Detecting and characterising weak radio emissions from the Quiet Solar Corona

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Observations spanning across wavelengths ranging from X-rays, Extreme Ultraviolet, optical and radio bands have demonstrated that copious amounts of nonthermal particles are generated during solar flares. Numerical simulations have also become more and more realistic and for the first time produced nonthermal particle spectra consistent with observations. However most observations of these nonthermal particles are focussed on active regions, particularly on big flares, where huge amounts of nonthermal particles are produced. While simulations can now qualitatively explain these properties, they also predict a regime of magnetic reconnection where particle acceleration would be very weak, leading to very small nonthermal signatures. To test our understanding of particle acceleration, it is critical to detect and characterise the nonthermal emissions from weak flares. Here we focus on detecting these signatures using the radio band. The first work of this nature at low radio frequencies, with focus on the quiet solar corona, was done by Mondal et al. (2020), where they detected ubiquitous radio emissions from the quiet solar corona. They postulated that these are the nonthermal signatures of the long hypothesised “nanoflares” and are evidence that not only are nanoflares happening in the quiet solar corona, but are also accelerating particles to nonthermal energies. Due to its importance, this work has been followed up on several fonts, ranging from investigating the validity of these results in independent datasets, using machine learning tools to characterise them, studying the spectral nature of these transient emissions and also studying them at higher frequencies. In this presentation, I will give a brief summary of the various works we have done for detecting and understanding the nonthermal nature of the quiet solar corona.