VLBI transient science with ATCA

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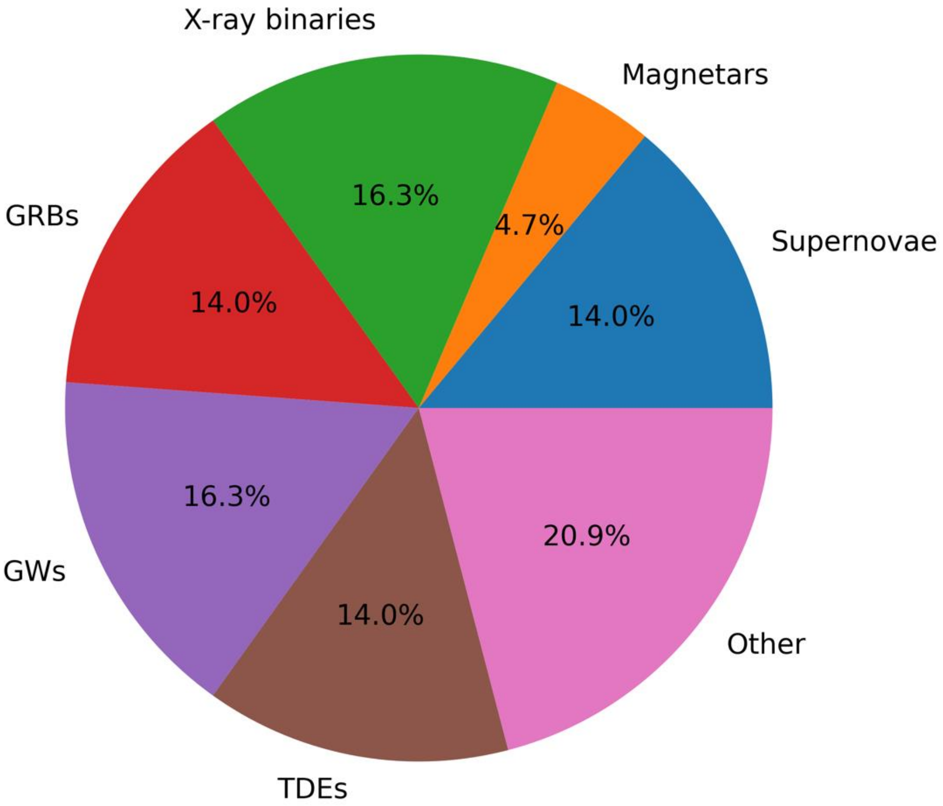
ATCA Science day 8 April 2025

ATCA: the go-to transients intrument

NAPA = Non A-Priori Assignable

- 50% of submitted proposals are NAPAs (2% are rapid response)
  - Up 10 pts from 2023!



Data from 2025 APRS semester

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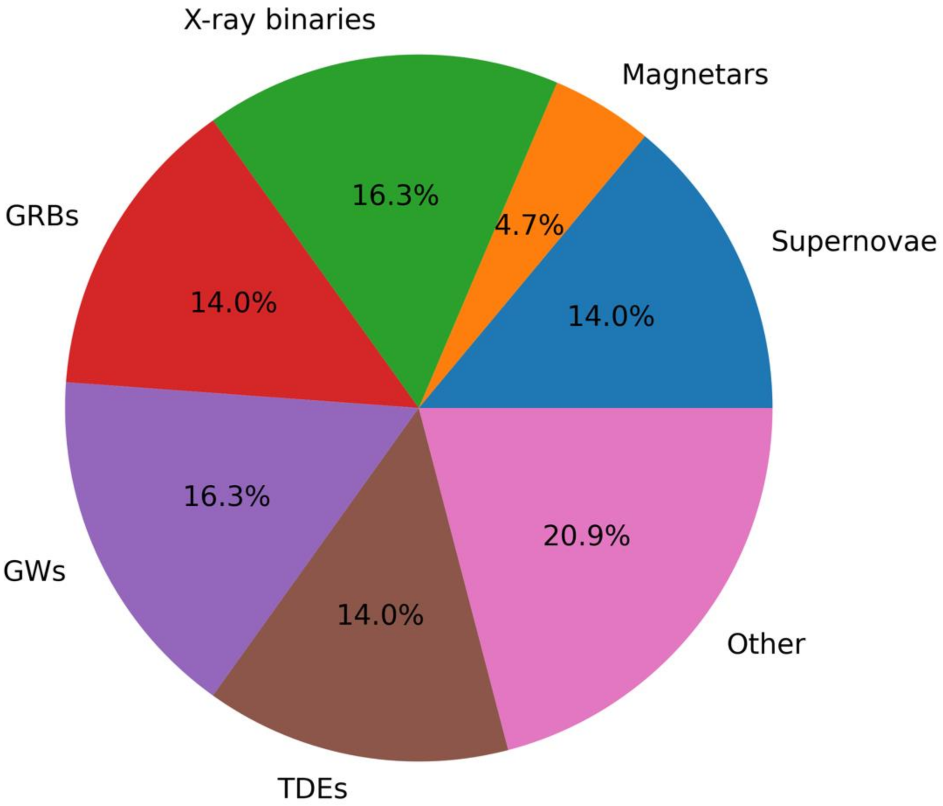

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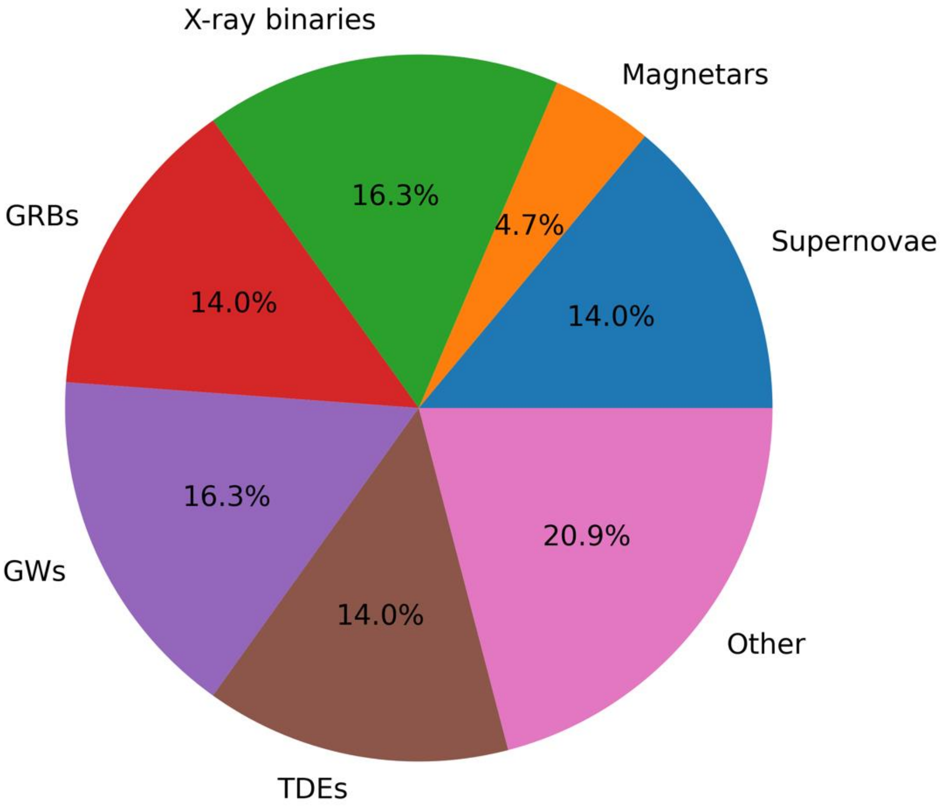
- All science areas would benefit from VLBI observations
- Yet, **only 20%** of LBA proposals are NAPA (4/19)



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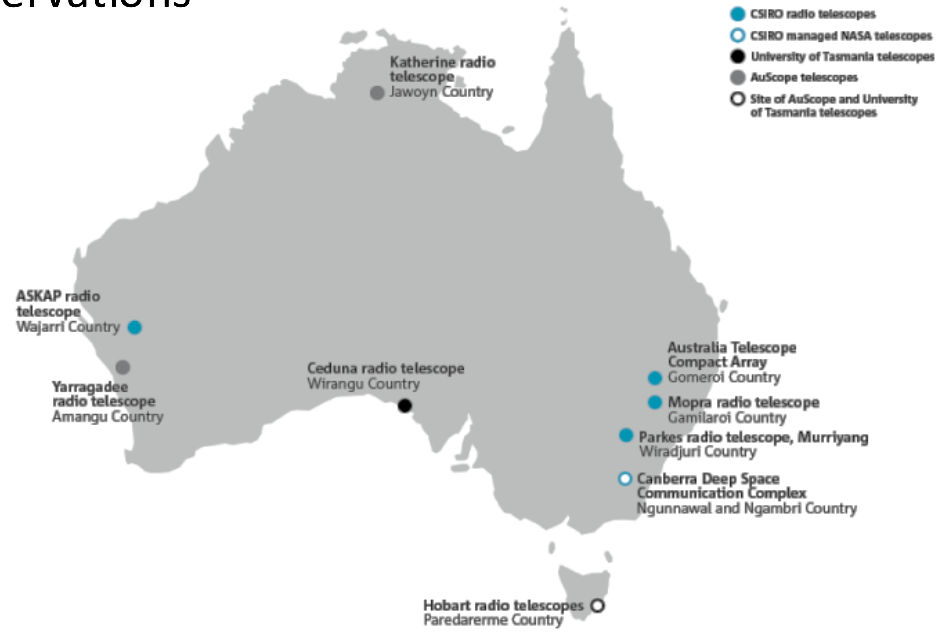
Why is the LBA underutilized for transients science?

Restricted scheduling

- ≤ 4 LBA sessions per year, plus 'out-of-session' observations on an ad-hoc basis

→ NAPAs, Global-VLBI observations



Transients science expected to keep growing

- 25% increase in ATCA NAPA proposals since 2023
  - Likely largely due to new transient instruments: e.g. SVOM, Einstein-Probe
- More transient instruments to come!
  - E.g. LSST-Vera Rubin and **the SKA**
- Now is the time to think about the LBA's role in transients science
  - E.g. Monthly LBA sessions? 'Rapid-response' capabilities?

ATCA as integral part of the LBA

High frequencies & sensitivity

- **Vast majority of LBA proposals (and NAPAs) request 3cm (8.4 GHz) band.**
- Murriyang: UWL (max freq 4 GHz) + CryoPAF (max freq 1950 GHz)
- Without Murriyang, ATCA is by far the most sensitive element in the array at 3cm.

Responsiveness

- Switching between receivers trivial

ATCA-SKA VLBI

- Most sensitive LBA antenna >15 GHz
- Crucial for **flexibility** in scheduling SKA-LBA observations

Yingjie Li et al 2024

Summary

- Transient science is exploding but the LBA is not fully capitalizing
  - What do you require to meet your high-resolution transients science goals?

- ATCA is both **flexible** and sensitive – critical for carrying out more LBA observations of transients

- ATCA is vital for VLBI science at high-frequencies
  - Will be even more important to capitilize on SKA-VLBI!

Extras

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Sensitivity

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- required for good calibration and hence precise astrometry

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Resolution

- ~3-5x lower resolution c.f. Northern Hemisphere VLBI networks
- ~doubled with **phased-ASKAP** (@ ~1.4 GHz)