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Moon-Forming Regions Around Exoplanets

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Why in News

Recently, scientists for the first time have spotted a **Moon-Forming Region** around a planet **beyond our solar system (Exoplanet)**.

Exoplanets

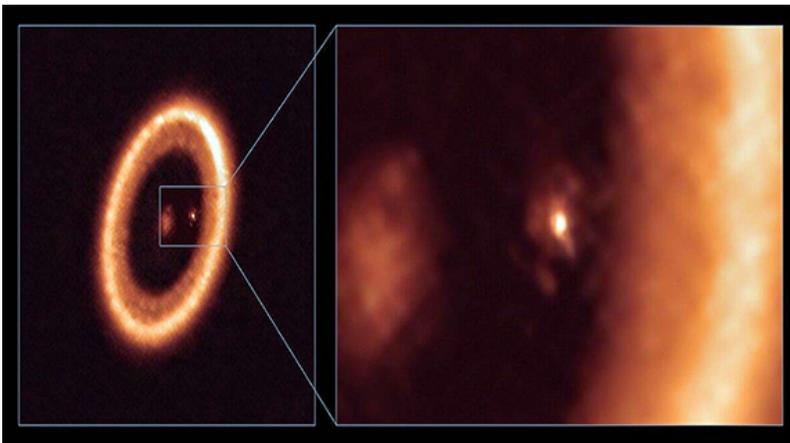
- An exoplanet or extrasolar planet is a **planet outside the Solar System**. The **first** confirmation of detection of exoplanets occurred in **1992**. More than **4,400 exoplanets** have been discovered till now.
- Exoplanets are very **hard to see directly with telescopes**. They are **hidden by the bright glare of the stars** they orbit. So, astronomers use other ways to detect and study exoplanets such as **looking at the effects these planets have on the stars they orbit**.

Key Points

Observation & Findings:

- Scientists detected a **disc of swirling material** accumulating around **two exoplanets** seen orbiting a young star called **PDS 70**.
 - **PDS 70** is located a relatively close **370 light years from Earth**.
 - **A light year** is the distance light travels in a year, about **9.5 trillion km**.
- It is called a **circumplanetary disc**, and it is **from these that moons are born**. The disc around **PDS 70c (The Exoplanet)**, with a **diameter about equal to the distance of the Earth to the sun**, possesses enough mass to **produce up to three moons the size of Earth's moon**.

PDS 70c orbits its star at 33 times the distance of the Earth from the sun, **similar to the planet Neptune in our solar system**.
- The orange-coloured star **PDS 70**, roughly the same mass as our Sun, is about **5 million years old**. The **two planets are even younger**. Both planets are **similar** (although larger) **to Jupiter**, a gas giant.
- It was **around one of the two planets, called PDS 70c, that a moon-forming disc was observed**.
- Both planets are still in their youth and are at a dynamic stage in which **they are still acquiring their atmospheres**.



• Instrument Used:

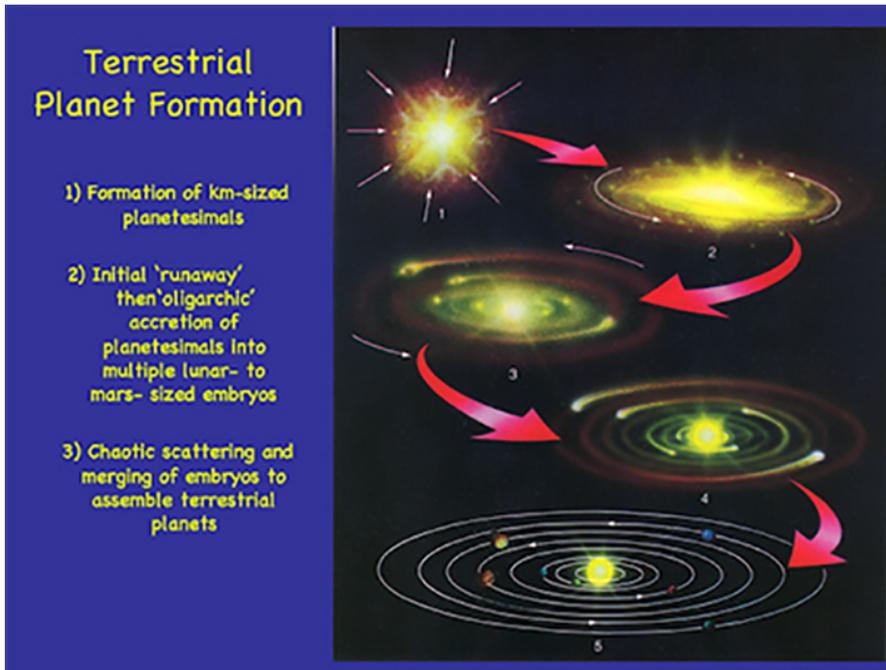
- They used the Atacama Large Millimeter/submillimeter Array (ALMA) **observatory in Chile's Atacama desert**. It is the **most complex astronomical observatory ever built on Earth**.

Teams from **North America, East Asia, and Europe** merged projects to develop this breakthrough scientific instrument.
- It uses **66 high-precision dish antennas** of two sizes: 54 of them are 12 meters across and 12 of them are 7 meters across.

- **Other Moon Forming Regions:**

- **No circumplanetary discs had been found** until now because all the known **exoplanets** resided in “mature” – fully developed – solar systems, **except the two infant gas planets orbiting PDS 70.**
- In our solar system, the impressive **rings of Saturn**, a planet around which more than 80 moons orbit, **represent a relic of a primordial moon-forming disc.**

- **Planet & Moon Formation:**



- Stars burst to life within clouds of interstellar gas and dust scattered throughout galaxies. **Leftover material spinning around a new star then coalesces into planets, and circumplanetary discs surrounding some planets similarly yield moons.**
- The dominant mechanism thought to underpin planet formation is called “**core accretion**”.

Core accretion occurs from the **collision and coagulation of solid particles into gradually larger bodies** until a massive enough planetary embryo is formed (10-20 Earth masses) to accrete a gaseous envelope.

- In this scenario, **small dust grains, coated in ice, gradually grow to larger and larger sizes through successive collisions with other grains.**
- This continues until the grains have grown to a size of a planetary core, at which point the **young planet has a strong enough gravitational potential to accrete gas** which will form its atmosphere.
- Some **nascent planets attract a disc of material around them**, with the same process that gives rise to planets around a star **leading to the formation of moons around planets.**

Source: TH