Relationships and Attributes of Objects in the Solar System

Standard 3: Students will understand the relationship and attributes of objects in the solar system.

Objective 2: Describe the use of technology to objects in the solar system and relate this to science's understanding of the solar system.

a. Describe the use of instruments to observe and explore the moon and planets.

ELA RI.6.1

Title: Telescopes

Description: Students will use a graphic organizer to analyze the text for meaning.

Materials:

Copies of the text: http://science.howstuffworks.com/telescope1.htm

Graphic organizer at: http://www.eduplace.com/graphicorganizer/pdf/spider.pdf

Procedures:

1. Ask students to work in groups and do a "Brain Drain" on the subject of telescopes. Each group of students should write down all the words or phrases they can think of when they think of telescopes.
2. Explain the use of the "spider" graphic organizer. Each leg becomes more and more specific information.
3. Allow students time to read the article and create their "spiders". They can work in groups if desired.
4. Ask students to pass around their work and compare different ways it could be done.

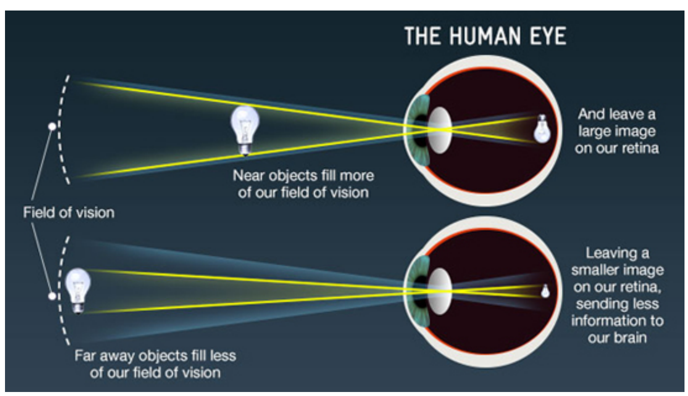
How do telescopes let us see so far into space?

Everything you need to know about how telescopes work.

Why is your eye so bad at seeing things far away?

Human eyes can see long distances. In fact the Andromeda Galaxy can be seen with the naked eye and that's 2.5 million light-years away. But even a massive galaxy, like Andromeda, appears to us as a tiny point in the sky.

It makes sense that as an object gets further away it becomes harder to see. But why this happens helps us understand how vital telescopes have been in exploring the universe.



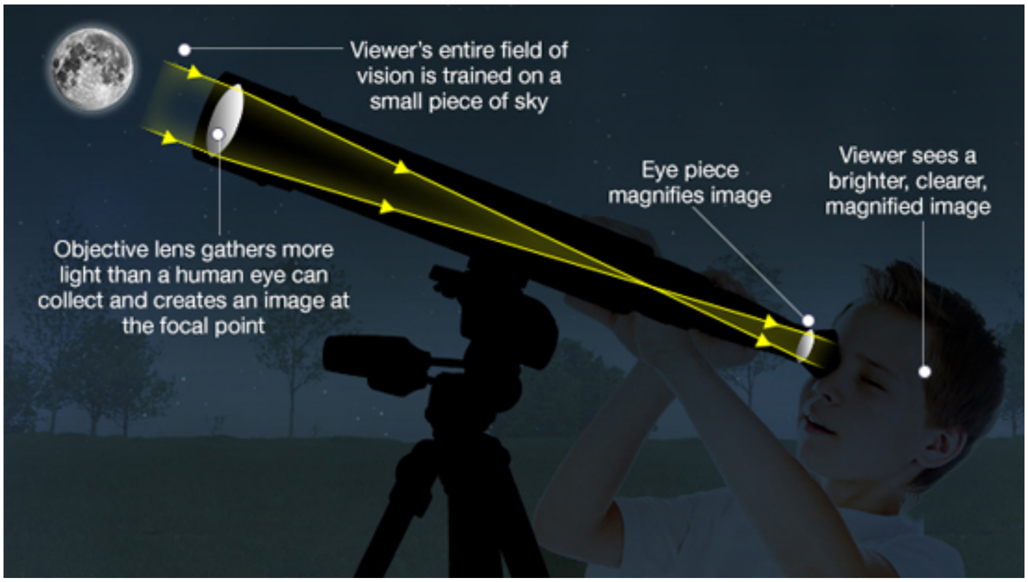
As an object gets further away less of its light will reach your eye. The image takes up less space on your retina (the light-sensitive tissue at the back of your eye), making the image smaller. This makes details of the

Do bigger lenses give us a bigger image?

To make a distant object appear brighter and larger, we effectively need a bigger eye to collect more light. With more light we can create a brighter image, we can then magnify the image so that it takes up more space on our retina.

The big lens in the telescope (objective lens) collects much more light than your eye can from a distant object and focuses the light to a point (the focal point) inside the telescope.

A smaller lens (eyepiece lens) takes the bright light from the focal point and magnifies it so that it uses more of your retina.



A telescope's ability to collect light depends on the size of the objective lens, which is used to gather and focus light from a narrow region of sky.

The eyepiece magnifies the light collected by the objective lens, like a magnifying glass magnifies words on a page. But the performance of a telescope depends almost entirely on the size of the objective lens, sometimes called the aperture.

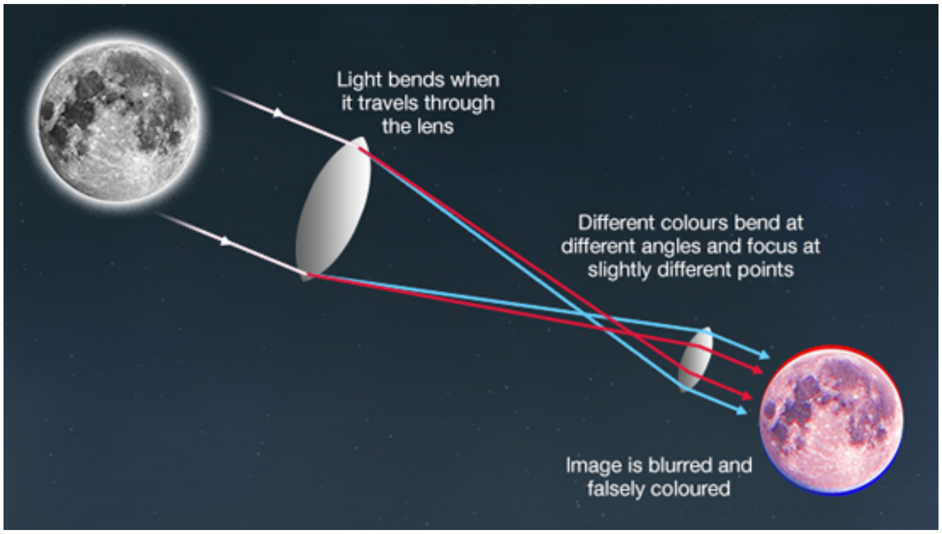
What's the big problem with refracting telescopes?

If you've ever seen light bend through a prism you probably have an idea of where the problem lies with a refracting telescope; it's the lens.

When light travels through glass it slows down, that's why it bends. Lenses are shaped perfectly to bend light in particular ways. But the amount light bends depends on the wavelength, or color, of the light.

White light is a mixture of all colors, from red to violet. Red light bends the least and violet light bends the most.

When white light travels through the objective lens, the different colors bend at different angles and are focused at slightly different points. Different colored images are misaligned creating a blurry image with fringes of color along the boundaries that separate dark and bright parts.

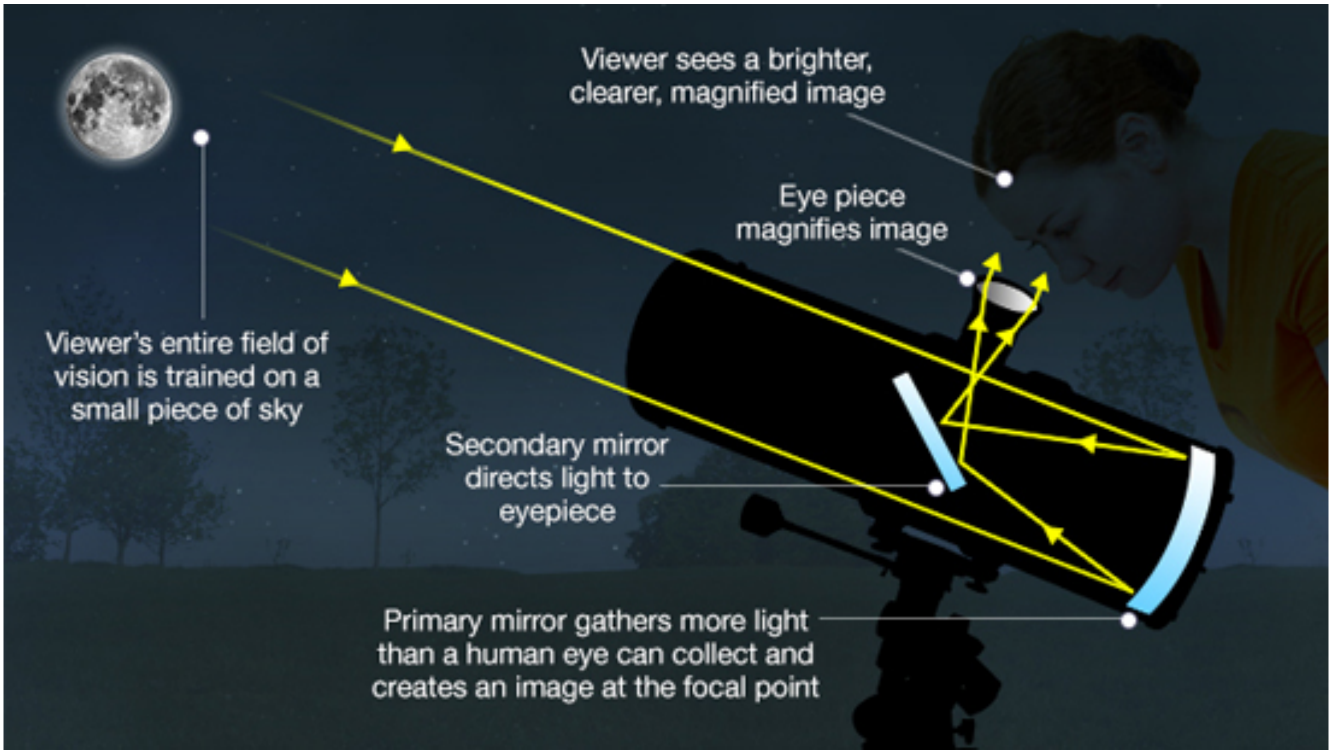


Can telescopes with mirrors correct the problem?

Reflecting telescopes magnify distant objects using the same principle: more light is collected and focused to a point and this is magnified so that it fills your field of vision.

But instead of using a lens, a curved mirror (primary mirror) collects the light and reflects it to a focus. Because light doesn't pass through the mirror, it doesn't bend the different colors by different amounts, the way a refracting lens does.

A small mirror (secondary mirror) is placed in the path of light from the primary mirror to reflect the image towards the eyepiece. The secondary mirror must be very small so that it doesn't block the light from the distant object as it travels to the primary mirror.



Another benefit of using mirrors instead of lenses is that big mirrors are easier and cheaper to make than big lenses. Reflecting telescopes can be much larger and therefore look deeper into space.