Photography And Photometry

Who Pioneered The Use Of Photography In Astronomy?

British astronomer William Huggins (1824–1910) was one of the first people to use photographs in astronomy. He used photographic plates exposed over a long period of time—minutes or hours—to record images. Huggins also showed how photographic emulsions could be mixed to increase sensitivity to infrared or ultraviolet light.

What Is Photometry?

Photometry is the astronomical measurement of brightness (also known as flux or intensity) and colour. Photometric intensity is measured as the amount of light energy that strikes a certain surface area on Earth over a certain period of time—in other words, how bright it appears—and is usually measured in units like "ergs per square centimetre per second," or in terms of apparent magnitude.

How Does An Astronomical Digital Camera Work For Taking Images?

Adigital camera used in astronomy today uses the same basic technology as digital cameras available for purchase at any electronics shop. Light that enters the camera is electronically recorded on a pixellated detector called a charge-coupled device (or CCD for short). When the exposure is finished, an electronic system reads out the information stored on the CCD onto a recording device such as a computer memory stick or hard drive.

The difference is that astronomical sources like planets, stars, and galaxies are so far away that they are almost always too faint to study with typical photographic equipment. In astronomical telescopes, special optical components are therefore used to transmit as much light as possible; CCDs especially efficient in detecting light are used; and the entire camera assembly is cryogenically cooled to hundreds of degrees below zero Fahrenheit in a special container called a dewar. These measures help astronomers measure objects millions—even billions—of times fainter than would be possible with ordinary store-bought cameras.

Radio Telescopes

How Does A Radio Telescope Work?

A radio telescope works very much like the antenna on your car radio. Any long piece of metal can "pick up" radio waves moving past it, and any sheet or scaffolding made of metal can reflect radio waves. Radio telescopes are giant antennae that are specially constructed to reflect radio waves and focus them to a single point. At that point, those waves can be detected, amplified, and interpreted into images or spectra, just like visible light. Since radio waves are millions or even billions of times longer than visible light waves, radio telescopes are generally very large, or consist of large arrays of telescopes that use interferometry to create more detailed images.

What Is The World's Largest Radio Telescope Dish?

The Arecibo Observatory in Arecibo, Puerto Rico, is operated jointly by the United States National Science Foundation and Cornell University in Ithaca, New York. The Arecibo radio telescope disk is a breathtaking sight. Nestled between hills, on top of a natural valley in the land, it is 305 metres in diameter and covers an area of more than 25 football fields. Its Gregorian reflector system is at the focal point of the radio disk, weighs 68 tonnes, and hangs 137 metres in the air; it is attached to a much larger, 544-tonne observing platform, which also hangs there in midair. Arecibo is by far the world's largest radio dish, and it is the most sensitive radio telescope in the world since its completion in 1963. It has stayed current with regular upgrades to its instrumentation and equipment, and is used day and night for scientific observations and, occasionally, communications with spacecraft far out in the solar system.

What Is The World's Largest Steerable Radio Telescope Dish?

The Robert C. Byrd Green Bank Telescope (GBT) is the world's largest fully steerable radio telescope. It is located at the U.S. National Radio Astronomy Observatory's Green Bank site in Pocahontas County, West Virginia. Another large radio telescope at Green Bank, which was a slightly smaller telescope than the current one, collapsed in 1988 after 25 years of operation. The current GBT weighs more than 6,800 tonnes and has a collecting area nearly twice the size of a football field; it is slightly off-axis, and is not exactly round at 110 metres long and 100 metres across. The focal point is at the end of an arm that reaches over the dish from one side. The telescope is mounted on a track 64 metres in diameter that is level to within a few microns. The track allows the telescope to view the entire sky in any direction. Furthermore, each of the 2,004 panels that make up its surface are mounted on motor-driven pistons. This way, the shape of the surface can be carefully adjusted to make very precise observations.

What Is An Observatory?

An observatory is a facility where astronomical observations can take place. They can consist of just one telescope, but often they have many telescopes. Modern observatories sometimes do not even have a telescope at the location; instead, they are the locations where scientists gather to obtain and analyse data, even if the telescope they are using is far away on Earth or in space.

What Astronomical Observatories Are In Australia?

Australia has many well-known radio telescopes, including the Parkes Radio Telescope, which was used to communicate with the Apollo missions to the Moon. The premier astronomical research facility in Australia is the Mount Stromlo and Siding Spring Observatories, which is run by the Australia National University.

Living In Space

Can Humans Live In Space?

Humans not only can live in space—we already do live in space! Since 1971, humans have been maintaining space stations in low Earth orbit, where people can stay in outer space for extended periods of time. Human beings have now lived continuously in space for nearly a decade. They have been doing so for so long, in fact, that most people on Earth do not even give it a second thought any more. The challenge now for humanity is to live in outer space beyond low Earth orbit, such as on the Moon, or Mars, or in interplanetary or interstellar spacecraft.

What Life Support Is Necessary For Humans To Live In Space?

In space every environmental need for humans to survive—including air to breathe, water to drink, food to eat, and room to move around—must be provided by artificial methods. This means a fully contained life support environment must exist, including everything from light and heat to air recycling and waste removal. Above Earth's atmosphere, it is also essential for any human habitat in space to provide protection against hazards in the space environment, such as excessive radiation, cosmic rays, or meteoroids.

What Happens To The Human Body In Space?

In orbit or in deep space, humans are weightless; that is, the net force on their bodies from gravity is zero. This is not because they are far away from Earth, but rather their orbital speed and trajectory create acceleration that exactly balances Earth's gravitational acceleration. Since humans evolved in an environment where gravity is not zero, our biological systems react significantly to the zero-gravity or micro-gravity environment. Bodily fluids like blood fill the face, puffing up the skin; muscle fibres grow thinner with disuse, causing muscles to weaken and atrophy; the mineral turn-over process slows down in bones, causing a decrease in bone density akin to osteoporosis. Thus, when people are in space for any prolonged period of time they must conduct rigorous physical activity and exercises in order to stay healthy.

What Is The International Space Station?

The International Space Station (ISS) is a multinational research vessel that is currently orbiting at an altitude of 210 miles (340 kilometres) above Earth's surface. The ISS project grew out of an agreement between the governments of the United States and Russia, who both wanted to build a permanent human presence in space but lacked the political will and funding to do so separately. With the breakup of the Soviet Union and end of the Cold War in 1991, civilian space projects took a backseat to other funding priorities in both superpowers; this meant that the Americans' Freedom and the Russians' Mir 2 space station programs were at a near-standstill. In 1993 an agreement was reached to build a new, fully international space station to be completed by 2010, a plan that was ultimately palatable to the voters and taxpayers of both nations. Today, the ISS is a joint project of the space agencies of Russia, Europe, Canada, Japan, Brazil, Italy, and the United States. The first ISS module was launched on November 20, 1998, by a Russian Proton rocket; the second module, called "Node 1," was brought into orbit by the space shuttle Endeavour. The fully completed ISS is expected to have 14 pressurized modules in all, contain about 1,000 cubic metres of interior space, and have a mass of more than 400 tonnes.