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Opinion Article

Use of Electromagnetic Radiation in Radio Astronomy

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DESCRIPTION

Radio telescopes are used by astronomers all over the world to observe naturally occurring radio-waves emitted by stars, planets, galaxies, dust clouds, and gas molecules. The majority of us are familiar with visible-light astronomy and the information it provides about these objects. Visible light, also known as optical light, is what our eyes see; however, visible light does not tell the entire story about an object. To gain a complete understanding of a distant quasar or planet, astronomers study it in as many wavelengths as possible, including the radio range. Atoms make up everything around us. Atoms are made up of subatomic particles, with electrons orbiting the nucleus, which is made up of protons and neutrons.

Electrons and protons emit electromagnetic radiation when they accelerate by changing their speed or direction. The electromagnetic spectrum is made up of many different types of electromagnetic radiation that we can detect. Radio waves have a long wavelength, a low frequency, and therefore a low energy. The electromagnetic spectrum, which increases in frequency and energy, includes radio and microwave waves, infrared waves, visible light, ultraviolet rays, X-rays, and gamma rays. The motion of charged objects such as molecules and atoms causes thermal emissions. Because all matter contains some heat energy, atoms vibrate and emit electromagnetic radiation. The more energy stored, the more the atoms vibrate, and the more radiation is emitted. When a gas is heated, the energy produced is sufficient to expel one or more of the electrons orbiting an atom. The atom is now ionised and has a positive charge, whereas the electron is no longer bound. Negative electrons constantly interact with positive charges as they move around in this high-temperature, charged gas (called plasma). As a result of their increased speed, they emit electromagnetic radiation.

A radio telescope is simply a telescope designed to collect radio waves from space. In its most basic form, it consists of three parts. One or more antennas for receiving incoming radio waves most antennas are parabolic dishes that reflect the radio waves to a receiver, in the same way that a curved mirror can focus visible light on a point. However, antennas can take on other forms. As with the early Dover Heights telescopes, a Yagi antenna, similar to that used for TV reception, can be used for radio astronomy. A receiver and amplifier for boosting a very weak radio signal to a usable level. Nowadays, amplifiers are extremely sensitive and are typically cooled to very low temperatures to minimize interference caused by the movement of the atoms in the metal. In the early days of radio astronomy, a recorder for recording the signal was typically a chart recorder that drew a graph on paper with ink. Most radio telescopes now record directly to a computer memory disc and astronomer process and analyse the data using sophisticated software.

Radio astronomy has altered our perception of the universe and significantly increased our understanding of it. Traditional optical astronomy is ideal for studying objects that emit a lot of visible light, such as stars and galaxies. Individual stars, on the other hand, are typically only weak radio wave emitters. We only detect radio waves from our sun because it is so close, even though its radio emissions can disrupt radio communications on Earth when a solar storm occurs. In interstellar space, cold gas clouds emit radio waves with different wavelengths. Because hydrogen is the most abundant element in the universe and is abundant in galaxies, astronomers use its distinctive emission at 21 cm to map the structure of galaxies.

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