

Planetary Wonderings

November 2006 Focus: Infrared

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What is “Infrared?”

Our eyes are designed to detect visible light waves (or visible *radiation*). Visible light is one of the few types of radiation that can penetrate our atmosphere and be detected on the Earth's surface. Most forms of light (a.k.a. *electromagnetic spectrum*) we cannot see.

The electromagnetic spectrum includes gamma rays, X-rays, ultraviolet, visible, infrared, microwaves, and radio waves. The only difference between these different types of radiation is their *wavelength* or *frequency*. Wavelength increases and frequency (with energy and temperature) decreases from gamma rays to radio waves. Visible light, radio, some infrared, and a very small amount of ultraviolet radiation reach the Earth's surface from space. Our atmosphere blocks out the rest, much of which is very hazardous, if not deadly, for life on Earth.

Infrared radiation lies between the visible and microwave portions of the electromagnetic spectrum. Infrared waves have wavelengths longer than visible and shorter than microwaves.

The primary source of infrared radiation is heat or thermal radiation. This radiation is produced by the motion of atoms and molecules in an object. The higher the temperature, the more the atoms and molecules move and the more infrared radiation they produce. Everything emits infrared radiation. Even objects that we think of as being very cold, such as an ice cube, emit infrared

Infrared Astronomy

Infrared Astronomy is the study of infrared radiation emitted from objects in the Universe. Since all objects emit infrared radiation, Infrared Astronomy involves the study of just about everything in space.

The Universe sends us a tremendous amount light. Much of this is in the infrared, which we cannot see with our eyes or with visible light telescopes. Only a small amount of this infrared information reaches the Earth's surface, yet by studying this small range of infrared wavelengths, astronomers have uncovered a wealth of new information. Only since the early 1980's have we been able to send infrared telescopes into orbit around the Earth, above the atmosphere which hides most of the Universe's light from us. The new discoveries made by these infrared satellite missions has been astounding. The first of these satellites - IRAS (Infrared Astronomical Satellite) - detected about 350,000 infrared sources, increasing the number of cataloged astronomical sources by about 70%.

In space, there are many regions and objects which are hidden from optical telescopes. Some are embedded in dense regions of gas and dust. Others are much too cool and faint to be detected in visible light. Many of these can be “seen” in infrared. Studying infrared in the Universe helps us understand more about it.

A Sampling of Missions to Study Infrared Radiation

The Spitzer Space Telescope (formerly SIRTF, the Space Infrared Telescope Facility) was launched on 25 August 2003. During its mission Spitzer is obtaining images of the universe in infrared. It is the largest infrared telescope ever launched into space. Because it is detecting infrared radiation in the universe, Spitzer was built to minimize

heat radiation both from the sun as well as itself. Very recently Spitzer made the first recordings of temperatures on a planet beyond the solar system.

The Wide-field Infrared Survey Explorer, or “Wise” for short, is scheduled to launch in late 2009, and will scan the entire sky in infrared light. It will accomplish this in only six months time and 1,500,000 pictures. It will be 500 times more sensitive than IRAS. The atlas created will be used by the James Webb Space Telescope, Hubble’s replacement.

Resource of the Month: If you have an interest in space telescopes check out Science Daily at http://www.sciencedaily.com/news/space_time/space_telescopes/

Activity of the Month: In the year 1800, Sir Frederick William Herschel discovered infrared using only a prism and three thermometers. You can perform the experiment yourself! Details are at http://coolcosmos.ipac.caltech.edu/cosmic_classroom/classroom_activities/herschel_experiment2.html .

Suggestions, questions, and comments about “Planetary Wonderings” are welcomed and may be directed to stargazer @ keeplookinup.net.

Remember to *keep looking up!*

Sources: <http://www.spitzer.caltech.edu/>
<http://wise.ssl.berkeley.edu/>