The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus
Proceedings IAU Symposium No. 303, 2013
L. O. Sjouwerman, C. C. Lang & J. Ott

doi:10.1017/S1743921314001148

A new era for low frequency Galactic center transient monitoring

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Abstract. An upgrade of the low frequency observing system of the VLA developed by NRL and NRAO, called low band (LB), will open a new era of Galactic center (GC) transient monitoring. Our previous searches using the VLA and GMRT have revealed a modest number of radio-selected transients, but have been severely sensitivity and observing time limited. The new LB system, currently accessing the 236–492 MHz frequency range, promises $\geqslant 5\times$ improved sensitivity over the legacy VLA system. The new system is emerging from commissioning in time to catch any enhanced sub-GHz emission from the G2 cloud event, and we review existing limits based on recent observations. We also describe a proposed 24/7 commensal system, called the LOw Band Observatory (LOBO). LOBO offers over 100 VLA GC monitoring hours per year, possibly revealing new transients and helping validate ASTRO2010′s anticipation of a new era of transient radio astronomy. A funded LOBO pathfinder called the VLA Low Frequency Ionosphere and Transient Experiment (VLITE) is under development. Finally, we consider the impact of LB and LOBO on our GC monitoring program.

Keywords. Galaxy: center, Radio: transients, Instrumentation: interferometers.

1. Introduction

During the VLA upgrade, two narrow-band systems at 74 MHz ($\Delta\nu$ =1.6 MHz) and 330 MHz: ($\Delta\nu$= 6 MHz) were decommissioned due to incompatibility issues. Now low frequencies have returned as *low band* (LB) based on a single receiver sampling 50–500 MHz and currently accessing feeds sensitive to 54-86 MHz, and 236-492 MHz (Clarke *et al.* 2011). With more bandwidth, lower receiver temperature, and access to the WIDAR correlator, the system is much more powerful than the legacy VLA low frequency systems.

2. G2 gas cloud encounter

The gas cloud, G2, is colliding with Sgr A* (Gillessen *et al.* 2012) and theory predicts enhanced low frequency emission (∼1-40 Jy; Narayan *et al.* 2012). Our Oct. - Nov. 2013 VLA LB images of the region around Sgr A* detected no enhancement ($\leqslant$1 Jy), nor did earlier GMRT observations ($\leqslant$ 0.5 Jy at 330 MHz, Kassim *et al.* 2013, $\leqslant$ 0.2 Jy at 610 MHz, Roy & Kanekar 2013). Much more sensitive and higher resolution observations are scheduled when the VLA is in its most extended array configuration from February to May 2014.

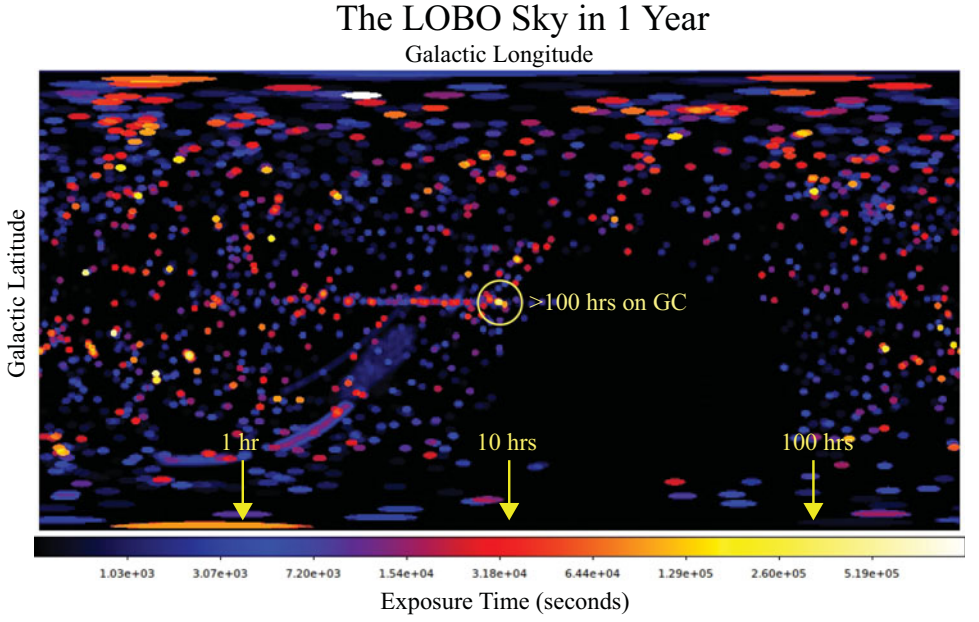

Figure 1. The fraction of the sky observed by the VLA as a function of dwell time. About [25,10]% of the accessible sky is observed for at least [100 sec, 1 hr] per year, respectively. For a future LOBO operating in the VLA′s 74 MHz band, the fractions are 96% and 85%, respectively. [A color version is available online.]

3. LOBO and VLITE

LOBO is a proposed real time transient monitoring and high-z spectroscopy capability for the VLA. It will utilize the primary focus feeds to observe in parallel with the Cassegrain feeds. With a $\sim$5 deg^2 FoV at 330 MHz, LOBO will perform continuous, blind searches for non-thermal transients and high-redshift spectral lines, annually surveying over 25% of the available sky. A 10-antenna LOBO pathfinder called the VLA Low Band Ionosphere and Transient Experiment (VLITE) is currently funded by NRL and under development with NRAO.

4. Implications of low band and LOBO for Galactic center transient monitoring

Figure 1 shows an exposure map of 1 year of LOBO observations based on the VLA archives. It indicates that in 1 year LOBO can harvest $\sim$6000 hrs on the sky, of which $\geqslant$100 hrs is on the GC. Previous detections (Hyman *et al.* 2009) of *radio selected* transients from $\sim$ 200 hrs of VLA and GMRT monitoring yielded $\sim$0.05 events at 330 MHz per VLA FoV, with flux density S $>$ 50 mJy in characteristic 1.5 hr exposures. The new low band system is $\geqslant 5\times$ more sensitive, and would yield for a disk population of transients an estimated $\sim$0.2 events per VLA FoV, for S $>$ 12 mJy, in 1 hr exposures. This suggest that for $\geqslant$ 100 hrs/yr LOBO would detect $\sim$20 GC transients per year, and considerably more for a spherical population.

https://doi.org/10.1017/S1743921314001148 Published online by Cambridge University Press

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