Radio emission from Transient bursting source GCRT J1745–3009 -- New Results

Subhashis Roy

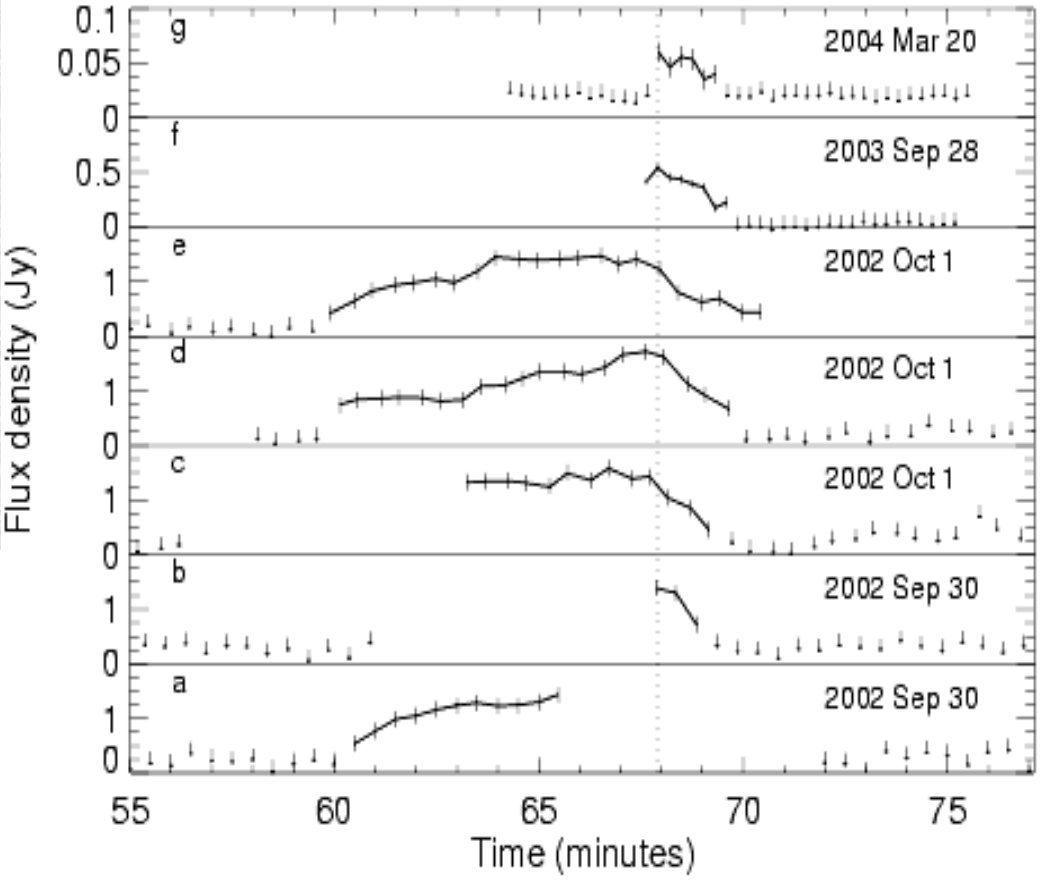
ASTRON

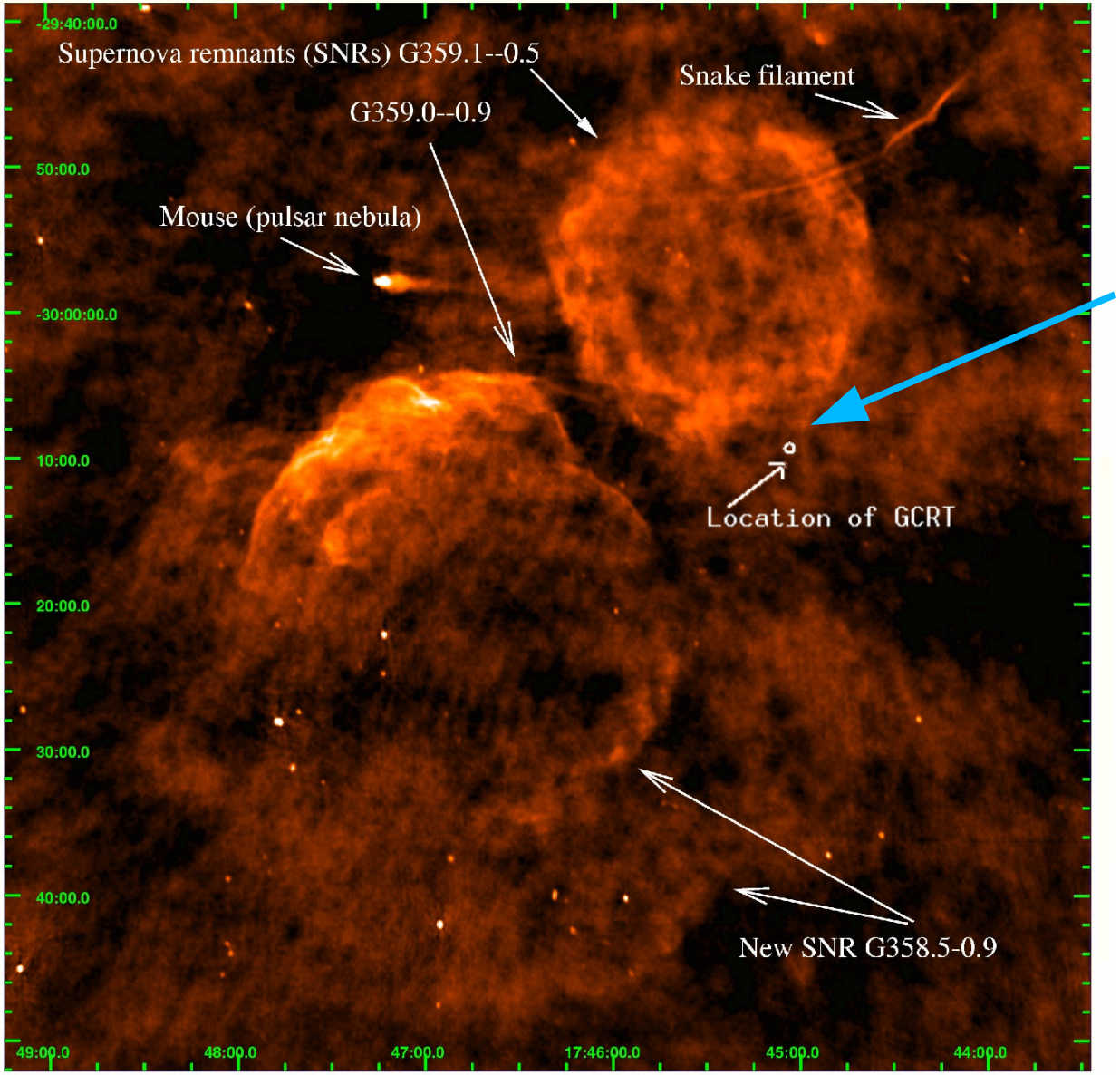
Collaborators: Scott Hyman, Sabyasachi Pal, Joseph Lazio, Paul S. Ray, Namir Kassim, Sanjay Bhatnagar

Introduction

GCRT J1745-3009:

- Bursting transient radio source discovered by Hyman et al. (2005) at 330 MHz.
- **Brightness temp >10^{15}K.**
- Likely to be coherent emission.
- On 10 minutes, after each 77 minutes.





330 MHz image of the field G358.8--01 located about 1 degree south of the Galactic Centre. The resolution is ~14" and the rms noise ~1 mJy/beam. This is the highest sensitivity image of the region and is made from GMRT data. The map is used to confirm a faint barrel shaped SNR shown near the bottom.

GCRT...

- Cyclotron emission or pulsar emission known to be coherent.
- 77 min too high for a typical pulsar.
- Nulling pulsar (e.g., B1931+24 off ~90% time, quasi-periodic bursts) remains possible.
- GMRT observations in 2003 to detect transients resulting in its re-detection.
- Serendipitous detection from 2004 SNR data.

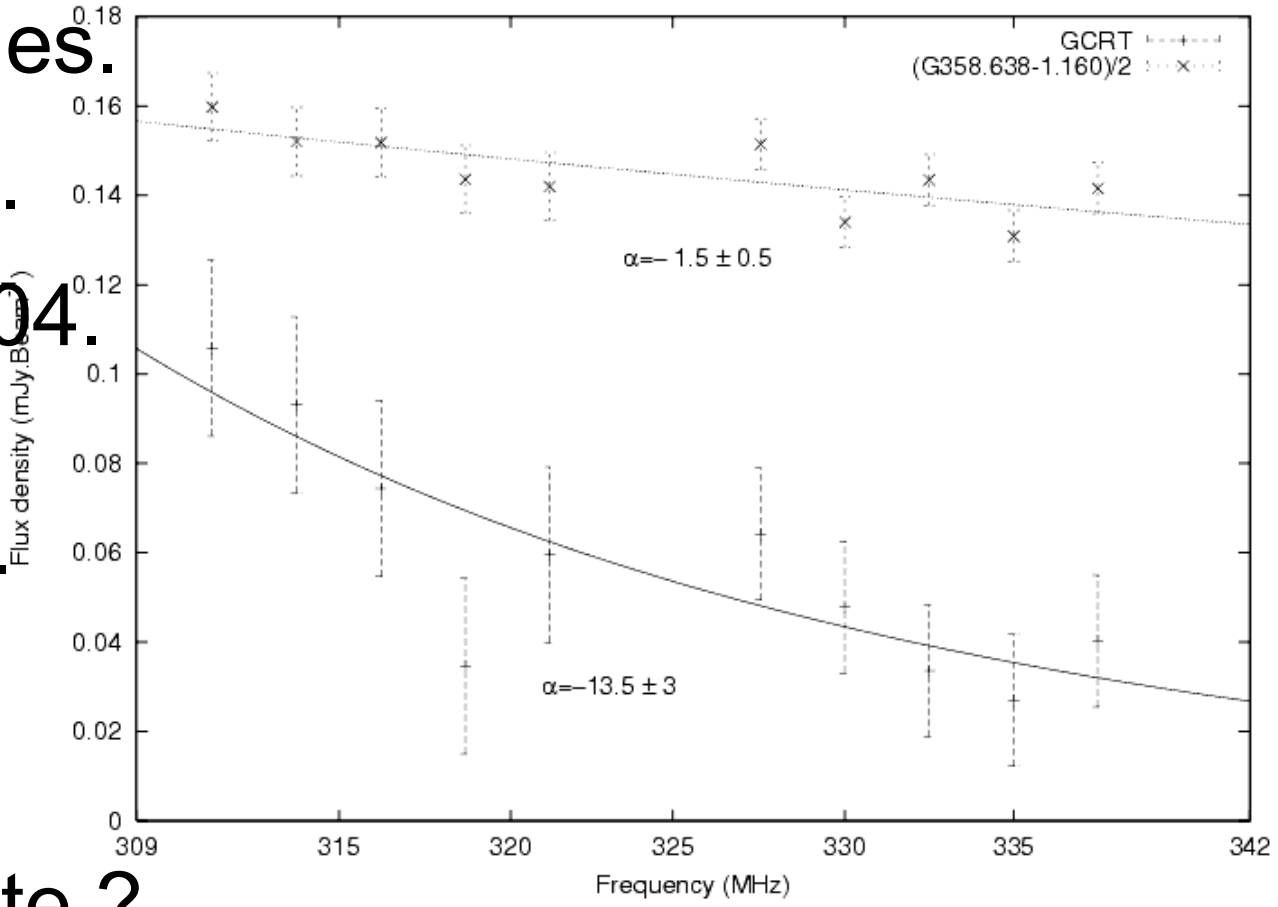
Results:

- Peak flux densities.

1→ 0.4→ 0.06 Jy.

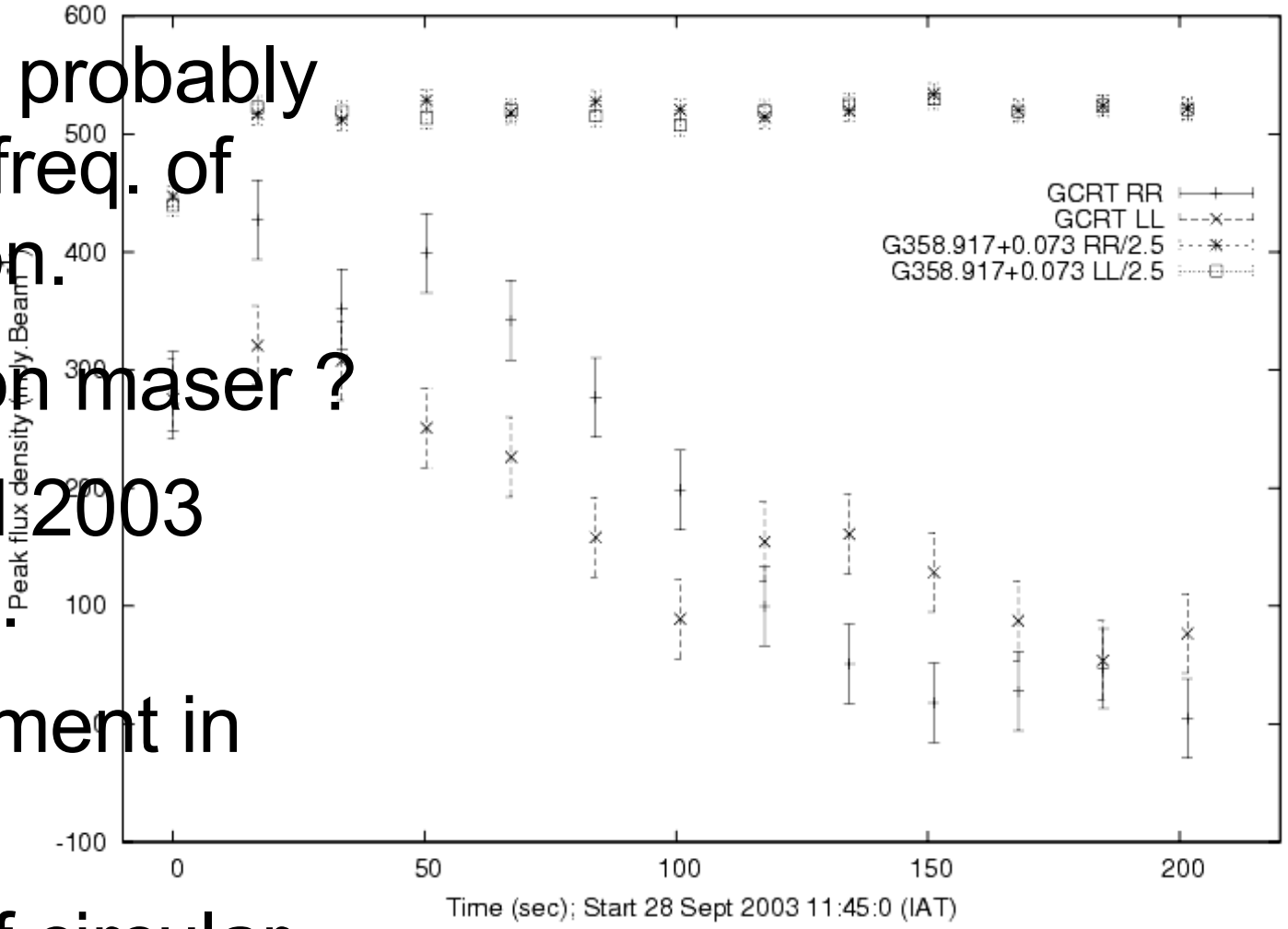
2002→2003 →2004.

- 75 → 25 → 6 mJy.beam^{-1} rms.
- Unresolved with beam size ~15".
- 2004 → new state ?
- Very steep spectral index of -13±3 (Hyman et al. 2007).



Results ...

- Very steep spectrum→ probably near cutoff freq. of line emission.
- Is it cyclotron maser ?
- Reanalysed 2003 GMRT data.
- ~3 improvement in rms noise.
- Detection of circular polarisation at ~tens of percent level.



Discussions

- Cyclotron or plasma emission produces high circular polarisation.

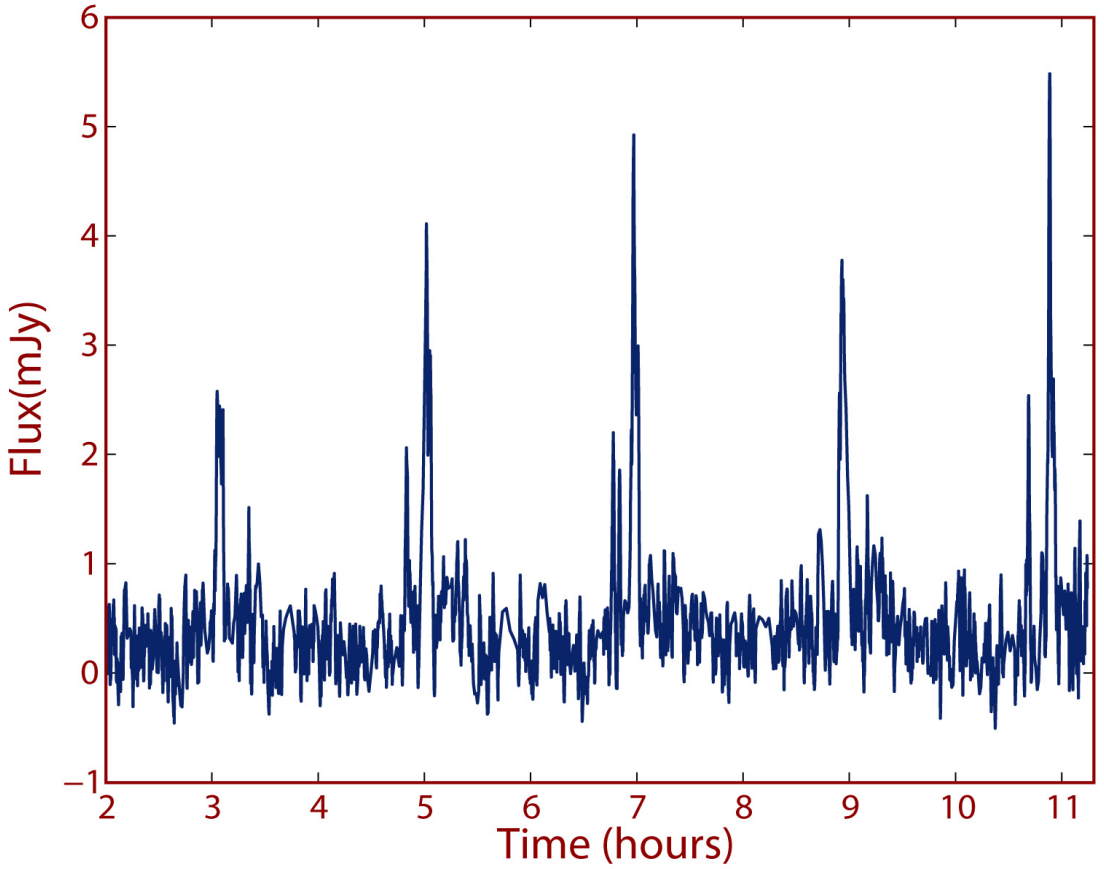
$$B = \frac{(2\pi\nu mc)}{e}$$

- Required magnetic field ≤120 Gauss.
- Neutron star based models ruled out.
- Stars within only ~few tens of pcs have detectable cyclotron emission.
- Lack of optical counterpart suggest brown dwarf or extrasolar planet.

Discussions ...

- How do we explain 77 min periodicity ?
- Mass > 0.1 $M_{\odot}$ cannot have rotation period of 77 min.
- Could it be a rotating brown dwarf or a planet around a nearby brown dwarf (similar to Jupiter-Io system) ?

(Roy et al. 2007, in preparation).



Time series of radio emission from M9 dwarf TVLM 513-46546 (Hallinan et al.)