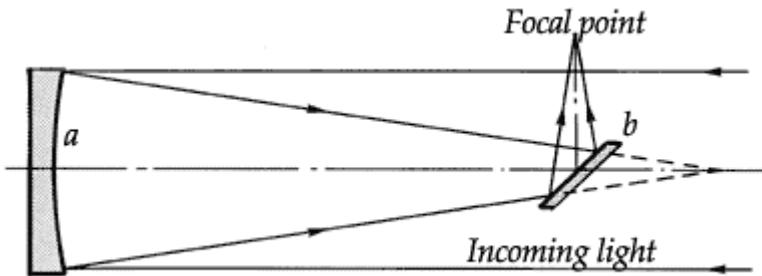
### Options:

Place the lenses on top of a table so that they are on the same level. Now you can try to insert other lenses up to about 4 lenses to maximize or invert the image...See below:



## Reflective Telescope.

1668--Newton produces the first successful reflecting telescope, using a two-inch diameter concave spherical mirror, a flat, angled secondary mirror, and a convex eyepiece lens. (See the drawing of Newton's telescope in this website.) As is often the case in physics, the simplest solution is often the most practical one. The reflector telescope that Newton designed opened the door to magnifying objects millions of times--far beyond what could ever be obtained with a lens.



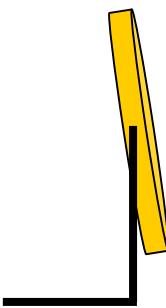
This one can be tough to build, but well worth the effort if you get it to work.

### Materials

- 1 metal framed magnifying mirror
- 1 plastic framed mirror (also with magnifying side but of poor quality)
- 1 convex lens

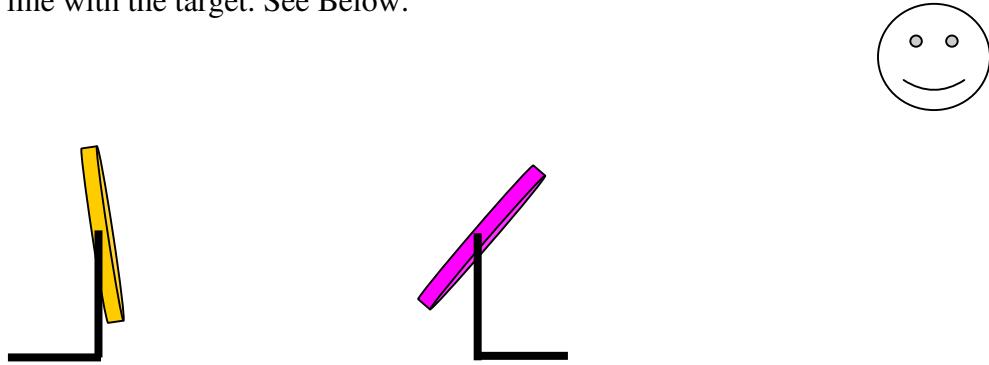
### Step 1.

Place the metal framed magnifying mirror on a table with the magnifying side aimed roughly at a target. See below:

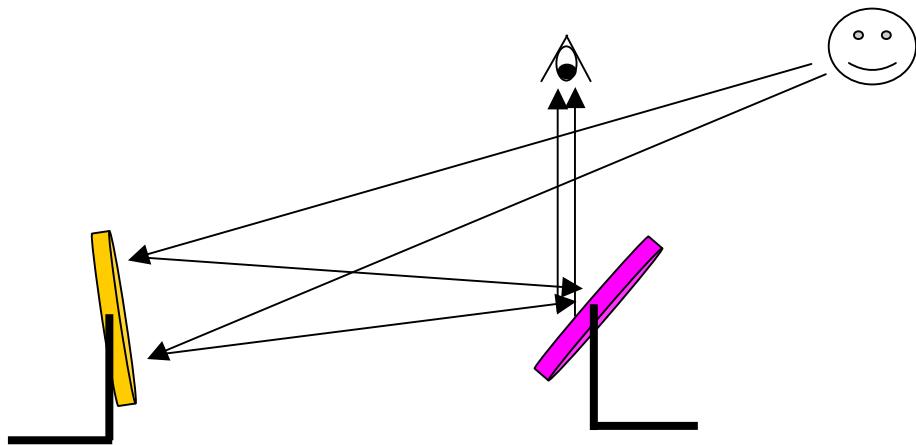


**Step 2**

Place the plastic framed flat mirror about .6 meters away from the magnifying mirror but still in line with the target. See Below:

**Step 3**

While looking down into the plastic flat mirror adjust the mirrors so that you get a passing view of your target. See light path below:

**Step 4**

Add the convex lens to act as an eyepiece. See below:

