The ATA Galactic Center Survey:
Slow Radio Transients

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ABSTRACT
The population of slow galactic radio transients is weakly understood. While these sources have been detected both serendipitously and systematically, their characterization has typically suffered from poor spectral and temporal coverage. The ongoing Allen Telescope Array Galactic Center Survey (GCS) aims to ameliorate this situation with frequent observations and multifrequency coverage. Below, we summarize the progress of the 2009 GCS campaign and present some preliminary results.

ACKNOWLEDGMENT

The first phase of the ATA was funded through generous grants from the Paul G. Allen Family Foundation. UC Berkeley, the SETI Institute, the National Science Foundation (Grant No. 0540599), Sun Microsystems, Xilinx, Nathan Myhrvold, Greg Papadopoulos, and other corporations and individual donors contributed additional funding.

SETI Institute

Allen Telescope Array

Scientific Goals

The GCS will produce robust measurements of, or upper limits to, radio transient event rates in a wide range of timescales. The events to which it is most sensitive will be outbursts in X-ray binary systems, though there have also been many bright GC radio transients of unknown origin (Fig. 1, below). The GCS will also yield a large-area, intermediate-resolution map of the GC region with spectral index information. This map will be sensitive to large-scale structures in the GC such as SNRs, nonthermal filaments, and H II regions.

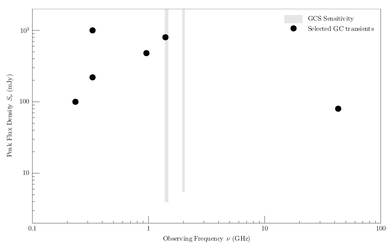
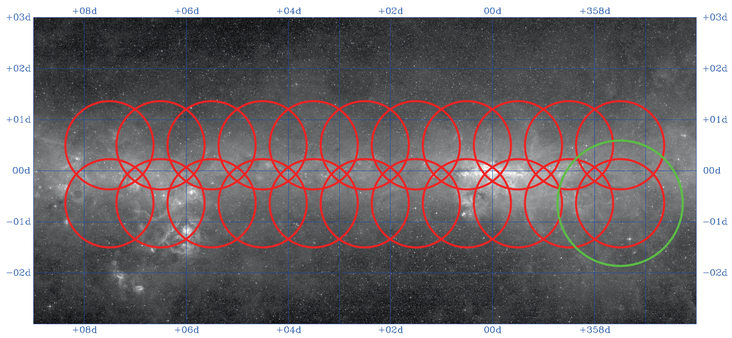


Figure 1. A comparison of the expected GCS single-epoch sensitivity to the peak flux densities of some previously detected GC radio transients (Bower et al. 2005; Davies et al. 1976; Hyman et al. 2002, 2005, 2009; Zhao et al. 1992).



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2009 Campaign Overview

The first GCS campaign took place between May and October of 2009. A total of 186 hours of GC observations were collected.

Table 1. Summary statistics of the 2009 GCS campaign. Analysis of the data is in progress.

Observing Frequencies	1.43 and 2.01 GHz (simultaneous)
Number of Epochs	74
Time on GC per Epoch	2.7 hr
GC FOVs per Epoch	~8 (~25 sq. deg.)
Single-Epoch Sensitivity	~5 mJy / bm.
Total Number of Scans	3503
Raw Data Volume	1.2 TB

Technical Development

The first GCS campaign took place between May and October of 2009. A total of 186 hours of GC observations were collected.

- *Commensal observing* requires realtime coordination between SETI observing software (controlling telescope pointing) and the science script (controlling the correlators). A coordination protocol was developed and deployed very successfully.
- *Data calibration and editing* require pipeline and algorithmic development. RFI flagging (Fig. 3, below) has been particularly demanding. The basic pipeline is in place with work ongoing to improve it.
- *Imaging the GC region* demands excellent u-v coverage, a precise model of the region, and good knowledge of the ATA primary beam (cf. #403.05). Preliminary work has begun (Fig. 4, right) but the imaging pipeline is still in a primitive state.
- *Transient detection* will be done in visibility space after subtraction of the static emission model. Existing work on transient detection with the ATA (cf. #403.04) will be helpful in this effort.

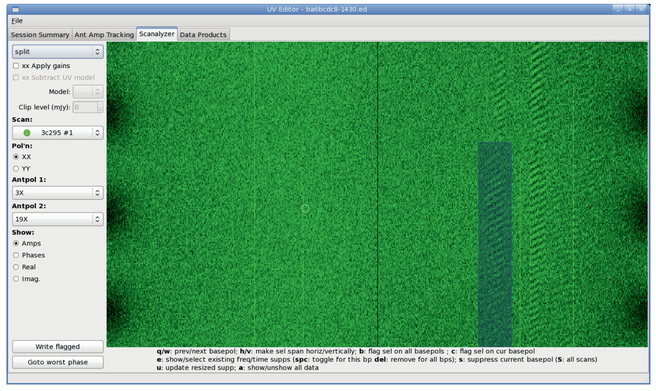

Figure 3. A screenshot of a graphical data visualizer and editor that is being developed as part of the GCS. Radiofrequency interference (RFI) has proven to be a significant hurdle in the data reduction. The editor's design principles emphasize speed and integration with pipeline-style data processing. The display shown here plots the complex visibility amplitude as a function of frequency (x axis) and time (y axis) for a long calibrator observation.

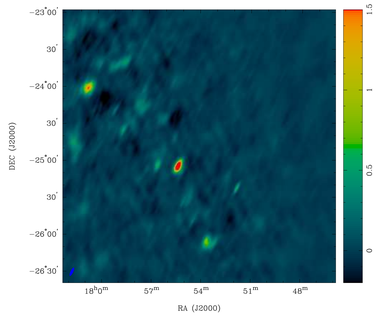

Figure 4. A shallow image of one of the GC fields at 1.43 GHz. The wide field of view is apparent, as are the effects of preliminary calibration and sparse *u-v* coverage.

Current Plans

- Development of the calibration, imaging, and transient detection pipeline software continues, with the goal of being able to reduce 2010 data within 24 hours.
- The GCS observing software and pipeline are being reused to observe the microquasar Cyg X-3 simultaneously with INTEGRAL. Detection of correlated X-ray and radio variability would provide insight into the physical configuration of the system (Abdo *et al*. 2010).

References
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