

Review of Science Results from the GMRT : Pulsars

*Y. Gupta*¹

¹ National Centre for Radio Astrophysics (TIFR), Pune University Campus, Pune 411007, India.

Abstract :

The GMRT, in its phased array mode, is a powerful and versatile instrument for pulsar studies. We present here a review of the main interesting results obtained in this field with the GMRT, during the past few years. These include (i) discoveries of new pulsars (ii) simultaneous multi-frequency observations of pulsars (iii) detailed studies of pulse profiles for various applications (iv) single pulses studies (v) polarization properties of pulsars.

1 Summary

The GMRT supports two main modes of operation : (i) the Earth rotation aperture synthesis mode which uses the 30 antennas as an interferometer to produce images of the radio sky and (ii) the array mode where any selected sub-set of the antennas can be added in either incoherent or coherent (phased) mode to produce single beam outputs. The array mode is primarily used for observations of pulsars and some transient sources. In this paper we present a review of the main results from the GMRT in the field of pulsars. These include the following topics.

(i) Discoveries of new pulsars : A few different new pulsars have been discovered with the GMRT in the past few years, in targeted and untargeted surveys. Results from these are summarized here.

(ii) Multi-frequency observations : Using the sub-array mode, the GMRT used can be used for simultaneous multi-frequency observations of pulsars. Such observations have been used to study various aspects ranging from accurate estimates of dispersion measures to study of subpulse behaviour at different frequencies. Further, the GMRT has been used in conjunction with other radio telescopes in the world, for simultaneous multi-frequency observations over a larger frequency range. Interesting results from these are also presented here.

(iii) Pulse profile studies : Using high sensitivity observations made possible with the GMRT, the pulse profile structure of some of the strong, well known pulsars has been studied in detail to reveal the presence of multiple components of emission not seen before. Unique interpretation of the asymmetry of the locations of these emission components within the profile window has led to very useful estimates of the location of the emission regions that may be responsible for these components. These results are important in that they provide direct evidence for the conal model of emission and the radius to frequency mapping effect.

(iv) Drifting subpulses : Wide profile pulsars with drifting subpulses hold important clues to understand the emission mechanism of radio pulsars. The high sensitivity of the GMRT has allowed detailed studies of single pulse structure of such pulsars. This has led to some new results, including unique drifting behaviour for pulsars like PSR B0818-41, and also a better understanding of the behaviour of pulsars like PSR B0826-34.

(v) Polarization : Pulsars are generally quite highly polarized at the metre wavelengths at which the GMRT operates. Detailed studies of the polarization properties of some pulsars has revealed some new facets, which are presented here.