U.S. NAVAL RESEARCH LABORATORY

VLITE

VLA Low-band Ionosphere and Transient Experiment

AT A GLANCE

What is it?

VLITE is a novel radio-frequency instrument that operates commensally (in parallel) with scientific research programs on the National Radio Astronomy Observatory's Very Large Array (VLA). VLITE was designed by NRL to record a constant data stream at 340 MHz during nearly all VLA programs.

How does it work?

By taking advantage of separate optical paths for high and low frequencies on the VLA, VLITE is able to harvest data continually from the low frequency receivers during higher frequency science programs. VLITE effectively makes the VLA into two scientific instruments.

What will it accomplish?

VLITE provides NRL with over 6000 hours of scientific data per year. These data are used to measure diurnal and seasonal changes in the Earth's ionospheric, to identify and characterize transient and variable cosmic sources (e.g. supermassive black hole outbursts and stellar explosions), and to develop new data analysis methodologies. Applications for VLITE data range from space weather to communications.

R&D Sponsor(s)

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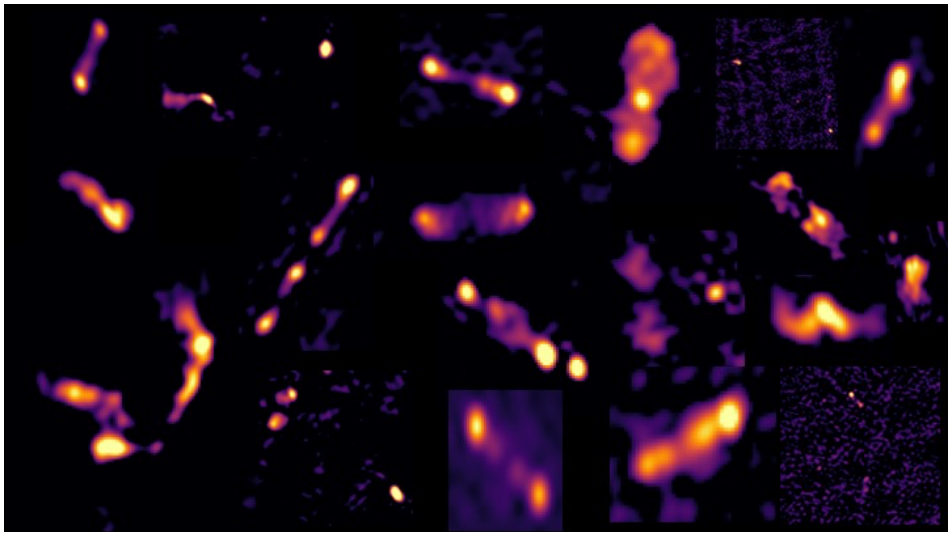

Astrophysical sources seen by VLITE reveal a wide range of shapes. These data trace explosive events in and beyond our Milky Way galaxy, as well as the history of explosions from supermassive black holes (quasars) over the past several billion years. Credit: T. Clarke & VLITE Team/NRL

The U.S. Naval Research Laboratory (NRL) developed the VLA Low-band Ionosphere and Transient Experiment (VLITE) to overcome the difficulties of acquiring long-timescale, low-frequency datasets necessary to support new passive ionospheric research programs. VLITE is a low-cost back end developed by NRL on the National Science Foundation-funded VLA infrastructure (see VLA antennas below). Operating on 18 of the 27 VLA antennas, VLITE continually monitors areas of the sky roughly seven full moons across, producing maps of cosmic sources and tracking variations in source brightness on scales of minutes to years. Ionospheric studies use near real-time analysis of the brightest astrophysical sources in the sky.

The National Radio Astronomy Observatory's Very Large Array consists of 27 antennas (25m each) operating in reconfigurable arrays from a compact 1 km array to an extended 36 km array. Photo credit: T. Clarke/NRL

Opening New Opportunities

Through the development of innovative calibration, analysis, and cataloging programs, NRL has established VLITE as a powerful instrument for astrophysics and atmospheric remote sensing.

During the next few years, NRL's researchers will use the VLITE data for astrophysics and ionospheric studies and to improve accuracy of positioning and navigation. One approach aims to improve our understanding of quasars which play a critical role in the celestial reference frame that ties the GPS to ground-based navigation. A second program is designed to identify new millisecond pulsars that are critical to the next generation of Pulsar X-ray Navigation and Timing that will enable spacecraft to determine their positions beyond the Earth-based global navigation networks.