Transients

Observing and Mapping Solar Radio Bursts with ALPACA

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Here we propose to use the Focal L-band Array for the GBT (FLAG) receiver for a pilot study to observe the ∼1.5 GHz emission from small radio bursts (SRBs) in the low solar corona. These bursts are related to decimetric Type III (Type IIIdm) SRBs, which occur during flaring events and can initiate coronal mass ejections (CMEs). Understanding the particle acceleration during flares will provide important insight into magnetic reconnection and space weather. Type III SRBs are caused by energetic electrons traveling at 10% to 20% of the speed of light with radio emissions at the plasma frequency fpe = 9ne kHz, and are typically observed in the frequency range 20 MHz < ν < 2 GHz. The bursts have strengths of ∼0.5 solar flux unit (sfu) to several hundred sfu, where 1 sfu = 10^4 Jy, with a typical time range above 80% of peak flux of tens to hundreds of seconds.

Developing measurement methods of the decimeter radiation from SRBs will help determine the complex magnetic fields associated with flaring events in the Sun's corona, which can be used to determine the acceleration of the plasma in CMEs before they can be tracked with white light coronagraphs.

The 122.1 MHz bandwidth of the ALPACA spectral line mode centered at 1400 MHz corresponds to electron densities of $2.2 - 2.6 \times 10^{10}$ cm^{-3}, therefore allowing the study of electron acceleration in the early stage of a solar flare. This central frequency is chosen to have the least known RFI within the bandwidth.

The rate of occurrence for Type III bursts varies based on solar conditions, but during periods of medium to high activity, a few can be expected to be observed on a given day. We are now leaving solar minimum, so it is historically expected to be 1-40 per hr per Active Region, so we propose to observe for 5 hours and expect to catch at least several microflares.