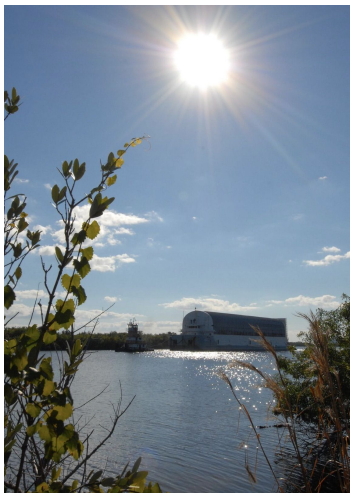
Reading: Observing Stars

Obtaining Information from Scientific Texts	
Before	1. **With your group**: Identify the question(s) you are trying to answer. Record them in your notebook.

During	2. Read once **individually** for understanding to see what the reading is about.
	• Read for the gist - skim the title, headings, and images.
	  • What is the central idea or claim?
	• Select methods for marking up the text. For example...
	  • Keep track of questions you have in the margins.
	  • Circle key words.
	  • Put question marks by words you want to learn more about.
	  • Underline main ideas.
	• Examine any images, graphs, or tables. Write one sentence about the central point of each image, graph, or table.

	3. Read a second time out loud **with your group** to identify the key ideas.
After	4. Summarize the key ideas in your notebook.



The Sun is a star, just like the thousands of others we see in the sky each night. But it looks so big. Is that because it is bigger than all the other stars?

The Sun is not bigger than all the other stars in the sky. The only reason the Sun appears so big is because it is closer to us than any other star. The Sun is just 93,000,000 miles (or 14,88,000,000 km) away from Earth. That may seem like a big number, but compared to the other stars it is right next door! Most of the stars that we see at night are more than 1,000 times farther away from us than the Sun is. The next closest star to us after the Sun is 25,000,000,000,000 (25 trillion) miles away (or 40,233,600,000,000 km).

The distances to other stars are so big that we don't typically use miles or kilometers to describe them. This is because we will end up having to write too many zeroes. Instead, we talk about these big distances in terms of how long it takes for light from them to get to us. Light is the fastest thing in the universe. It travels at 670,616,629 miles per hour. If you could travel at this speed (the speed of light), you could go around Earth 7.5 times in one second.

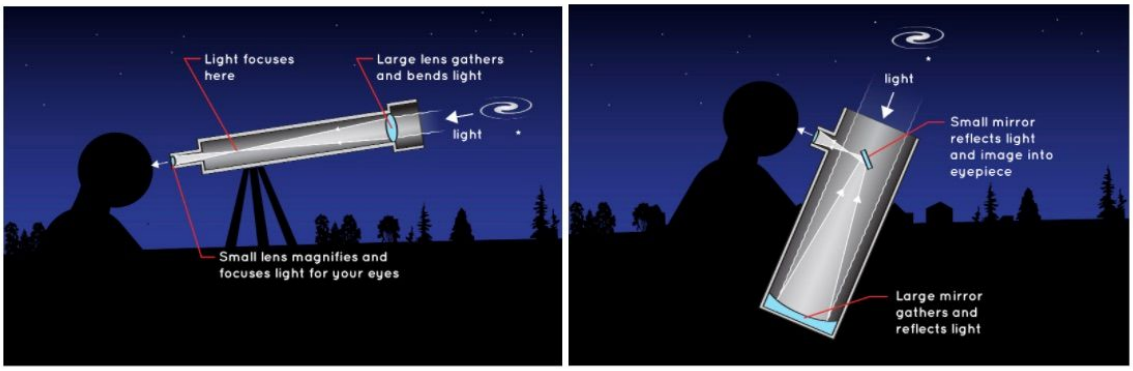
Even at this very fast speed, light still takes 8 minutes to travel the 93,000,000 miles from the Sun to Earth. And it takes 4.5 years to travel from the closest star beyond our Sun. Because light from the next closest star to us takes 4.5 years to get to us, we say it is 4.5 light years away. That may not seem too far away, until you remember that only light can move that fast. If we wanted to send our fastest spacecraft and robot we've ever built to the closest star beyond our Sun, it would take about 6,300 years to get there!

Because the stars are so far away, astronomers who study the stars cannot go there to collect data, like other scientists can. Biologists can collect lab specimens of plants and animals to dissect and analyze. Chemists can mix chemicals in the laboratory and observe reactions. Even planetary astronomers can send spacecraft and robots to the surface of Mars and analyze rock samples. But astronomers who study stars cannot do any of that. If they want to know more about what is out there, the only data they have come from the light stars produce, which has traveled for thousands, and sometimes even millions of years, through empty space.

Luckily, light is very special. Light is a wave, like sound. A wave transfers energy from one place to another place. Sound transfers energy by compressing matter. But light is different.

We did a couple experiments with vacuum chambers in both the *Sound Unit* and *Magnets Unit* units showing how light and sound transfer energy differently. As shown in the image below, we put a cell phone inside a vacuum chamber and took out all the air. We heard nothing. Sound cannot travel through empty space, because it travels as compressed particles. But we could still see the cell phone. When we see something, light waves are coming from that object and going into our eyes. This was happening when we could see the cell phone, even though there was an empty chamber between the phone and our eyes. This is not like sound. Light clearly does not need air in order to travel. This is what makes light so special. It is a wave that can transfer energy through outer space.

We can see the light from space with our eyes very well. That is why we can see stars when we look up at night. But we can also use scientific instruments to collect the light from stars and make objects appear brighter and bigger so that we can study them more clearly. There are two ways to do this. One way is to use a curved mirror to collect and focus light. The second way is to use a lens, like a lens in a pair of eyeglasses. The devices that use either of these methods to collect starlight are called telescopes.



When we look at stars through a telescope, light that has traveled for hundreds or thousands of years is collected and then refocused onto your eye, a camera, or a light detector. The result of using a telescope is an image of the star that is much brighter. This brighter image can be enlarged without losing too much information. Below are some images of stars taken through a telescope this way. These stars are (from left), Polaris, Betelgeuse, and Alpha Centauri.