



भारतीय ताराभौतिकी संस्थान
INDIAN INSTITUTE OF ASTROPHYSICS
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स्नातक अध्ययन मंडल Board of Graduate Studies.

IIA - CU - PhD (Tech) Public Ph.D viva-voce examination

Speaker: V. Mugundhan

Title: Design of Digital Receivers for Low Frequency Radio Astronomy

सार Abstract

Indian Institute of Astrophysics operates low frequency radio telescopes in the Gauribidanur radio observatory to observe emission from the solar coronal plasma. Observations of radio emission from the Sun at low frequencies are critical to understand space-weather and associated phenomena. The associated solar radio transients show a plethora of temporal, spectral, and spatial fine structures. In order to study these, it was proposed to upgrade the radio telescopes in Gauribidanur to enable wide-band, high time, frequency and spatial resolution observations, in three phases. In Phase I it was decided to increase the number of antennas in the Gauribidanur radioheliograph array. Phase II is to upgrade the existing narrow-band digital back-end to a wide-band backend with high time and spectral resolutions. In Phase III, the longest baseline of the heliograph array will be increased to 10 km, to achieve $\sim 1'$ angular resolution to image the Sun. This thesis deals with precursor experiments carried out as technology demonstrators for Phase II and III of the proposed upgrade.

For studying the feasibility of Phase II upgrade, spectrometer and spectropolarimeter backend digital receivers were developed using high speed ADCs and FPGAs, and preliminary observations were carried out. From these observations, we were able to study the fine structures in type III bursts, using which we estimated the electron density turbulence in the low solar corona (between 1.6 - 2.4 R_{sun}).

Using observations with the spectropolarimeter backend receiver, an unified picture for metric and decametric storm emission from the solar corona is presented. We also set-up a simple two element interferometer experiment with disconnected elements, with a baseline of 10 km and 200 km, where the raw voltages were recorded using a data recorder developed as a part of this thesis work. For the first time, sources of sizes $\sim 15''$ at low frequencies (< 100 MHz) were identified to arise from regions, whence meter and decameter wavelength radio emission originate.

This talk will discuss the related analog/digital instrumentation and the science results obtained using them in detail.

बुधवार Wednesday, 20 नवंबर November 2019

Venue: प्रेक्षागृह Auditorium

Time: 2:30 PM

सभी का स्वागत है All are welcome.