FYI Observing Different Types of Electromagnetic Radiation

All astronomical objects emit electromagnetic radiation. Each form of electromagnetic radiation gives a different type of information about the object. Below is a summary of the primary kinds of electromagnetic radiation and the information they provide about astronomical objects.

X-rays and Gamma Rays

X-rays and **gamma rays** are the highest-energy forms of electromagnetic radiation. They are produced by material that is heated to millions of degrees, and they are often a result of cosmic explosions, high-speed collisions, or material moving at extremely high speeds. X-ray and gamma-ray astronomy has led to the discovery of black holes in space and has added much to our understanding of supernovae, white dwarfs, and **pulsars**. Also, observations of x-rays and gamma rays from the sun allow us to study its hottest regions.

Ultraviolet

Ultraviolet radiation (also called **ultraviolet light**) has lower energy than x-rays but higher energy than visible light. Very young massive stars, some very old stars, bright **nebulae**, young white dwarf stars, active galaxies, and **quasars** all shine brightly in the ultraviolet. Ultraviolet observations have contributed to our understanding of the sun's atmosphere and tell us about the temperatures of hot, young stars. Ultraviolet radiation also gives astronomers information about the chemical composition, densities, and temperatures of gas and dust surrounding and between stars.

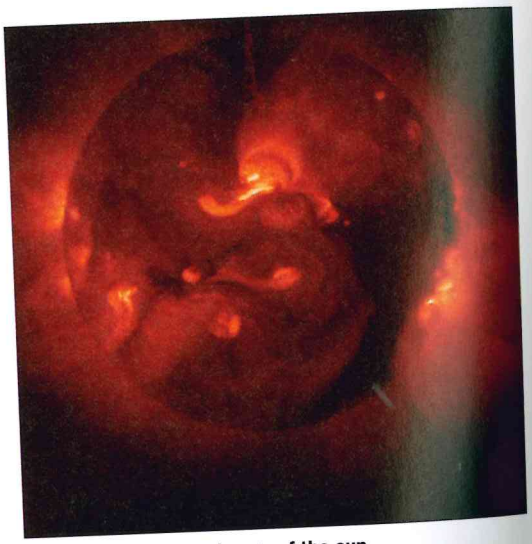

Figure 1-10: An x-ray image of the sun

Visible Light

Visible light is what we see with our eyes. In astronomy, optical **telescopes** are used to collect and magnify visible light. Visible light observations have given us the most detailed views of our solar system, and have brought us fantastic images of nebulae and galaxies. Astronomers also use the different colors of visible light to understand the composition, motion, temperature, and many other features of astronomical objects.

Figure 1-11: An infrared image of M16, the Eagle nebula

Infrared

Infrared radiation (also called **infrared light**) has lower energy than visible light and is the type of electromagnetic radiation emitted by objects (including humans) that we perceive as heat. Infrared light is not as affected by dust and molecules as higher-energy electromagnetic radiation is. Therefore, infrared observations are used to peer into dusty star-forming regions and into the central areas of our galaxy. Cool stars and cold interstellar clouds emit relatively little visible light, so are easier to observe in the infrared.

Radio

Radio waves have very low energy compared to other forms of electromagnetic radiation. Radio waves bring us information about **supernovae**, quasars, pulsars, regions of gas between stars, and interstellar molecules. It was through radio waves that astronomers observed their most conclusive evidence of the formation of the universe through the **big bang**.

Checking In

1. How do the different forms of electromagnetic radiation differ from one another?
2. Name four objects or processes that are better observed using a type of electromagnetic radiation other than visible light.

The Very Large Array (VLA) radio telescope in New Mexico