Results from the Allen Telescope Array: The ATA Twenty-centimeter Survey

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ABSTRACT

We present the Allen Telescope Array Twenty-centimeter Survey (ATATS), a recently-completed multi-epoch survey of 800 square degrees of sky. We are able to construct light curves to look for changes from epoch to epoch (including transient sources appearing in a single epoch) as well as a deep, multi-epoch image and associated catalog of the sky, which we compare to previous surveys such as the NRAO VLA Sky Survey (NVSS). We also describe the pipeline which allows us to reduce and analyze the data with a minimum of human interaction.

1. SURVEY DESIGN

- 800 sq. deg. 1.4 GHz extragalactic survey
- 2′ × 4′ beam
- Centered at 15^h, $+41°$; overlaps Bootes deep field
- ATA's 5 sq. deg. field-of-view enables us to observe the whole field in 12 hours to a depth of $\sigma \sim 10$ mJy
- 361 pointings; 1 minute snapshots
- Multiple epochs let us build up a deep field and compare source fluxes from epoch to epoch

2. REDUCTION PIPELINE

- Image using MIRIAD-based RAPID software (Keating et al., poster 601.06)
- Restore using 150″ circular Gaussian beam to ameliorate snapshot beam changes from field to field
- Create linear mosaic of individual maps (up to 361 per epoch)
- SLOW (Source Locator and Outburst Watcher) software analyzes output from RAPID, and:
  - Generates source catalogs
  - Matches catalogs across epochs and to NVSS, at each epoch keeping only sources in regions of the mosaic which are good at *all* epochs
  - Generates light curves (Fig. 5)
  - Produces postage stamp images (Fig. 5)
- We use essentially the same technique at higher frequencies (see Bower et al. poster 601.07)
- Reduction pipeline run on 8 good epochs from 2009 Jan - Apr
- Created median combined map (Fig. 1) and extracted catalog

4. MAP AND CATALOG RESULTS

- Deep map sensitivity $\sigma \sim 5$ mJy
- Good match of positions (Fig. 3) and fluxes (Fig. 4) with NVSS
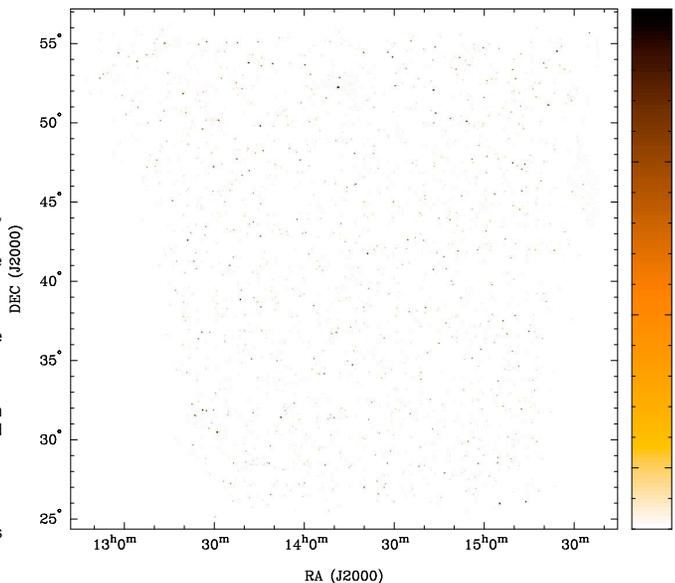

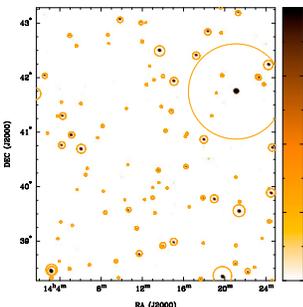Fig. 1: Median combined map of 8 ATATS epochs

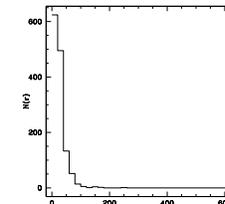Fig. 2: A subregion of Fig. 1, with NVSS sources plotted as circles of size proportional to NVSS flux

Fig. 3: Histogram of positional offsets between ATATS sources from epoch 20090402, and NVSS
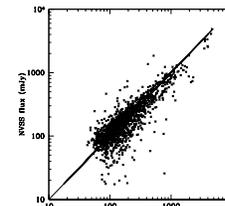
5. LIGHTCURVE AND TRANSIENT RESULTS

- Most lightcurves are flat (sources don't vary much); transients would show up as sources without a match in other epochs or in NVSS
- A few transient candidates, but distinguishing from artefacts will require further analysis

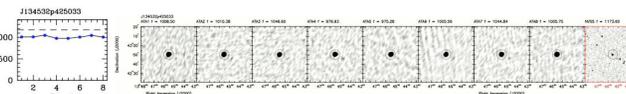Fig. 4: Fluxes of ATATS sources from epoch 20090402 compared to NVSS

Fig. 5: Light curve (dashed line is NVSS) and postage stamps for a typical ATATS source