

The Atacama Large Millimetre/submillimetre Array (ALMA)

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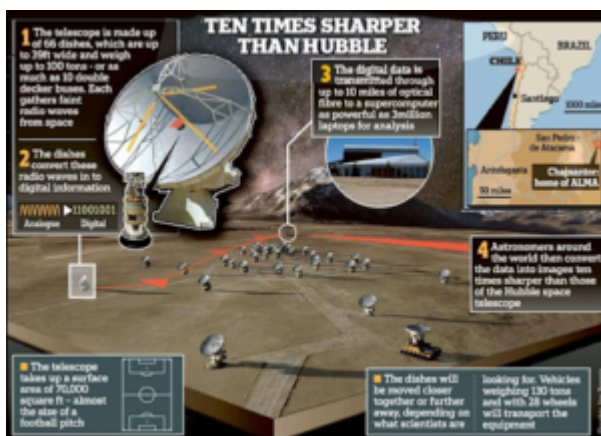
In news— The ALMA, a radio telescope comprising 66 antennas located in the Atacama Desert of northern Chile is set to get software and hardware upgrades.

About the ALMA-

- **ALMA is a state-of-the-art telescope that studies celestial objects at millimetre and submillimetre wavelengths** – they can penetrate through dust clouds and help astronomers examine dim and distant galaxies and stars out there.
- It also has **extraordinary sensitivity, which allows it to detect even extremely faint radio signals.**
- As mentioned before, the **telescope consists of 66 high-precision antennas**, spread over a distance of up to 16 km.
- ALMA is **operated under a partnership among the United States, 16 countries in Europe**, Canada, Japan, South Korea, Taiwan, and Chile.
- **Fully functional since 2013, the radio telescope was designed, planned and constructed by the US's National Radio Astronomy Observatory (NRAO)**, the National Astronomical Observatory of Japan (NAOJ) and the European Southern Observatory (ESO).
- Over the years, it has **helped astronomers make groundbreaking discoveries, including that of starburst galaxies** and the **dust formation inside supernova 1987A.**
- ALMA is **situated at an altitude of 16,570 feet (5,050**

metres) above sea level on the Chajnantor plateau in Chile's Atacama Desert as the millimetre and submillimetre waves observed by it are very susceptible to atmospheric water vapour absorption on Earth.

- **Moreover, the desert is the driest place in the world, meaning most of the nights here are clear of clouds** and free of light-distorting moisture – making it a **perfect location for examining the universe.**
- The recent upgrades will help it collect much more data and produce sharper images than ever before.
- The **most significant modernisation made to ALMA will be the replacement of its correlator**, a supercomputer that combines the input from individual antennas and allows astronomers to produce highly detailed images of celestial objects.
- **Today, ALMA's correlators are among the world's fastest supercomputers.** Over the next 10 years, the upgrade will double and eventually quadruple their overall observing speed.



What are some of the notable discoveries made by ALMA?

- With ALMA's capability of capturing high-resolution images of gas and dust from which stars and planets are formed and materials that could be building blocks of life, scientists are trying to find answers to age-old questions of our cosmic origins.
- One of the **earliest findings came in 2013** when it

discovered starburst galaxies earlier in the universe's history than they were previously thought to have existed.

- These newly discovered galaxies represent what today's most massive galaxies looked like in their energetic, star-forming youth.
- In 2014 **ALMA provided detailed images of the protoplanetary disc surrounding HL Tauri – a very young T Tauri star in the constellation Taurus**, approximately 450 light years from Earth and transformed the previously accepted theories about the planetary formation.
- **In 2015, the telescope helped scientists observe a phenomenon known as the Einstein ring**, which occurs when light from a galaxy or star passes by a massive object en route to the Earth, in extraordinary detail.
- **More recently, as part of the Event Horizon Telescope project, a large telescope array consisting of a global network of radio telescopes, it provided the first image of the supermassive black hole** at the centre of our own Milky Way galaxy. The image was unveiled by scientists in May 2022.

Further reading: <https://journalsofindia.com/dark-galaxy/>