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A new look into pulsar microstructure with the GMRT

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1 Extended Abstract

Microstructure emission, involving short time scale, often quasi-periodic, intensity fluctuations in subpulse emission, is known to be a common feature of radio emission from normal pulsars. However, the high time resolution and sensitivity required to detect these features has limited such studies to only few pulsars, mostly in the northern sky. In this paper, we present results from a detailed statistical analysis of the polarization properties (with single frequency observations) and spectral properties (with simultaneous dual-frequency observations) of microstructure emission in pulsars observed with the Giant Metrewave Radio Telescope (GMRT). The high sensitivty of the GMRT at low frequencies, its extensive sky and frequency coverage, along with the availability of a recently developed real-time coherent dedispersion system ([1]) allows us to characterize these properties of microstructure in a number of pulsars, including pulsars where such emission has never been reported before. We also present the first detections of quasi-periodic microstructure emission from millisecond pulsars (MSPs), in GMRT observations of two MSPs at 325 and 610 MHz ([2]). These detections allow us to extend the microstructure timescale - rotation period relationship by more than an order of magnitude, down to a rotation period of $\sim$ 5 ms. We discuss the automated characterization algorithms that have been developed for analysis of our large data sets of single pulses, as well as physical implications of our results, both in terms of a radial / temporal origin as well as an angular origin of micropulse emission. Finally, we highlight the prospects for an even larger scale study of microstructure emission with the upgraded GMRT, which will have $\sim$ 8 times larger bandwidths than the legacy system, and will be equipped with one of the largest bandwidth real-time coherent dedispersion systems at low frequencies ([3]).

References

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