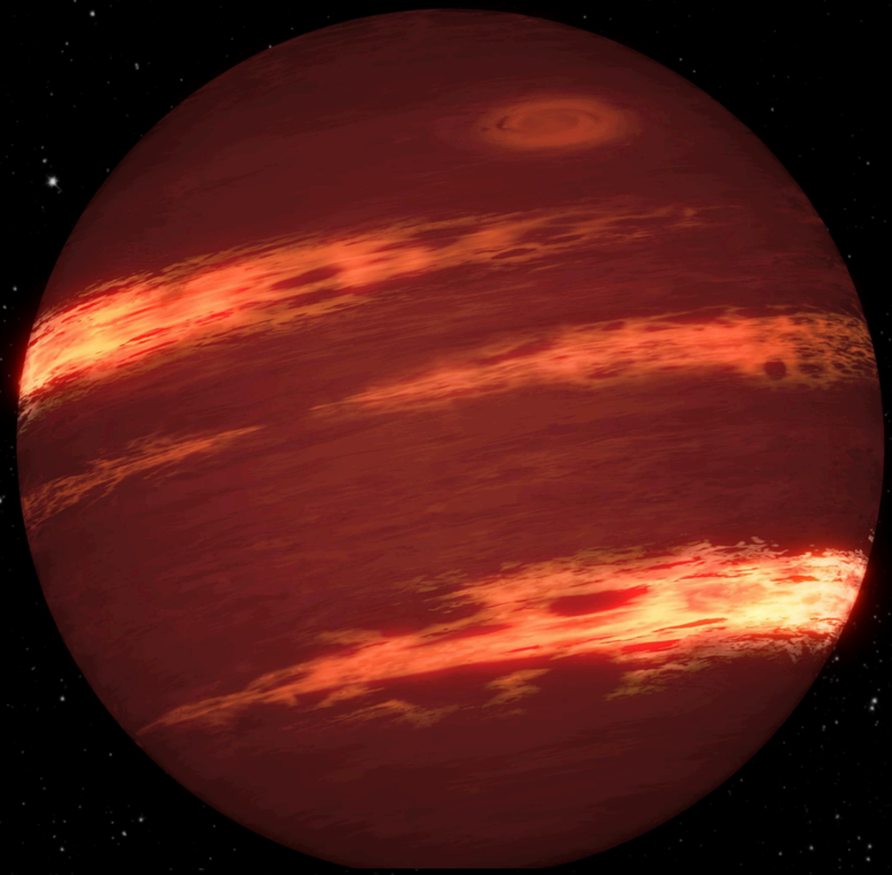
Source: NASA, 2025



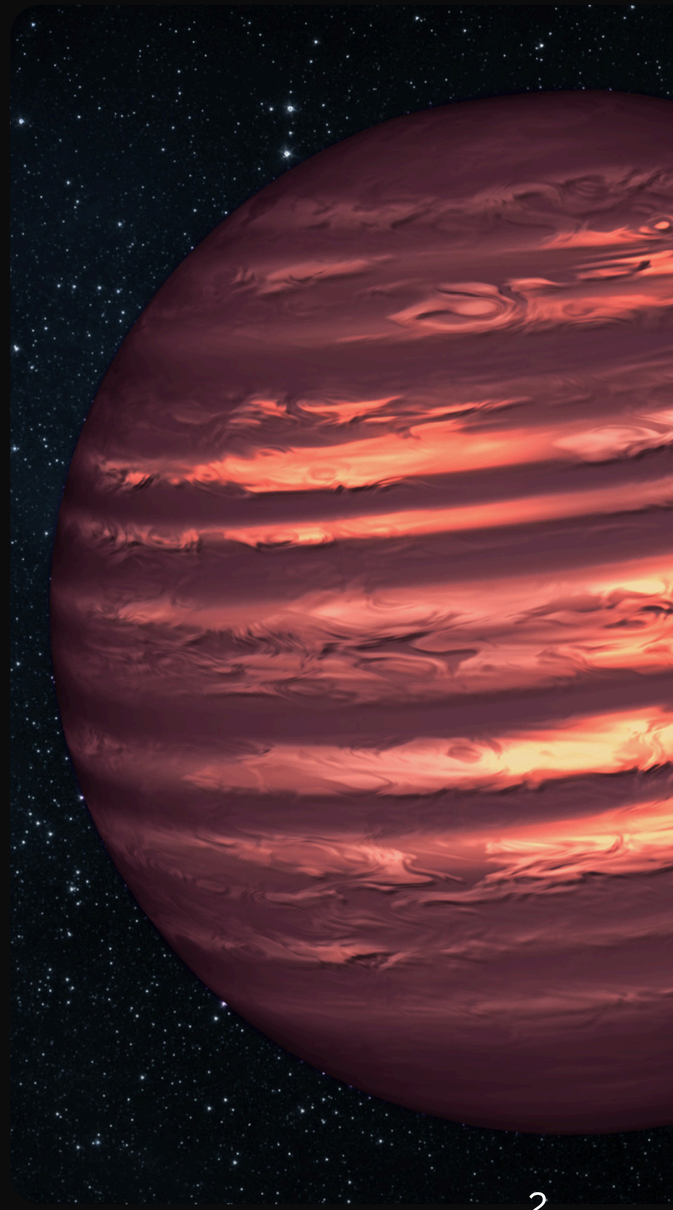
RADIO EMISSION FROM AN ULTRACOOL DWARF

PAPER BY IRIS DE RUITER, JOSHUA PRITCHARD, TARA MURPHY, ANDREW K. HUGHES, DAVID L. KAPLAN, KOVI ROSE, AND ANDREW ZIC

Presented by
Adly Ramsey

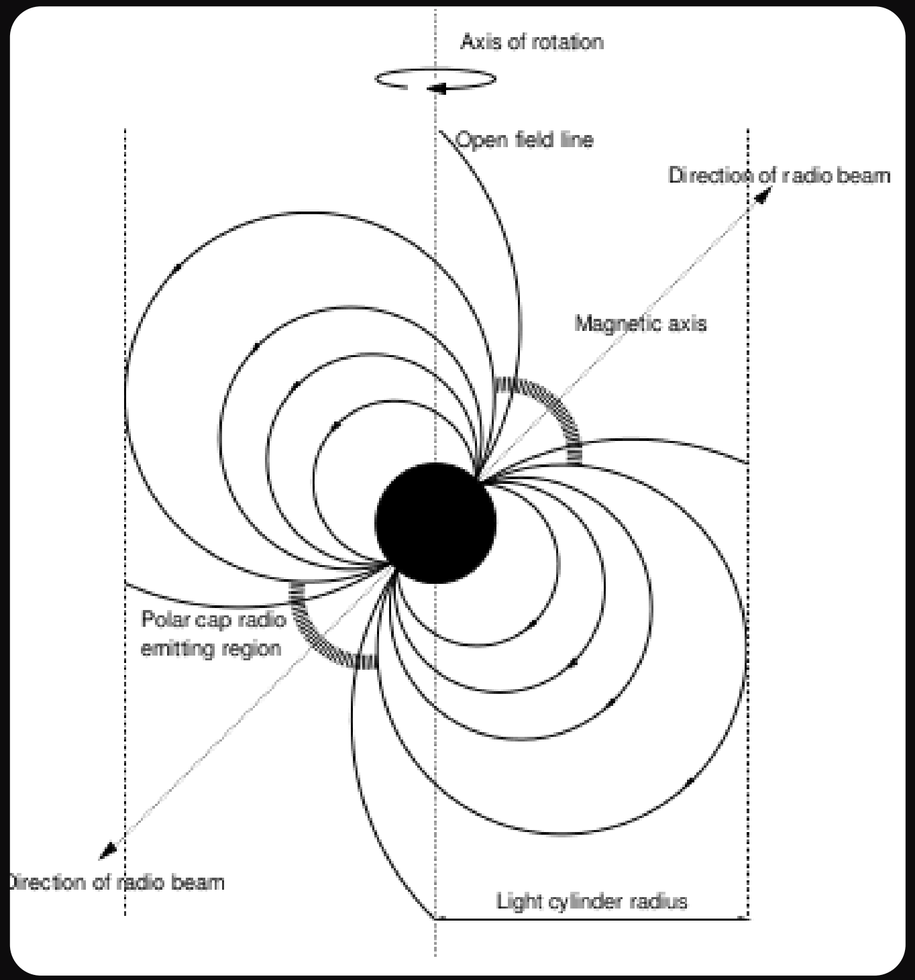
WHAT ARE ULTRACOOL DWARFS?

- Ultracool Dwarfs live between low-mass stars and giant exoplanets
- Classified as spectral type M7 and later
- Interiors are fully convective
- Brown dwarfs are a subclass of ultracool dwarfs
- Our object of interest is T8 dwarf WISE J151721+05



Source: NASA, 2025

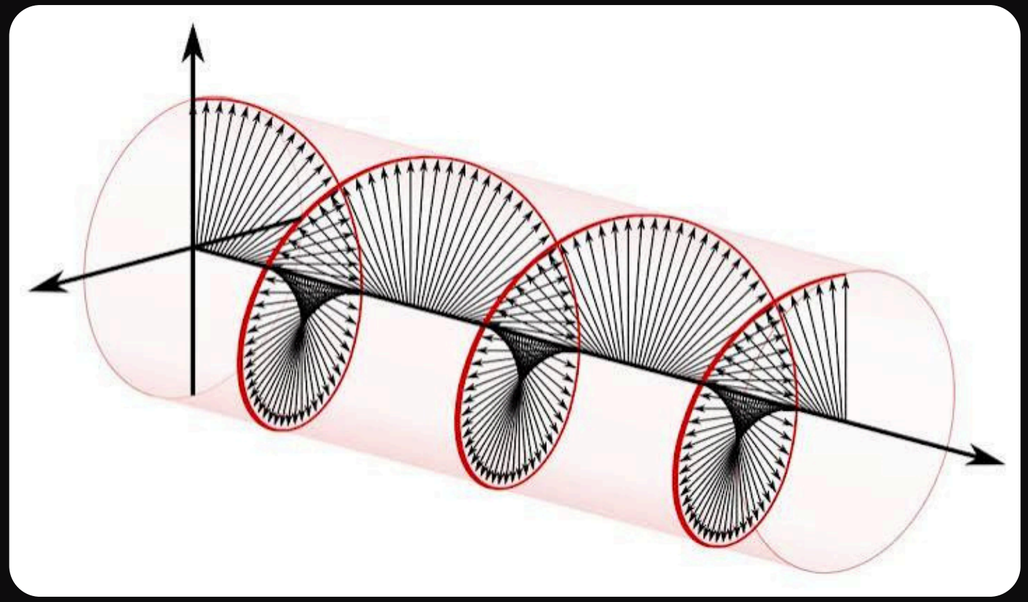
MAGNETIC FIELDS & RADIO EMISSION



- Many UCDs have been shown to have strong, stable magnetic fields
- Gyrosynchrotron Emission
  - Produces weaker, less polarized emission
- Electron Cyclotron Maser Emission (ECME)
  - Produces highly circularly polarized radio emission
  - Can produce periodic bursts as the object rotates

RADIO POLARIZATION

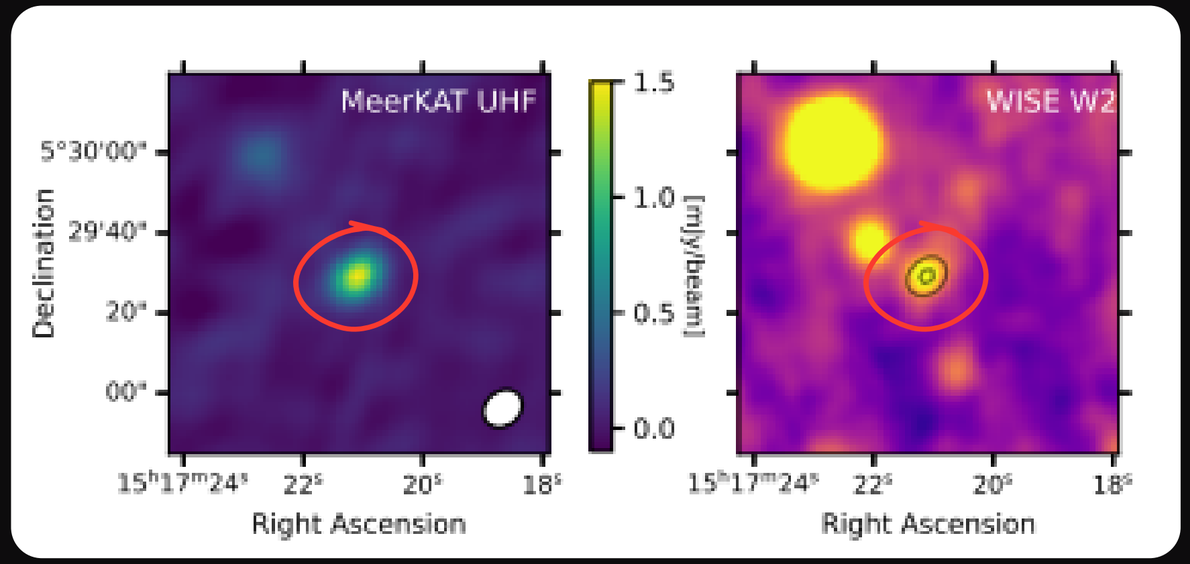
- Radio waves can be polarized in different waves
- Stokes I measures total radio intensity
- Stokes V measures circular polarization
- Positive and negative Stokes V indicate opposite directions of circular polarization



Example of a radio wave

OBSERVATION & METHODS

- ASKAP, ATCA, and MeerKAT observations
- Radio and multi-wavelength observations
- Intensity, polarization, time variability, and frequency behavior



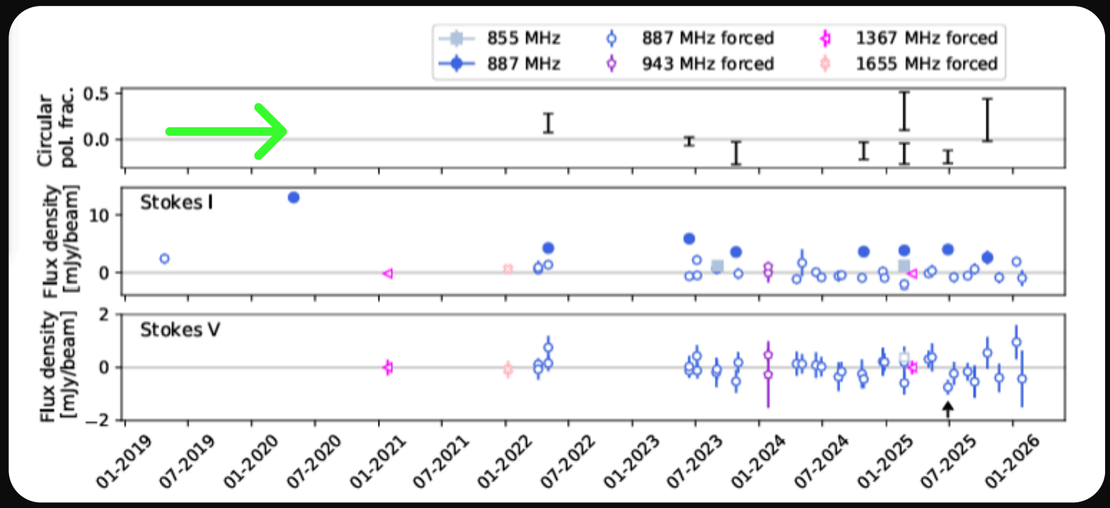
Radio detection from MeerKAT along with the infrared WISE image

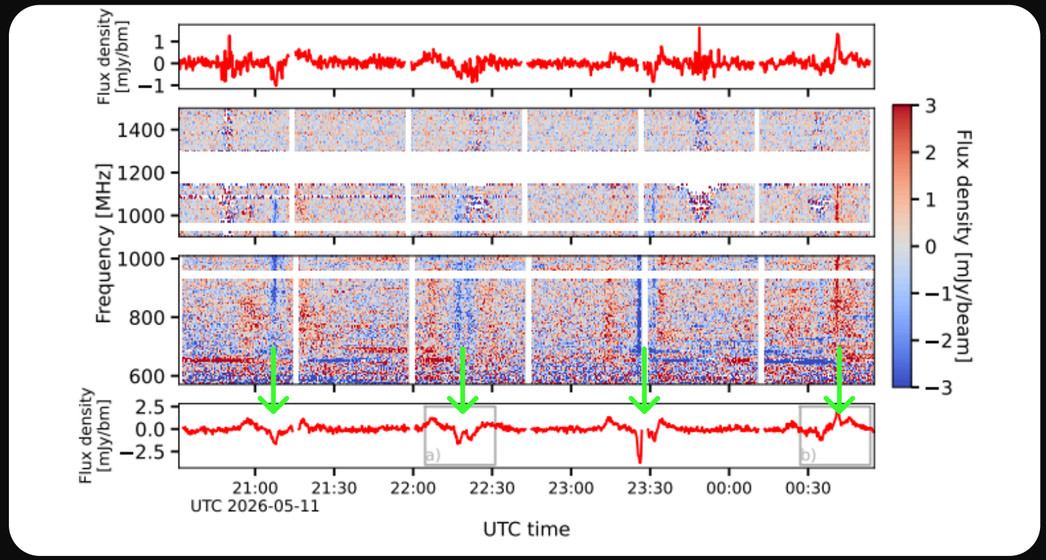


MeerKAT Observatory

PERIODIC RADIO EMISSION

How radio signal changes over time, with several periods of detected radio emission.

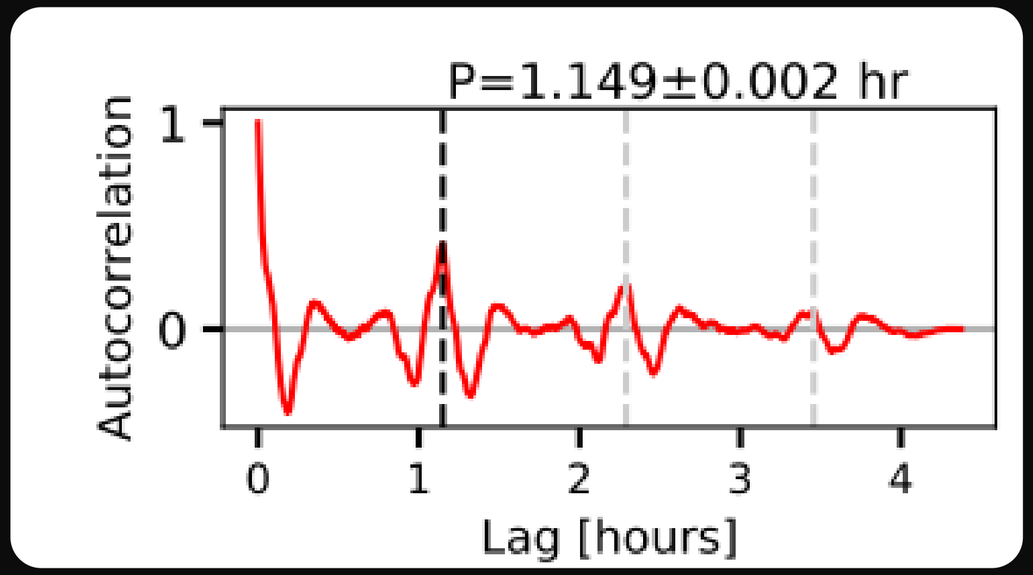




Radio signal at different frequencies over time. Four panel compare in two bands: UHF and L-band.

- Radio bursts identified by ASKAP and MeerKAT
- Four prominent radio bursts were observed
- Repeated bursts with a period of 1.149 hours
- Radio Emission changed in strength and polarization

ROTATION PERIOD



Shows the repeating pattern of the radio signal

- Used radio light curves to identify repeating patterns
- Autocorrelation helped measure time between signals
- **Rotation period of 1.149 Hours**
- The fastest period recorded from a brown dwarf



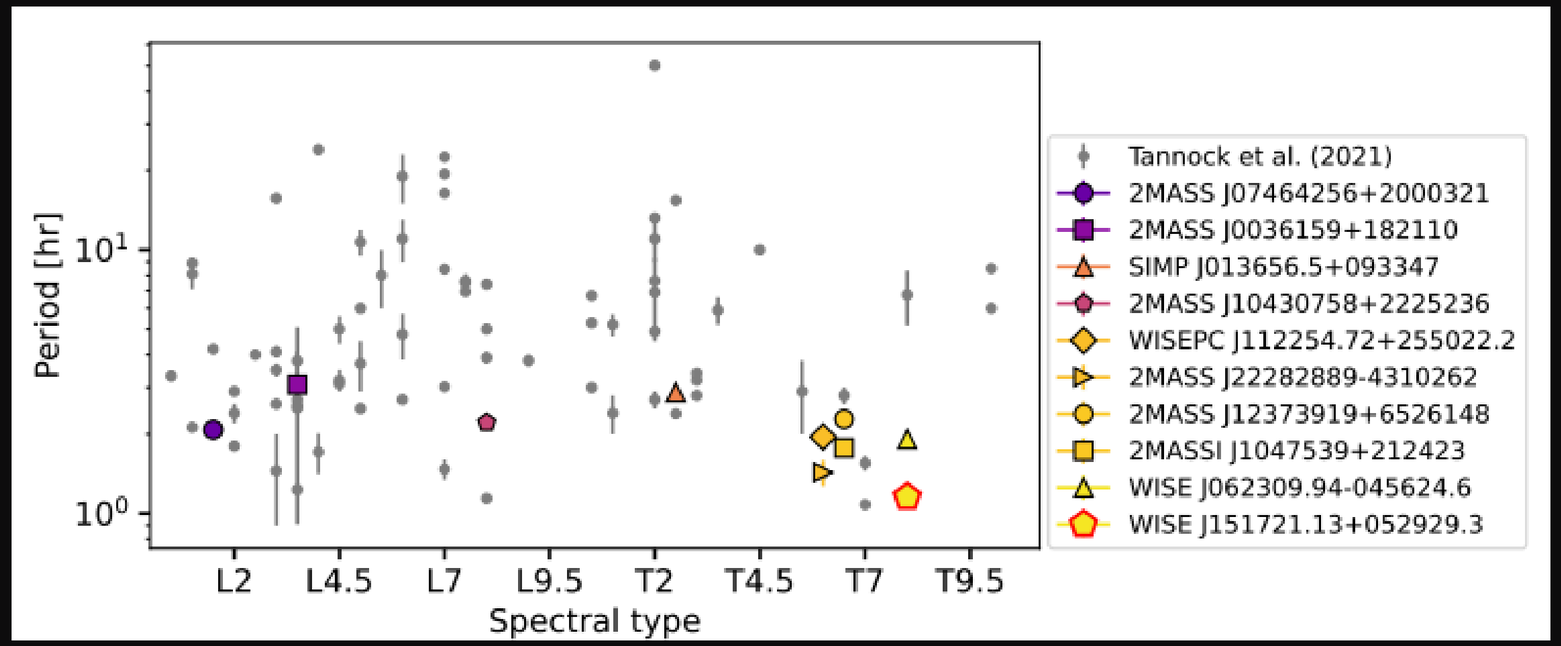
MAGNETIC FIELD & EMISSION MECHANISM

- Researchers favor Electron Cyclotron Maser Emission
  - Stable, periodic bursts
  - Strong magnetic fields
- Magnetic Field Estimates:
  - Inclination: 48°
  - Obliquity: 40°

Source: NOIRLab, 2020

CONCLUSION

- Researchers discovered periodic radio emission from the T8 dwarf WISE J1517+05
- It has a rotation period of 1.149 hours
- The radio emission had unusual, changing circular polarization
- Researchers favor ECME as the emission mechanism



WISE J1517 has one of the fastest periods