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Study of Fine Structure Phenomena in Solar Radio Emission

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Solar radio emission can be broadly categorized as : i) continuum emission and ii) transient emission. The former is composed of a non-variable stationary component considered to be due to the free-free emission from the electron distribution ubiquitous in the corona and a "slowly-varying" component due to the extreme density condensations above "active regions". At times the radio emission from the Sun can vary drastically over much shorter temporal and spectral scales, this is the transient emission often referred as "radio bursts" (viz type I, II, III, IV, V, **[9]**). The solar radio bursts are often identified and classified based on their spectro-temporal characteristics. These transient phenomena are observed to occur over a broad range of frequencies from a few kHz up to a few GHz, and show very high brightness temperatures in the range 10^{12} -10^{14} K. This radiation is often associated with the solar transients, viz. flares, Coronal Mass Ejections (CMEs), etc. which are the consequences of large scale magnetic energy releases that take place on the Sun.

With the advent of digital technology and improved radio instrumentation the next generation of very sensitive radio telescopes offer the capability of spectroscopic and imaging observations covering many octaves of the radio frequency band with very high spectral and temporal resolution. This is leading to the identification of new spectro-temporal phenomenology in solar emission features which are very weak **[5,6]** as compared with the well known solar bursts. Such weak emission features have been found to occur even at times of minimal solar activity. They are very interesting as they might provide clues to the understanding of the coronal heating phenomena. In order to build a physical understanding of such phenomena it is important to have regular observations of the Sun with highly sensitive radio telescopes, which are presently very limited.

Solar radio emission can be highly dynamic, varying over time scales down to a few milliseconds and spectral scales down to a few kHz. High sensitivity radio telescopes (viz. Long Wavelength array (LWA1, **[1]**), Low Frequency Array (LOFAR, **[8]**), upgraded Giant Meterwave Radio Telescope (uGMRT, **[2]**), the Murcison Widefield Array (MWA, **[7]**), Mingantu Ultrawide Spectral Radioheliograph (MUSER, **[10]**)) with instantaneous wide-band coverage at high resolutions (spectral, temporal and angular) are ideal for such observational studies, particularly during periods of low solar activity. In this presentation, I will describe some of our recent high time and frequency resolution observations of fragmented radio emission **[3,4]** from the Sun using the LWA1 and uGMRT, and their usefulness in the understanding of the solar corona.

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