

Murchison Widefield Array (MWA)

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Murchison Widefield Array Latest News

Using the Murchison Widefield Array (MWA), astronomers recently discovered a new millisecond pulsar as part of the ongoing Southern-sky MWA Rapid Two-metre (SMART) survey.

About Murchison Widefield Array

- It is a **low-frequency radio telescope** located at the Murchison Radio-astronomy Observatory (MRO) in **Western Australia**, where the **future low-frequency Square Kilometre Array (SKA) will be built**.
- It is a **collaboration** between **20 research institutions** in **five countries (Australia, Canada, China, Japan, and the United States)** and is led by Curtin University, Australia.
- It is made of **4,096 spider-like antennas** tuned to **receive signals** from the sky **between 70 and 300 MHz**.
- It is special for its **very wide field of view, high angular resolution**, nanosecond time resolution, and digital pointing agility.

- This makes the instrument invaluable for **quickly mapping the sky** and studying rare and faint events as they happen.
- The MWA is **used to study**:
 - The **early Universe**, particularly the **Epoch of Reionization, when the first stars and galaxies formed**.
 - The structure and evolution of galaxies and galaxy clusters.
 - The **Sun and space weather**, including solar flares and coronal mass ejections.
 - **Transient radio sources**, such as **pulsars** and **fast radio bursts**.
 - The interstellar medium and **cosmic magnetism**.

Key Facts about Southern-sky MWA Rapid Two-metre (SMART)

- SMART pulsar survey is an ongoing project to **discover new pulsars (neutron stars) in the southern sky using the MWA**.
- This is the **only pulsar survey** capable of **looking for pulsars in the Southern Hemisphere at low frequencies** (140-170 MHz).
- Once complete, it is expected to discover hundreds of new pulsars.
- Apart from its inherent scientific value, it also serves as a **valuable reference for future pulsar searches** planned with the **low-frequency SKA**.

Key Facts about Square Kilometre Array

- It is an **international effort** to build the **world's largest and most sensitive radio telescope** to help better understand the **history of the universe**.
- It is **co-located in Australia (SKA-Low) and South Africa (SKA-Mid)** with operational headquarters in the UK, and is expected to revolutionize **radio astronomy**.
- The construction of the project **officially started** on 5 December **2022**.
- The telescope will consist of **hundreds of antennas** that will generate unprecedented data volumes.
- It is meant to observe the universe in a new way and probe questions related to the **origins of the universe, the formation and evolution of galaxies**, and seeking the **origins of life**.
- **India became a member** of SKA in December 2022.
- **Other countries** involved in this project are **Australia, South Africa, the United Kingdom, Canada, China, France, Germany, Italy, Portugal, Spain, Sweden, Switzerland, and the Netherlands**.

What are Pulsars?

- Pulsars are **rapidly rotating neutron stars** that **blast out pulses of radiation** at **regular intervals** ranging from **seconds to milliseconds**.
 - **Neutron stars** are highly **dense remnants of massive stars** that have collapsed, **composed mainly of neutrons** and other elementary particles.
- **Pulsars** have very **strong magnetic fields**, which **funnel jets of particles out** along the two magnetic poles. These accelerated particles **produce very powerful beams of light**.

- Often, the magnetic field is not aligned with the spin axis, so those beams of particles and light are swept around as the star rotates.
- The **periodicity** of pulsars is **caused by these beams of light crossing the line of sight on Earth**, with the pulsar appearing to **'switch off' at points** when the **light is facing away from us**. The time between these pulses is the 'period' of the pulsar.
- Pulsars have been **primarily observed at radio wavelengths**.
- Pulsar **masses** range between **1.18 and 1.97 times** that of the **Sun**, but most pulsars have a mass 1.35 times that of the Sun.

News: PHYS

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