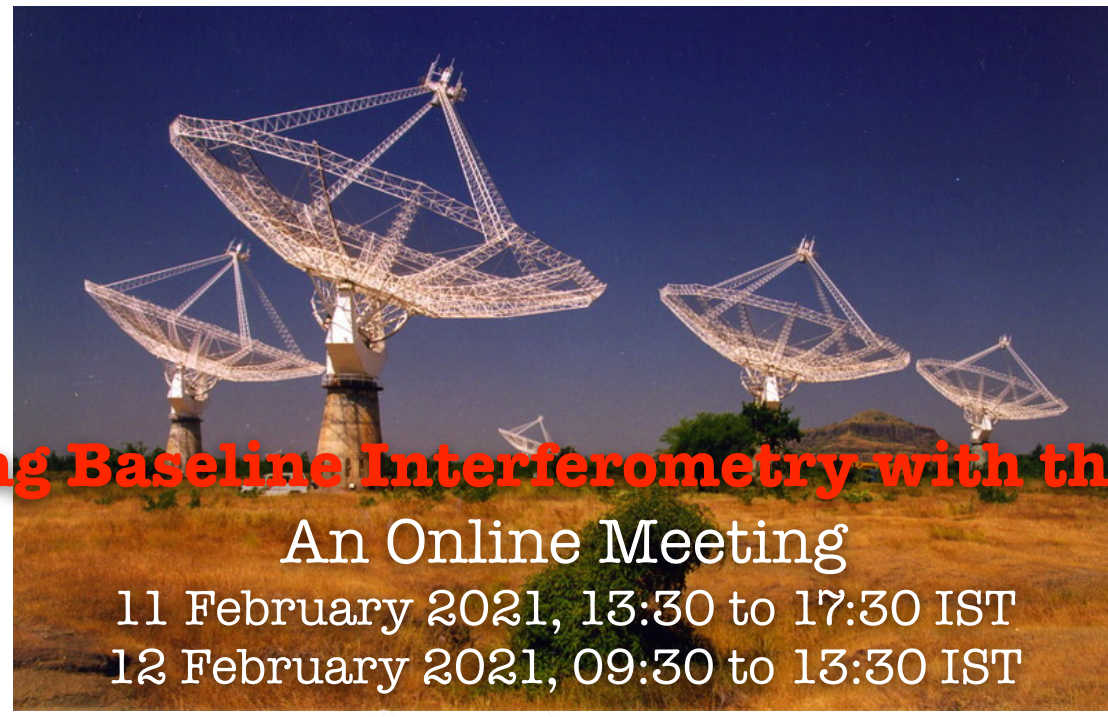

Very Long Baseline Interferometry with the uGMRT

An Online Meeting

11 February 2021, 13:30 to 17:30 IST

12 February 2021, 09:30 to 13:30 IST

The VLBI technique provides the highest angular resolution of any telescope for carrying out astronomical observations. Recent Event Horizon Telescope (EHT) observations of the AGN M87 that imaged the shadow of the supermassive black hole have taken our understanding of general relativistic and gravitational physics to unprecedented levels. The uGMRT situated at a latitude of +19◦06' and longitude of 74◦03' is the only large radio telescope array at these Earth coordinates, midway between the Equator and Tropic of Cancer. The uGMRT samples the astronomical sky from a declination of +90◦00' to -53◦54'. At low radio frequencies (≲1.4 GHz), the uGMRT with 50m dishes, is currently the telescope array with the highest sensitivity.

A VLBI array comprising of the uGMRT and telescopes in Australia or Europe (e.g., telescopes in the European VLBI Network) can provide angular resolutions of 5-10 mas at 1.4 GHz. At these resolutions, radio jets of AGN can be traced to just a few parsecs from the supermassive black holes from where they are launched. For instance, the radio jets in the nearby powerful AGN, Centaurus A, can be imaged and traced down to 0.3-0.6 parsec from their launching sites. Estimating jet speeds through proper motion studies can provide unique constraints on jet-launching mechanisms, MHD and gravitational physics of black holes and accretion disks. While interstellar scattering and scintillation are generally of nuisance value in radio astronomy, VLBI techniques can provide invaluable insights into these processes. Typical scattering angles at 600 MHz are of the order of 0.1-10 mas. For perspective, a 10,000 km baseline at 600 MHz gives an angular resolution of ≈10 mas. This can be enhanced by an order of magnitude with earth-space baselines. Phase-resolved VLBI of pulsars can help map the scattering morphology, often helped by scintillation itself, giving a boost in effective angular resolution. FRB localization will also get a quantum jump in sensitivity from the addition of GMRT to the existing VLBI stations.

With the recent acquisition of highly stable frequency standards, the uGMRT as part of a VLBI array, is poised to make substantial and unique contributions to the study of high resolution phenomena like jets in AGNs, as well as protostars and X-ray binaries, binary supermassive black holes in merging galaxies and their evolution. These in turn can connect with contemporaneous studies of gravitational waves from experiments like the InPTA and IPTA. The 5-10 mas resolution make a VLBI array including the uGMRT extremely competitive in the field of galactic and extragalactic astronomy.

The technical and scientific aspects of VLBI with European, Asian and Australian telescopes are expected to be highlighted in this meeting with invited talks covering these aspects. A significant time is also set aside for discussions between the participants for tests to demonstrate feasibility of VLBI experiments with uGMRT.