Commensal Low Frequencies on the NRAO VLA: The VLA Low-band Ionosphere and Transient Experiment (VLITE) and VLITE-Fast

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The VLA Low Band Ionosphere and Transient Experiment (VLITE) was developed by the US Naval Research Laboratory and NRAO as a commensal observing system on the Karl G. Jansky Very Large Array (VLA). A 64 MHz sub-band from the prime focus 240-470 MHz dipoles is continuously correlated during nearly all observations using the VLA GHz receivers. Dedicated samplers and fibers transport the signal from the low band receiver to a custom designed, real-time DiFX software correlator. The operation of VLITE requires no additional resources from the VLA system running the primary science program.

During the initial 2.5 year phase, VLITE successfully demonstrated that an automated low frequency commensal system could operate on a GHz focused telescope. VLITE was upgraded in 2016 to handle correlation of on-the-fly (OTF) mode observing to support the NRAO VLA Sky Survey (VLASS) being undertaken in S band. VLITE was expanded to 16 antennas in 2017, more than doubling the number of baselines, which resulted in a much more stable system for the start of the VLASS program.

In parallel with the near real-time VLITE correlation described above, NRL has also worked to develop a GPU-based system to independently channelize, filter and analyze data at 1 ms resolution. This system, VLITE-Fast, is used to search over a large range in pulse width and dispersion measure (DM, up to 1000 pc/cm³) in real time. Targets for VLITE-Fast include fast radio bursts (FRBs) which have been detected at 400 MHz recently by CHIME, suggesting they may also be detectable at VLITE's operating frequency of 340 MHz. These sources have the potential to be a powerful probe of the Universe at cosmological distances.

Candidates detected in VLITE-Fast by multiple antennas trigger a dump of buffered voltages which can allow a precise localization and characterization of the pulse. VLITE-Fast is currently undergoing commissioning and evaluation of the RFI environment. Round-the-clock operation and autonomous triggering for VLITE-Fast are expected within a few months.

I will present an overview of VLITE, highlighting its capabilities, recent upgrades of the system and the current status of VLITE-Fast. I will also present an overview from the first epoch of the VLITE Commensal Sky Survey (VCSS). This survey is being developed from VLITE observations made in parallel with VLASS.