Astronomers use telescopes to learn about the universe. Since the time of Galileo, optical telescopes have grown in aperture from a centimeter to ten meters, and astronomers have put telescopes in space and have used them to detect electromagnetic radiation at wavelengths not visible to the eye. In no more than 750 words, address the following questions about telescopes:

1. What are the advantages of large telescopes? Provide at least one.
2. Why do astronomers want telescopes in space when putting them there is expensive?
3. What are some examples of wavelength regions beyond the spectrum of visible light where astronomers can learn about the universe? Provide at least two.

Project Title: Telescopes: Limitations and New Applications

1

Larger telescopes collect more light and deliver sharper images (by virtue of their greater angular resolution). Greater collection aperture and angular resolution enable finer and finer detail in fainter objects, allowing astronomers to yield greater detail in cluttered regions of space and more distant views of the universe.

(48 words)

2

While putting telescopes in space is expensive, doing so allows astronomers to avoid the limitations that affect ground-based telescopes. Namely, space-based telescopes need not worry about light pollution or the blurring effects of the earth’s atmosphere. Space-based telescopes may also operate over a greater span of the electromagnetic spectrum as earth’s atmosphere is opaque at many wavelengths, preventing the operation of ground-based telescopes at some frequencies.

(66 words)

3

The visible spectrum makes up a relatively narrow span within the electromagnetic spectrum and only a portion of the spectrum that astronomers use. In addition to the visible light spectrum, astronomers also commonly use telescopes that operate at radio and ultraviolet wavelengths. Radio telescopes have also long employed interferometry to combine multiple telescopes into very large arrays, effectively increasing the available baseline or aperture, to increase the angular resolution available. While visible spectrum telescopes have recently been able to start implementing this technique as well, they are still not able to achieve the same angular resolution that radio telescopes provide.

More recently, astronomers have also been using special telescopes and equipment to detect gravitational waves, permitting new research and an increased understanding of black holes and the creation of our universe.

(131 words)