

# MeerKAT / SKA South Africa

AmLight

6<sup>th</sup> May 2025

Keith Grainge,  
University of Manchester



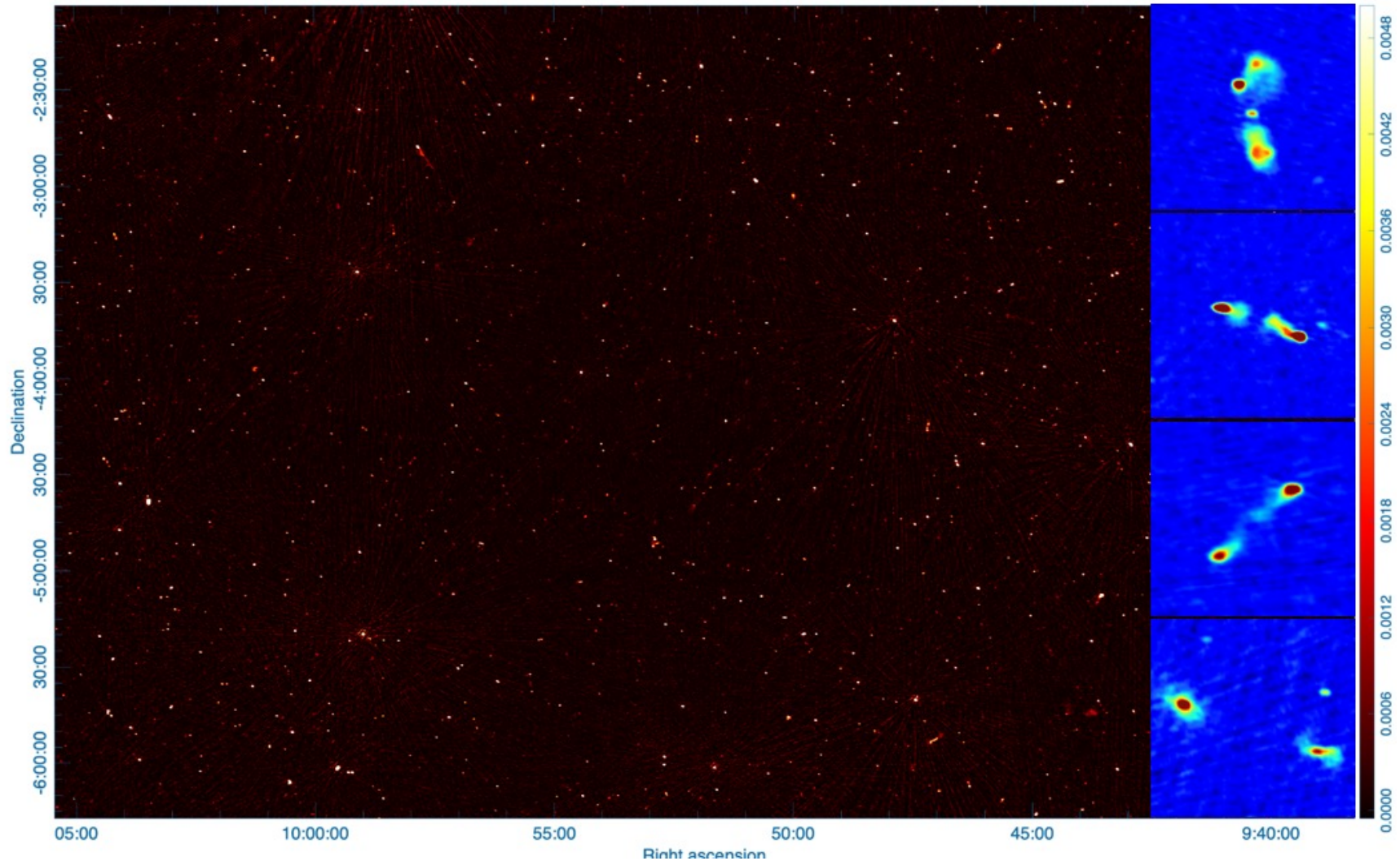
# MeerKAT



- Karoo desert, SA
- 64 antennas 13.5m
- 0.58 – 3.5 GHz
  - 3 bands
- 8 km max baseline
  - ~5" resolution
- Operating for 5 yrs
  - Most sensitive radio telescope in south
- MeerKAT+
  - 14 more antennas

Credit: SARA0

# MeerKLASS survey



- MeerKLASS – credit Sourabh Paul
  - 1 hour: 300 sq deg UHF; 100 $\mu$ Jy; 35000 sources

# SKA MID and LOW



## South Africa



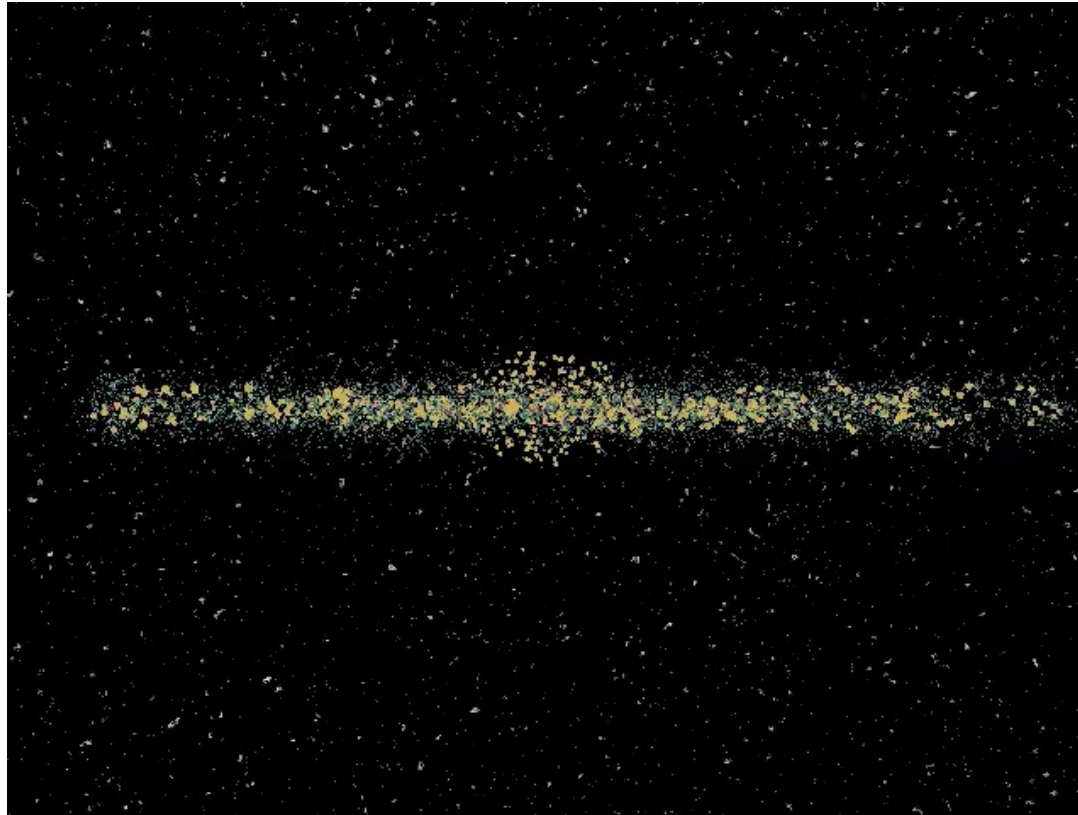
**SKA1\_Mid 350 MHz – 15 GHz**  
**64 MeerKAT dishes**  
**133 SKA1 dishes.**

## Australia



**SKA1\_Low 50 – 350 MHz**  
**131,000 aperture array dipole**  
**512 stations of 256 antennas**

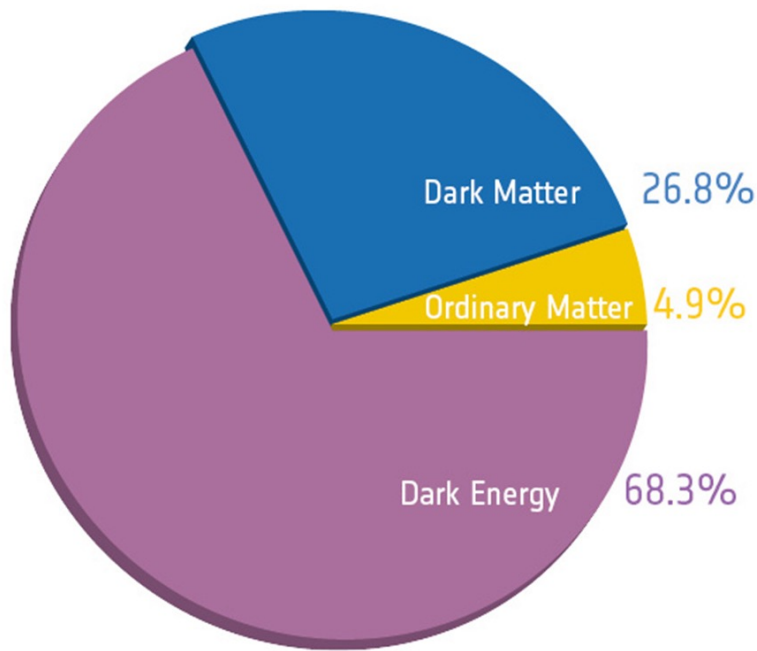
# Finding all pulsars in the Milky Way



Credit: Michael Kramer

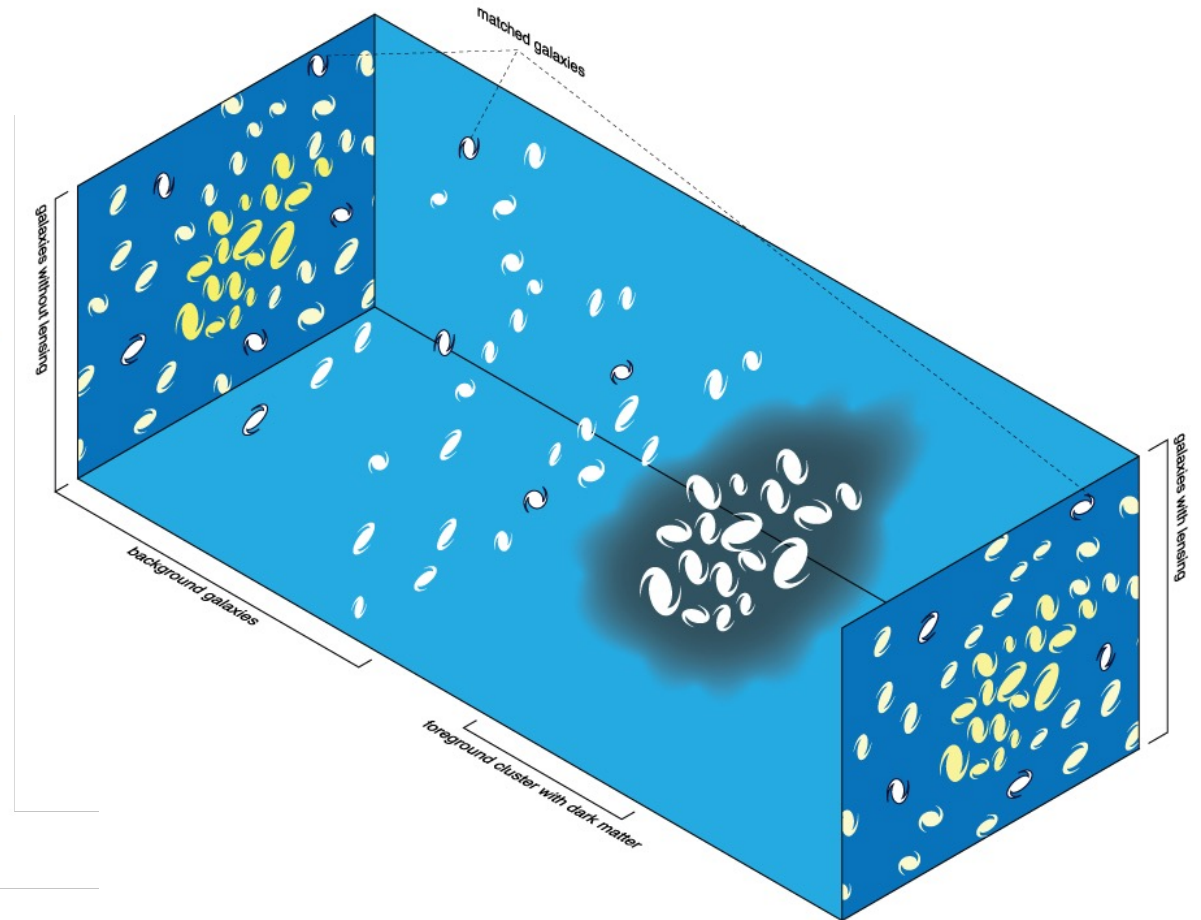
- Pulsars are extremely accurate clocks
- Test Einstein's General Relativity
- Detect gravity waves

# Cosmology



Composition of the Universe

Credit: ESA



Credit: M. Sachs

- Gravity from massive objects bends radio waves
- “Weak lensing” allows mapping of structure

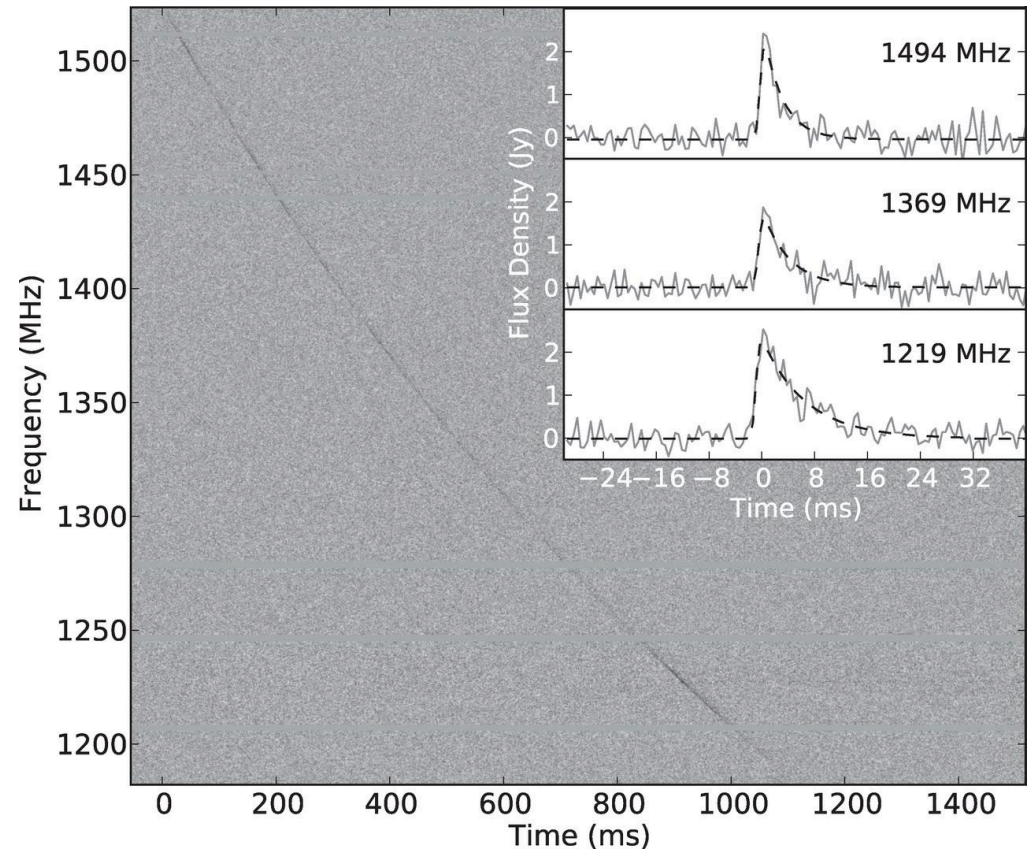
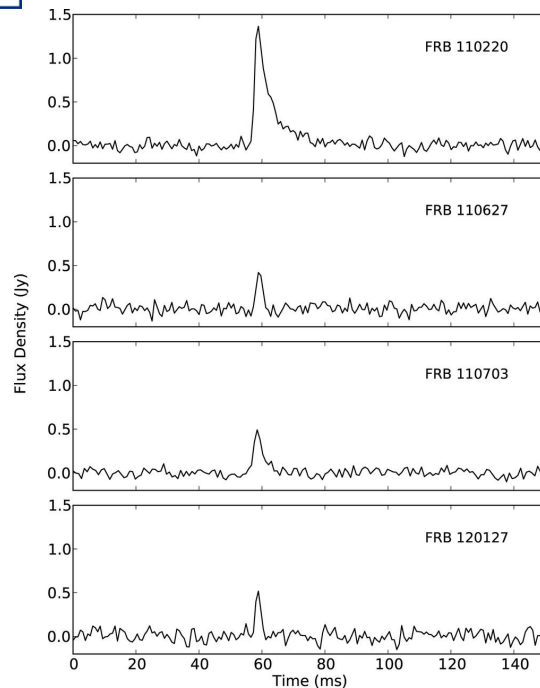
# The transient radio sky

**Science**

## A Population of Fast Radio Bursts at Cosmological Distances

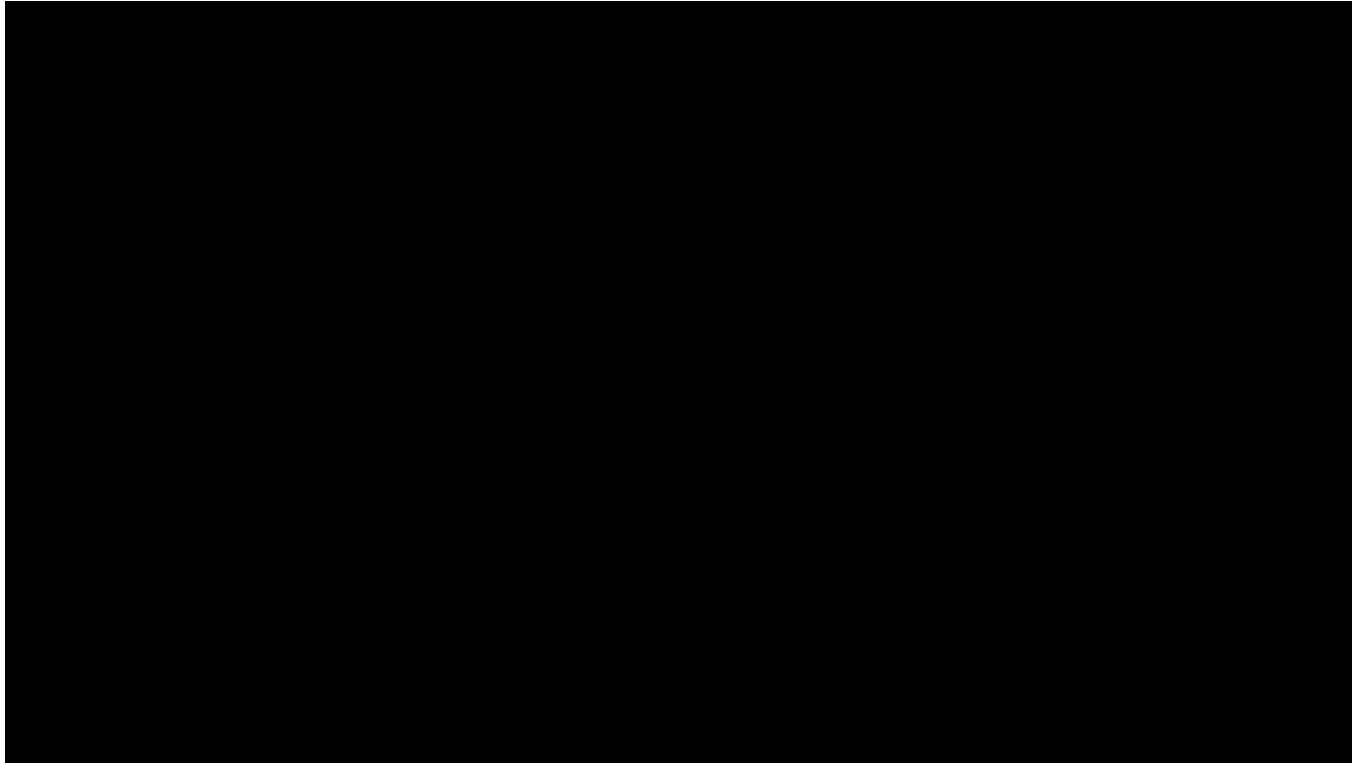
D. Thornton *et al.**Science* **341**, 53 (2013);

DOI: 10.1126/science.1236789



- Recent discovery of Fast Radio Bursts
- Hundreds now detected
- Unknown origin, at cosmological distances

# Cosmic Magnetism

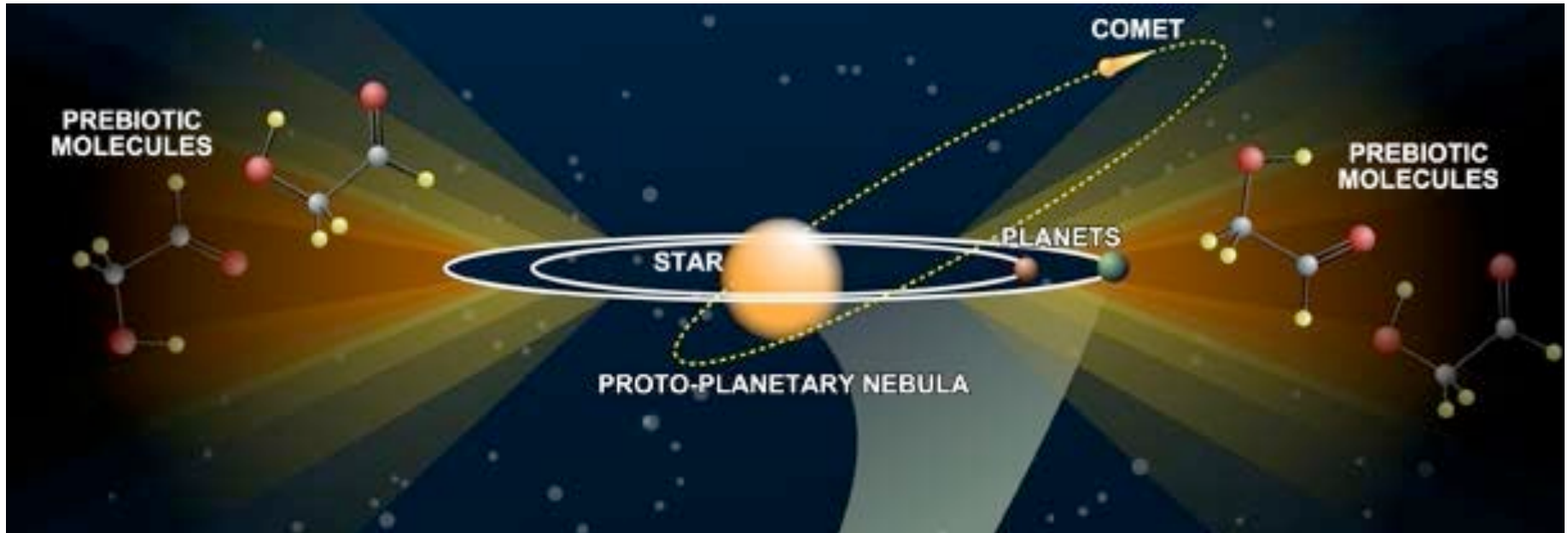


Credit: SKAO

- Faraday rotation – unique tool for measuring magnetic fields
- Vital in galaxy formation and for galaxy clusters
- Explore cosmic origin of magnetism



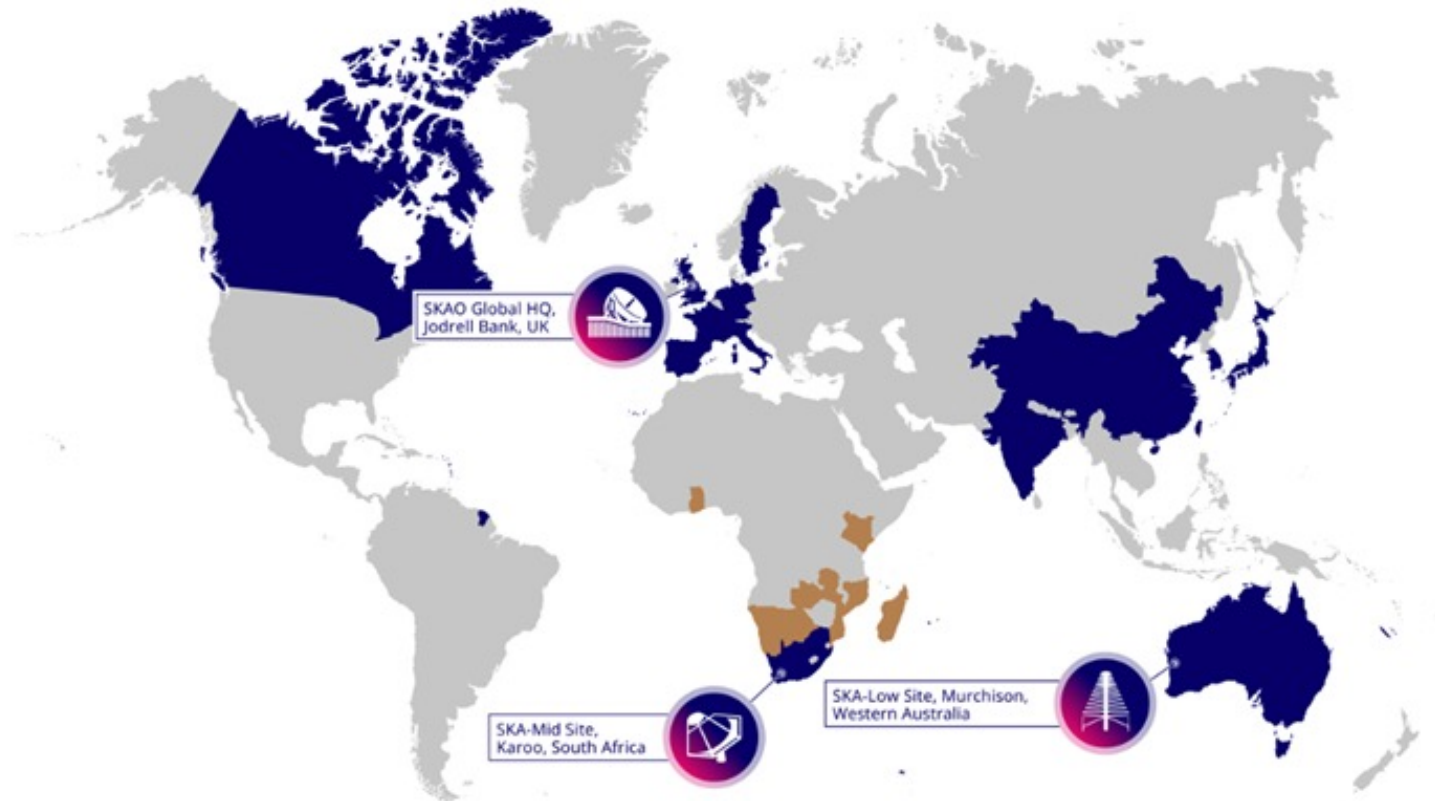
# Cradle of life



Credit: M. Hoare

- New planets being born in protoplanetary disks
- Jupiter-like extrasolar planets
- Complex organic molecules around protostars
- Searching for Extraterrestrial Intelligence
  - detect airport radar on a planet tens of light years away

# SKA across the world



■ SKAO Partnership - includes SKAO Member States\* and SKAO Observers (as of April 2023)



■ African Partner Countries



- Currently 12 full member countries; 2 in accession stage; 2 others in discussion

# International SKA Headquarters



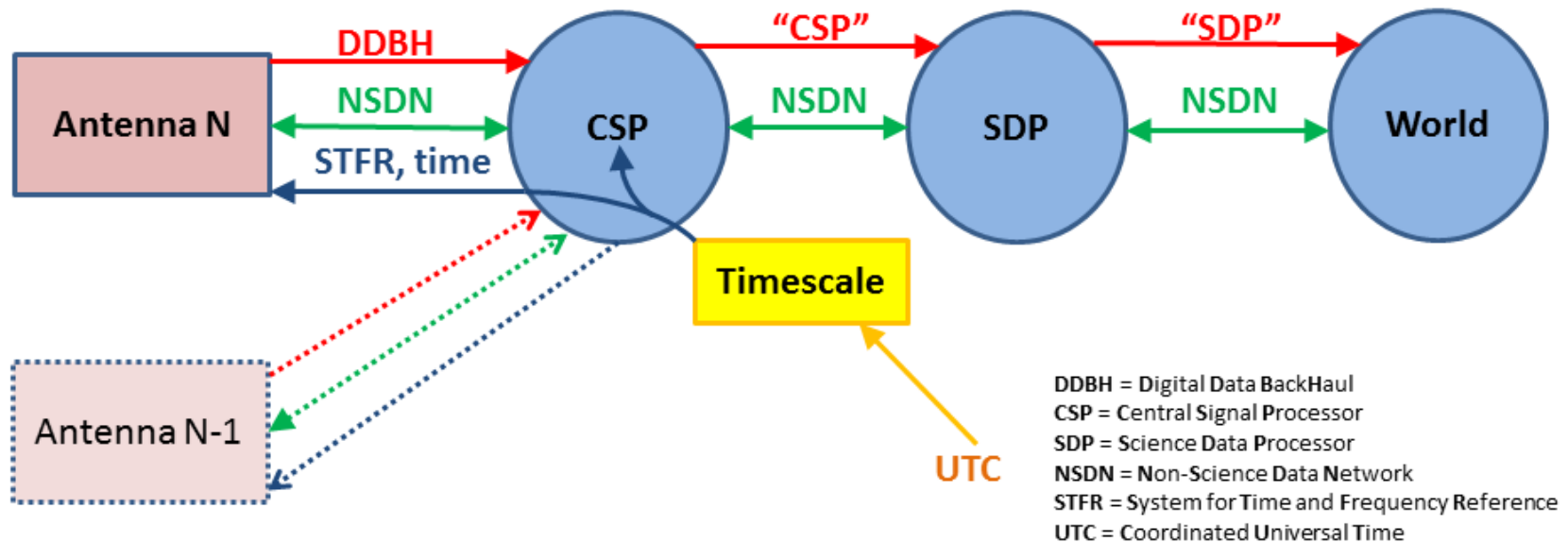
Credit: J. Santander-Vela

- HQ at Jodrell Bank; opened 10<sup>th</sup> July 2019
  - 150 staff
- In addition, teams sited in both South Africa and Australia

# SADT – 3 Networks



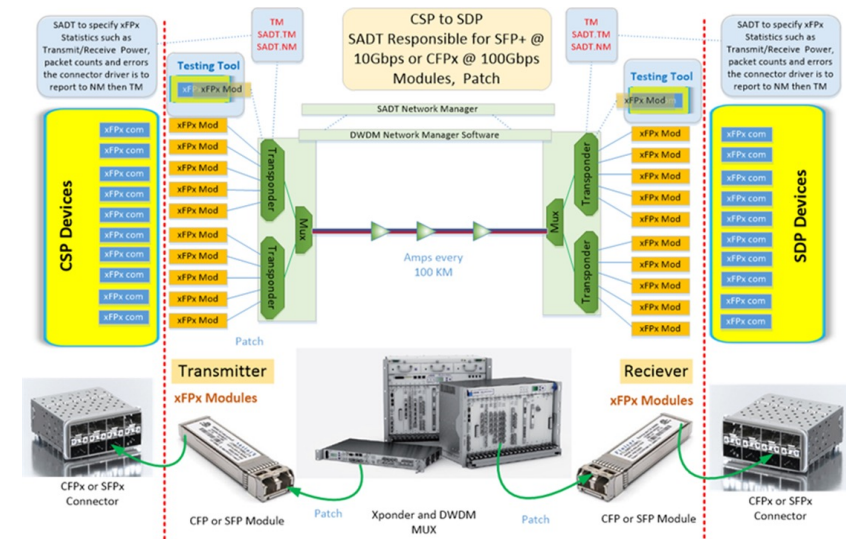
- The astronomy data network (DDBH)
- The synchronisation and timing network (SAT)
- The general purpose network (NSDN)
- Each has its own set of challenges



# SKA Data transport challenge



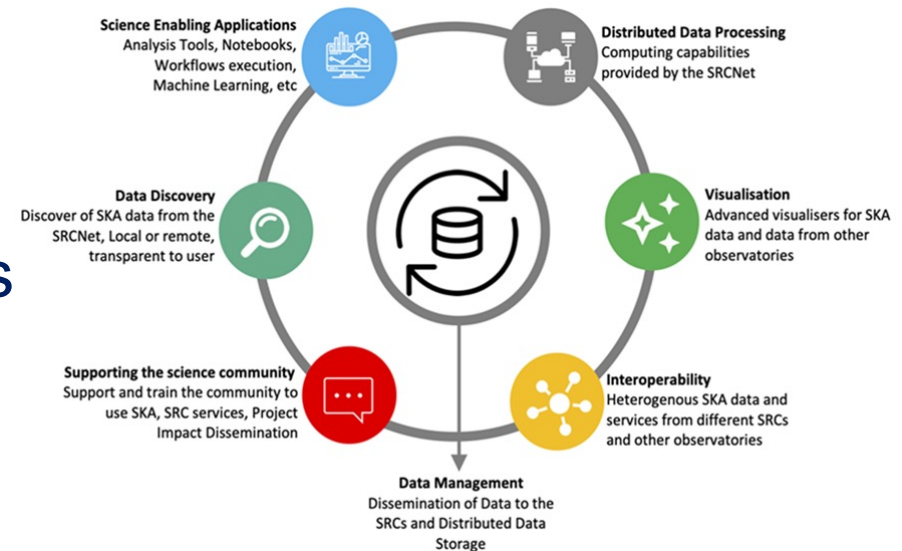
- Get the data out of the desert ~ 900km
- 197 antennas, 100 Gbit/s each  $\Rightarrow$  20,000 Gbits/s
- Out of correlator to SDP, 80 streams 100 Gbit/s
- Visibilities not kept after processing
- 350 PB/yr of Observatory Data Products
  - Transport to SKA Regional Centres



# SKA Regional Centres

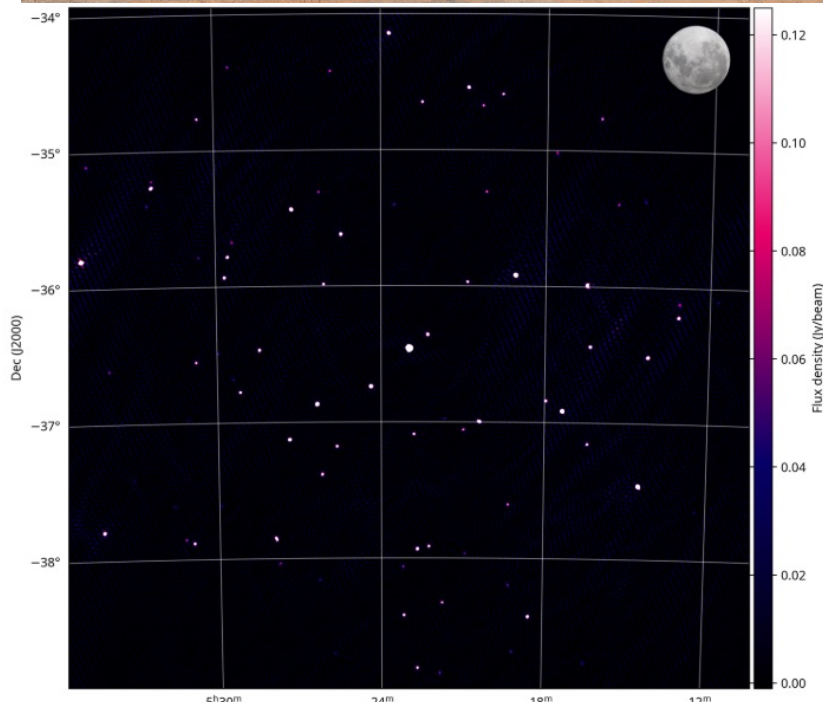


- SKAO will produce Observatory Data Products
  - No need to be a radio expert
- SRCs deliver SKA data products to scientists
- Store SKA data for future use
  - ~700 PB per year
- Authentication and authorization
- Compute facilities for analysis
  - Production of advanced products
- Local user support
- With international partners, global delivery of SRCNet



Courtesy of Rosie Bolton

# Current status



- MeerKAT delivering excellent science
- SKA construction underway
  - First Mid dish 4<sup>th</sup> July 2024
  - SKA-LOW first light image
    - Moon for scale
- See Richard Hughes-Jones' talk tomorrow!