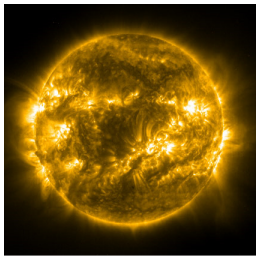
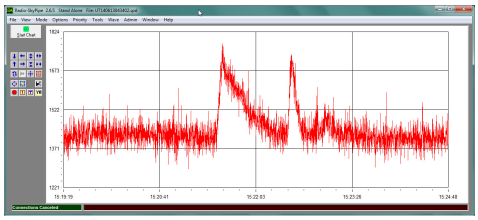
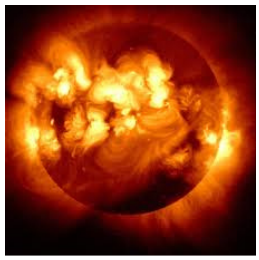
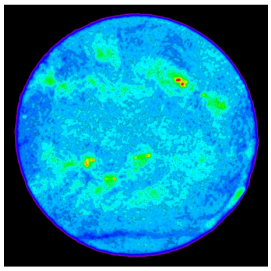
Sun – Part 18 - Sunlight 2


UV image at solar maximum


Solar radio emissions


Infrared image


Radio image

UV radiation Usually invisible to humans, but visible to birds, some fish and insects, this is a major source of energy in sunlight. The hotter a star, the proportionately more ultraviolet it emits. Ultraviolet radiation was discovered by Johann Whilhelm Ritter, in 1801, when he noticed that invisible rays just beyond the violet end of the visible spectrum darkened silver chloride soaked paper much more quickly than violet light itself.

The Sun emits at all ultraviolet wavelengths, including extreme UV where it crosses into X-rays. Earth's atmosphere absorbs around 77% of the Sun's ultraviolet, including almost all the most dangerous shorter wavelength (UVC) emissions, while allowing UVA and some UVB rays to reach the surface. UVC from the Sun is absorbed by atmospheric oxygen, generating the ozone in the ozone layer. This layer is important in blocking much UVB and any remaining UVC radiation. At the top of the atmosphere, ultraviolet forms around 10% of sunlight, but at ground level, only about 3%.

Visible radiation The Sun is the dominant source of visible light seen by life. The solar corona can be seen in visible light, but it is so faint that it is only observable when the bright photosphere which normally overwhelms it is obscured. eg total solar eclipse, solar shield in images.

Solar visible radiation is the strongest output range of the Sun's total irradiance spectrum, the energy at all wavelengths that falls on a surface in a given time. This is perhaps surprising, because this range is so narrow. Only a very small range of the electromagnetic radiation is visible to humans and human eyes are most tuned to the radiation that the Sun most abundantly emits. This suggests a strong link between solar energy emission and the evolution of life on Earth.

Infrared radiation This was discovered in 1800 by William Herschel. While using a prism to refract light from the Sun, he detected the infrared beyond the red part of the spectrum through an increase in temperature recorded on a thermometer. He called them 'calorific rays'. The term 'infrared' was only adopted as the scientific label in the late 19th century.

Most thermal radiation emitted by objects is in infrared and over half of total energy from the Sun arrives on Earth as infrared radiation. On Earth, with its much lower surface temperatures, almost all radiation is infrared. Only a few eg fire, lightning are hot enough to produce visible energy. Infrared from the Sun accounts for 49% of heating of Earth, the rest being caused by visible light which is absorbed and re-radiated at longer wavelengths.

Microwave radiation This is often regarded as part of radio radiation. The Sun and other astronomical radio sources emit low level microwave radiation which carries information about their make-up.

Radio radiation Although radio wavelengths can be very long, like all other electromagnetic radiation, it travels at the speed of light. In 1867, the Scottish physicist James Clerk Maxwell mathematically predicted their existence as part of his discovery of the wavelike properties of light. Two decades later, in 1887, the German physicist Heinrich Hertz generated radio waves experimentally, showing that they do have the same wave properties as light.

Celestial objects, including the Sun are source of naturally occurring radio waves. This was first discovered in 1932 when American Karl Jansky detected radio waves being emitted from an astronomical object, the Milky Way galaxy. In 1938, during the first radio survey of the sky, American Grote Reber's observations included the Sun, although he did not distinguish the objects he had detected with the first purpose-built radio telescope. The first specific detection of radio waves from the Sun was made by the English physicist Stanley Hey, in 1942 while he was working with radar during World War 2.

Radio waves penetrate through outer layers of solar gas ie the atmospheric chromosphere and corona and can be observed with radio telescopes, which allow 'sight' of objects and features not detectable in visible wavelengths. Because radio frequencies are little affected by Earth's atmosphere, radio telescopes can be Earth-based, although optimally from high altitudes.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.en.wikipedia.org, www.quora.com, www.windows2universe.org, www.universetoday.com, www.solar.physics.montatn.edu, www.missionscience.nasa.gov