The Electromagnetic Spectrum and Astronomy

Radio

Radio waves are very long compared to waves from the rest of the spectrum. Most radio radiation reaches the ground and can be detected during the day as well as during the night. Radio telescopes use a large metal dish to help detect radio waves. The study of the radio universe brought us the first detection of the radiation left over from the Big Bang. Radio waves also bring us information about supernovae, quasars, pulsars, regions of gas between the stars, and interstellar molecules.

Microwave

Only a few narrow bands of microwave light can be observed by ground-based observatories. To view the rest of the microwave universe we need to use space-based observatories or high-flying aircraft. Microwave energy can penetrate haze, light rain and snow, clouds, and smoke, which makes it good for taking pictures of the Earth's surface from space. Also, scientists have discovered that the sky is a source of microwaves at nearly the same direction in every direction, most often called the microwave background. This background is believed to be the remnant from the "Big Bang" scientists believe our Universe began with.

Infrared

Only a few narrow bands of infrared light can be observed by ground-based observatories. To view the rest of the infrared universe we need to use space based observatories or high-flying aircraft. Infrared is primarily heat radiation and special detectors cooled to extremely low temperatures are needed for most infrared observations. Since infrared can penetrate thick regions of dust in space, infrared observations are used to peer into star-forming regions and into the central areas of our galaxy. Cool stars and cold interstellar clouds which are invisible in optical light are also observed in the infrared.

Visible

The visible light from space can be detected by ground-based observatories during clear sky evenings. Advances in techniques have eliminated much of the blurring effects of the atmosphere, resulting in higher-resolution images. Although visible light does make it through our atmosphere, it is also very valuable to send optical telescopes and cameras into space. In the darkness of space we can get a much clearer view of the cosmos. We can also learn much more about objects in our solar system by viewing them up close using space probes. Visible light observations have given us the most detailed views of our solar system, and have brought us fantastic images of nebulae and galaxies.

Ultraviolet

Most of the ultraviolet light reaching the Earth is blocked by our atmosphere's ozone layer and is very difficult to observe from the ground. To study light in this region of the spectrum astronomers use high-altitude balloons, rockets, and orbiting observatories. At ultraviolet wavelengths, most stars fade from view because they are too cool to emit such high energy light. But very young massive stars, some very old stars, bright nebulae, white dwarfs stars, active galaxies and quasars shine brightly in the ultraviolet. Ultraviolet observations have contributed to our understanding of the Sun's atmosphere and tell us about the composition and temperatures of hot, young stars. Light from this part of the spectrum also gives astronomers information about the chemical composition, densities, and temperatures of interstellar gas and dust. Discoveries have included the existence of a hot gaseous halo surrounding our own galaxy.

X-Ray

Since high-energy radiation like X-rays is absorbed by our atmosphere, observatories must be sent into space to study the Universe at these wavelengths. X-rays are produced by matter which is heated to millions of degrees and are often caused by cosmic explosions, high speed collisions, or by material moving at extremely high speeds. This radiation has such high energy that specially made, angled mirrors must be used to help collect this type of light. X-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. High-energy observations also allow us to study the hottest regions of the Sun's atmosphere.

Gamma-Ray

Like X-rays, gamma rays are absorbed by our atmosphere, so gamma ray observatories are often satellites that are sent into space. However, there are special techniques scientists can use to study gamma rays from the Earth. Many of the same objects that produce X-rays also produce gamma rays, like black holes, supernovae, white dwarfs, and pulsars. However, since gamma rays have even higher energy than X-rays, only the most extreme environments in even these objects produce gamma rays.

All information either written from prior knowledge or taken from the following sources:

- http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_astronomy/observing.html
- http://science.hq.nasa.gov/kids/imagers/ems/micro.html
- http://imagine.gsfc.nasa.gov/docs/science/know_l1/emspectrum.html