भारतीय खगोलभौतिकी संस्थान

INDIAN INSTITUTE OF ASTROPHYSICS

कोरमंगला **Koramangala,** बेंगलूरु **Bengaluru – 560034.**

स्नातक अध्ययन मंडल Board of Graduate Studies.

Ph.D Synopsis Seminar

Speaker: Mr. Shaik Sayuf

शीर्षक Title: Estimation of the solar coronal magnetic field strength using low frequency radio observations (85-35 MHz)

सार Abstract

Estimation of the solar coronal magnetic field strength (B) is crucial for understanding various coronal phenomena, such as the formation and evolution of the background quiet solar corona and its structures (coronal helmet streamers, coronal holes, etc.), as well as its various forms of transient activities, including coronal mass ejections and radio bursts. Reliable measurements of B in the inner corona, particularly in the heliocentric height range of approximately 1.1–3.0 solar radii, remain scarce, as the inferred field strengths are low, typically of the order of a few Gauss. Solar radio astronomers generally use dynamic spectral and spectro-polarimetric observations of radio bursts, the intense radio emissions, to infer B at this heliocentric height range. Since these radio bursts are signatures of non-thermal energy releases associated with active regions, the estimates of B are pertinent to the active regions. Since such events are episodic, relying on them to measure the quiet coronal B routinely will not be effective. However, since the quiet solar corona continuously emits radio waves due to thermal processes, one may rely on that to measure its B on a routine manner. The magneto-ionic theory has shown that the presence of B in a magnetized plasma introduces anisotropy, splitting the originally unpolarized thermal radio radiation into two orthogonal circularly polarized components, the ordinary and extraordinary waves. These waves experience absorption and propagation differently depending upon the magnetic field topology, resulting in a net degree of circular polarization (DCP) in the observed thermal emission. Detecting and imaging this DCP helps us estimate B associated with the background quiet solar corona and its structures mentioned above. Furthermore, the imaging at different frequencies will help us determine B at different heliocentric heights and thereby its radial variation and topology. In view of the above, we decided to augment the Gauribidanur Radioheliograph (GRAPH), a T-shaped interferometric array dedicated to solar imaging in the 85-35 MHz range (corresponding to a heliocentric height range of ~1.2–3.0 solar radii), to determine B by routinely imaging the circularly polarized intensity of the thermal radio emission from the solar corona in addition to its present capability of imaging the total intensity. The earlier part of the presentation will cover the instrumentation aspects of the GRAPH augmentation project, including first-light observations and the estimation of B using the ray-tracing technique, which works based on Haselgrove's equations. Additionally, during the PhD tenure, the digital backend of the Gauribidanur Radio Interferometric Polarimeter (GRIP), a linear array, was upgraded with an FPGA-based system to detect the integrated circularly polarized radio emission from the unresolved solar corona in the frequency range of 85-35 MHz. Therefore, the later part of the presentation will cover the details regarding the GRIP backend instrumentation, observations, and estimation of B in the above frequency range using the combined observations of upgraded GRIP and augmented GRAPH.

सोमवार Monday 19, जनवरी January 2026

Time: 2:00 PM

Venue: प्रेक्षागृह Auditorium

सभी का स्वागत है All are welcome.