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Luhman 16: Binary Brown Dwarf System

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Why in News

Recently, a group of astrophysicists have found that the **closest known brown dwarf, Luhman 16A** which shows signs of **cloud bands** similar to those seen on Jupiter and Saturn.

They used the **technique of polarimetry** to determine the properties of atmospheric clouds outside of the solar system.

Polarimetry

- The concept of polarimetry technique was put forth by Indian astrophysicist Sujan Sengupta, that the **light emitted by a cloudy brown dwarf, or reflected off an extrasolar planet, will be polarised.**
- Polarimetry is the study of polarization. Polarization is a property of light that represents the direction that the light wave oscillates.
- When light is reflected off of particles it can favor a certain angle of polarization. By **measuring the preferred polarization of light** from a distant system, astronomers can deduce the **presence of clouds.**

However, in case of Luhman 16A, the researchers have found the actual structure of the clouds (not only their presence).

- The polarimetry technique isn't limited to brown dwarfs. It can also be applied to exoplanets orbiting distant stars, or even stars. However, light from brown dwarfs is ideal for the study.

Luhman 16

- **Luhman 16A** is part of a **binary system (Luhman 16)** containing a second brown dwarf, **Luhman 16B**. This pair of brown dwarfs Luhman 16A and Luhman 16B **orbit each other.**

- It is situated at a distance of about **6.5 light years** from the Sun and the **third closest system to the Sun after Alpha Centauri and Barnard's star**.
- Despite the fact that Luhman 16A and 16B have similar masses and temperatures and presumably formed at the same time, **they show markedly different weather**.
- Luhman 16B shows **no sign of stationary cloud bands**, instead showing evidence of more **irregular, patchy clouds**.

Luhman 16B, therefore, has **noticeable brightness variations** as a result of its cloudy features, unlike Luhman 16A which has less brightness variation due to a band of clouds.

- Understanding the cloud system over a brown dwarf **can shed light on the pressure, temperature and climate** on the surface of the celestial body.

Brown Dwarfs

- Brown dwarfs are also called **failed stars**, because **their masses are heavier than planets but lighter than stars**.
- Due to their small masses, they are unable to **sustain fusion of their hydrogen** to produce energy.
- It is believed that some of the more massive brown **dwarfs fuse deuterium or lithium and glow faintly**.

Binary Stars System

- Binary stars are two stars orbiting a **common center of mass**.
- The brighter star is officially classified as the **primary star**, while the dimmer of the two is the **secondary star**. In cases where the stars are of equal brightness, the designation given by the discoverer is respected.
- They are very important in astrophysics because **calculations of their orbits allow the masses of their component stars to be directly determined**, which in turn allows other stellar parameters, such as radius and density, to be indirectly estimated.

Source: TH