URSI-RCRS 2024, ARIES/GEHU, Bhimtal, India, 22 - 25 October, 2024

Beam Shaping Technique For Dual Polarized Cross Dipole Feed For Radio Astronomy Application: uGMRT.

Hanumanth Rao Bandari*(1) and Suresh Kumar S (2)
(1) GMRT Observatory, NCRA-TIFR, Pune, Maharashtra 410504, e-mail: hanuman@gmrt.ncra.tifr.res.in
(2) GMRT Observatory, NCRA-TIFR, Pune, Maharashtra 410504, e-mail: skumar@gmrt.ncra.tifr.res.in

The Giant Metrewave Radio Telescope (GMRT) is an international facility for Radio Astronomy, operational since 2002. It consists of 30 fully steerable parabolic antennas, each of 45 m diameter, spread over an area with an effective radius of nearly 15 km, and covering frequencies in the range of 120 MHz to 1450 MHz Though meant primarily as an aperture synthesis instrument, incoherent and coherent phased arrays can be formed out of the 30 dishes, and separate sub-arrays can work on different frequency bands concurrently [1].

The GMRT has prime-focus feeds at four faces of a rotating turret, covering frequencies 120-140 MHz (Band-02), 250-500 MHz (Band-03), 550-900 MHz (Band-04) and 1000-1450 MHz (Band-05) [2].

For Band-05 feed, Existing feeds are Corrugated Horns, designed and developed by RRI, Bangalore. As a part of GMRT feed upgrade, designed and developed a cone-dipole 1000-1500 MHz, which consists of a cross dipole with open sleeve [3] and a conical reflector for shaping the beam. For prototype testing, we have installed on 2 GMRT antennas and found that performance exactly matches with the Horn.

By theoretical calculations, we have understood that to enhance the feed's performance (G/Tsys), we need to achieve an edgetaper ~ -17 dB for which beam shaping is required. Hence, the corrugated conical reflector to achieve the edgetaper (-12 to -17 dB) at the astronomical frequency 1390 MHz.

Successful completion and deployment of this wideband feed on all 30 antennas will make the GMRT a very sensitive and versatile instrument for a variety of new science in astronomy.

1. Swarup, G., Ananthakrishnan S., Kapahi, V.K., Rao, A.P., Subramanya, C.R., and Kulkarni,V.K., "The Giant Metre-wave Radio Telescope", *Current Science*, Vol.60, No.2,1991.

2. Hanumanth Rao Bandari., G.Sankarasubramanian., et al., " Wideband feeds for the upgraded GMRT", *Radio and Antenna Days of the Indian Ocean (RADIO 2012)*, IOP Conf.Series: Materials Science and Engineering 44 (2013) 012023.

3. Wong, J., King, H., "A Cavity-Backed Dipole Antenna with Wide-Bandwidth Characteristics", *IEEE Trans. Antennas and Propagation*, Vol. AP-21, No. 5, pp. 725-727, 1973.