Low Frequencies in New Mexico:

The EVLA Low Band Upgrade and the Long Wavelength Array Station One

N.E. Kassim[1], T.E. Clarke[1], B.C. Hicks[1], P.S. Ray[1], K. W. Weiler[1], F.N. Owen[2], R.A. Perley[2], S. Durand[2], C. Kutz[2], M. Pospieszalski[2], P. Harden[2], L. Kogan[2], and the Long Wavelength Array consortium[3]

[1]Naval Research Lab., [2]National Radio Astronomy Observatory, [3]UNM, NRL, Virginia Tech, LANL, JPL, & New Mexico Tech

Summary: This is a transformative time in low frequency radio astronomy, and here we report on two exciting developments in New Mexico. The Expanded Very Large Array Low Band (EVLA-LB) project, an initiative to equip the National Radio Astronomy Observatory (NRAO) EVLA with broadband (~50-500 MHz) low frequency receivers and LWA1, the first station of the Long Wavelength Array (LWA: http://lwa.unm.edu). The potential to combine signals from early LWA stations, including LWA1, with the new EVLA-LB system is being explored.

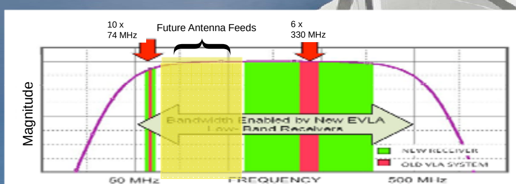
Expected EVLA-LB first call for proposals: early 2013.

namir.kassim@nrl.navy.mil for information on either project.

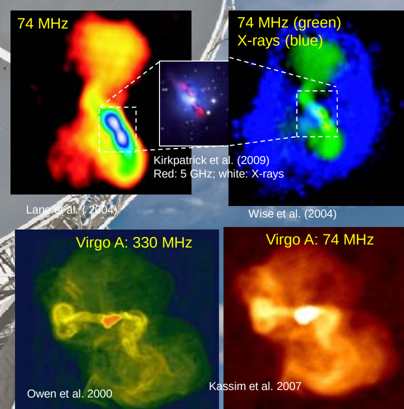
The next LWA1 call for proposals is expected by March 2012.

EVLA Low Band Upgrade

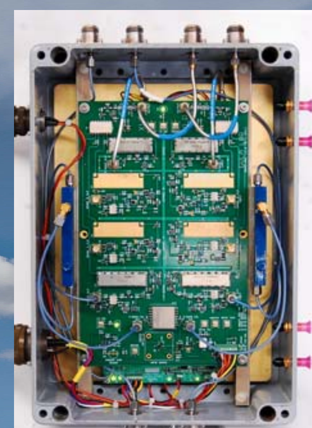
The VLA to EVLA transition resulted in the loss of low frequency capabilities. NRL and NRAO have collaborated to develop new EVLA receivers capable of accessing the frequency range of 50 to 436 MHz. Initially, the new receivers will utilize the existing feeds, increasing. the 74 MHz and 330 MHz bandwidths from 1.5 MHz to 16 MHz and 40 MHz to 240 MHz, respectively. The new receiver includes two expansion channels for future broadband feed development. This system will have significant improvement in sensitivity due to lower receiver noise temperature and broader bandwidths, and should be fully operational by 2013 – the first receivers will be tested on the sky in the next few weeks.



Top panel: Available bandwidth for new EVLA receivers. Old VLA bandwidth in red, new EVLA in green. Additional channels exist for future broadband feeds (yellow). Bottom panel: history of the universe from high (left) to low (right) z, indicating corresponding HI signal across the new EVLA low frequency range.



(above) : The low frequency images above are among the most beautiful made at the VLA. The new EVLA system should extend such capabilities to many more, much weaker sources.



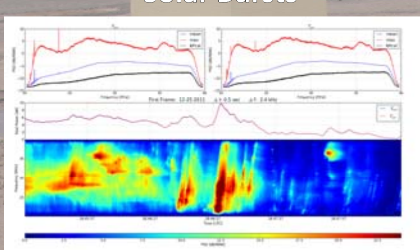
First EVLA LBR receiver– S/N-01.

EVLA Photo Bob Tetro

Long Wavelength Array Station One: The LWA1 Radio Observatory

LWA1 is located near the EVLA center, operates from 10 to 88 MHz, and consists of 256 NRL designed antennas (background). Examples of science commissioning are shown below. LWA1 has 4 independent beams and all-sky monitoring. Developing LWA technology is catalyzing several related University projects.

Solar Bursts

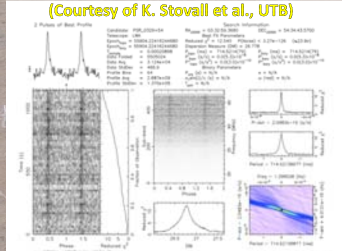


(Courtesy J. Craig, S. White, et al.)

(above) Solar radio bursts on Christmas Day - activity not visible in less sensitive spectrographs, unreported by Space Weather Prediction Center.

Pulsars

(Courtesy of K. Stovall et al., UTB)



(right) 20 min on PSR B0329+54 drifting through one LWA1 beam on Dec 9, 2011. BW of 20 MHz, centered at 37.5 MHz.

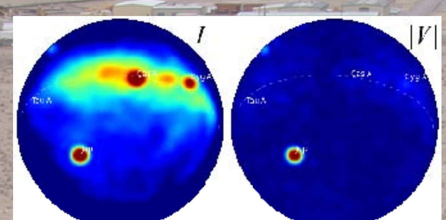
More LWA1 science commissioning underway:

- Cosmic Ray Air Showers (D. Besson, KU)
- GRBs, Crab Giant Pulses, PSRs (Ellingson, VT; P. Ray, NRL)
- Recombination Lines (Pihlstrom, UNM) (Peters et al. 2011, A&A, 525, 128)
- Magnetized exoplanets (J. Hartman, G. Halinan, J. Lazio, JPL/Caltech).
- Transients (J. Simonetti, VT; G. Taylor UNM)
- Solar/Space Weather (S. White, AFRL)
- High-z Cosmology (J. Bowman, UNA; L. Greenhill, CfA)
- Ionospheric science (S. Close, LANL; L. Rickard UNM; P. Crane, NRL)
- Sky surveys (E. Polisensky, NRL)

The related LoFASM and LEDA projects extends LWA transient science and cosmology, e.g. see neighboring UTB posters &coming soon to: http://www.cfa.harvard.edu/LEDA/.

For more on LWA science & technology: Kassim et al. 2005, ASP Conf. Ser. Vol. 345, 2005; Ellingson et al. 2009, IEEE, Vol. 97, No. 18, 1421

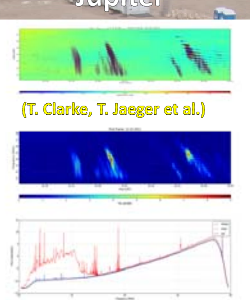
Transients



(Courtesy J. Hartmann et al.)

(above) LWA1 all-sky monitoring in Stokes I (left) & V (right). Real-time all-sky monitoring www.phys.unm.edu/~lwa/lwatv.html.

Jupiter



(T. Clarke, T. Jaeger et al.)

(left - top, middle) Jovian radiation by LWA1. Downward-sloping bands from Faraday rotation through Earth's ionosphere. (left - bottom) LWA1 frequency bandpass response - time averaged mean (blue), 2-hr max (red), and using a calibration load (black).

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