

PI Report

Tara Murphy and Shami Chatterjee

In the last quarter VAST work has got well underway, in particular in the areas of source-finding and simulations. It is an exciting time for SKA pathfinder transient projects, with the first published results from the Allen Telescope Array (see the article from Steve Croft below) and the transients groups in the MWA¹ and LOFAR² working on initial data from those instruments.

I was able to meet up with a number of VAST collaboration members at ISKAF 2010 in the Netherlands, and at the Astrominformatics workshop at Caltech. It was great having chance to chat, and talk more about what we can work on together over the next year. It was exiting to be present for the launch of LOFAR by the Queen of the Netherlands. We look forward to the first transients results!

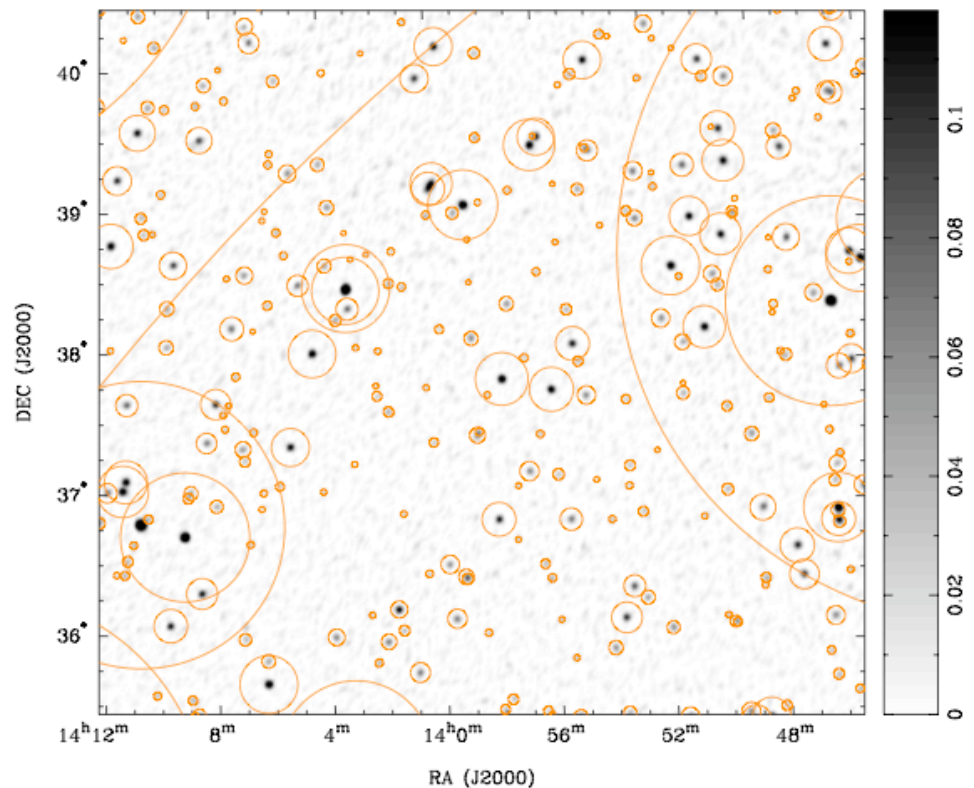
Science Report

The Allen Telescope Array Twenty-centimeter Survey (ATATS)

Steve Croft, Geoff Bower and the ATA team

VAST collaborators Steve Croft and Geoff Bower from UC Berkeley attended the meeting "A New Golden Age for Radio Astronomy" in the Netherlands from 10 – 14 June 2010, where Croft presented the results from the Allen Telescope Array Twenty-centimeter Survey (ATATS). ATATS is a pilot survey undertaken during early ATA science operations, intended to verify the performance of the telescope as well as search for transients by comparing to the NRAO VLA Sky Survey (NVSS). The paper is in press in the Astrophysical Journal, and has been posted on arXiv at <http://arxiv.org/abs/1006.2003>

Right: A 25 square degree region 690 square degree ATATS field. The ATA data are shown as a greyscale running from zero to 118.2 mJy / beam. All NVSS sources with flux densities brighter than 20mJy (corresponding to 5 times the RMS of the ATATS image) are plotted as circles; the size of the circle is proportional to the NVSS flux density. The faintest NVSS sources are below the ATATS completeness limit.



¹ <http://www.mwatelescope.org>

² http://www.astro.uva.nl/lofar_transients

During 2009 January – April, ATATS made 12 snapshot visits to a 690 sq. deg. region of the sky (covered in 243 pointings at 1.43 GHz) centered on the Bootes deep field. The initial paper presents the combined 12-epoch image and catalogue. The survey was designed to detect rare, very bright transients as well as to verify the capabilities of the ATA to form large mosaics.

The combined image (see figure below) has RMS noise 3.94 mJy/beam and dynamic range 180, with a circular beam of 150 arcseconds FWHM. It contains 4408 sources to a limiting 5-sigma sensitivity of 20 mJy/beam. When we compared our catalogue to NVSS we found that we can measure source positions to better than around 20 arcseconds. For sources above the ATATS completeness limit, the median flux density is 97% of the median value for matched NVSS sources, indicative of an accurate overall flux calibration.

We examined the effects of source confusion due to the effects of differing resolution between ATATS and NVSS on our ability to compare flux densities. We detected no transients at flux densities greater than 40 mJy in comparison with NVSS, and placed a 2-sigma upper limit on the transient rate for such sources of 0.004 per sq. deg. These results suggest that the 1 Jy transients reported by Matsumura et al. (2009), from drift-scan observations at 1.4 GHz with the Nasu Pulsar Observatory, may not be true transients.

The next ATATS paper, which is currently in preparation, will examine maps and catalogues for the 12 epochs individually, including further examination of the transient and time-variable sky at 1.4 GHz. Following on from ATATS, the Pi GHz Sky Survey (PiGSS), a large survey (10,000 square degrees, plus a 10 square degree deep field) at 3.14 GHz, is ongoing at the ATA. Another paper in preparation (Bower et al. 2010) examines the data from the PiGSS deep field.

We look forward to continuing to work with the VAST collaboration, and to sharing our experience with commissioning and early science operations at the ATA, and how this can inform VAST strategies.

Profile – David Kaplan

David is currently a Hubble Fellow at the University of California Santa Barbara and will soon take up a new position as Assistant Professor at University of Wisconsin, Milwaukee. He is the chair of VAST Working Group 6 and is responsible for the transient detection pipeline.



What are your main research interests?

Young neutron stars, neutron star evolution and radio transients. You can see more information on my website <http://www.kitp.ucsb.edu/~dkaplan>

What papers are you working on at the moment?

I'm currently working on three papers:

- Using eclipse timing to measure the masses of white dwarf binaries.
- The optical parallax of a nearby neutron star.
- The evolution of compact white dwarf binaries.

What is the main challenge for Working Group 6?

I think one of the main challenges will be defining and assessing the requirements for databases to be used for transient detection and characterization.

What do you enjoy outside astronomy?

Eating. Doing things outside.

Working Group Reports

WG1 – Simulations and Imaging

Randall Wayth

WG1 supplied the ASKAP simulation team with an initial set of lightcurves for 10 variable sources to include in simulations. The lightcurves are based on toy models of Gamma-ray bursts, extreme bursts (sources that appear on short timescales), extreme scattering events, and intra-day variables. The sources were included in simulations to provide test data for transient detection algorithms and to test the ASKAP imaging pipeline when variable sources are present.

Next we will provide more realistic lightcurves and some estimates for the number of each type of lightcurve we are likely to detect with ASKAP.

WG2 – Source Finding

Tara Murphy

In April we had a very successful source-finding meeting – the talks are available online at:

www.atnf.csiro.au/research/workshops/2010/sourcefinding

Paul Hancock is now conducting an evaluation of existing continuum source-finding packages against a range of criteria including: completeness, reliability and performance on different classes of sources (e.g. point, extended, double lobe). Once this evaluation is complete we will decide on whether any existing tools meet our needs.

We are also discussing source-finding strategies with our LOFAR colleagues, who have developed two custom source-finders for the LOFAR pipeline.

WG3 – Survey Strategy

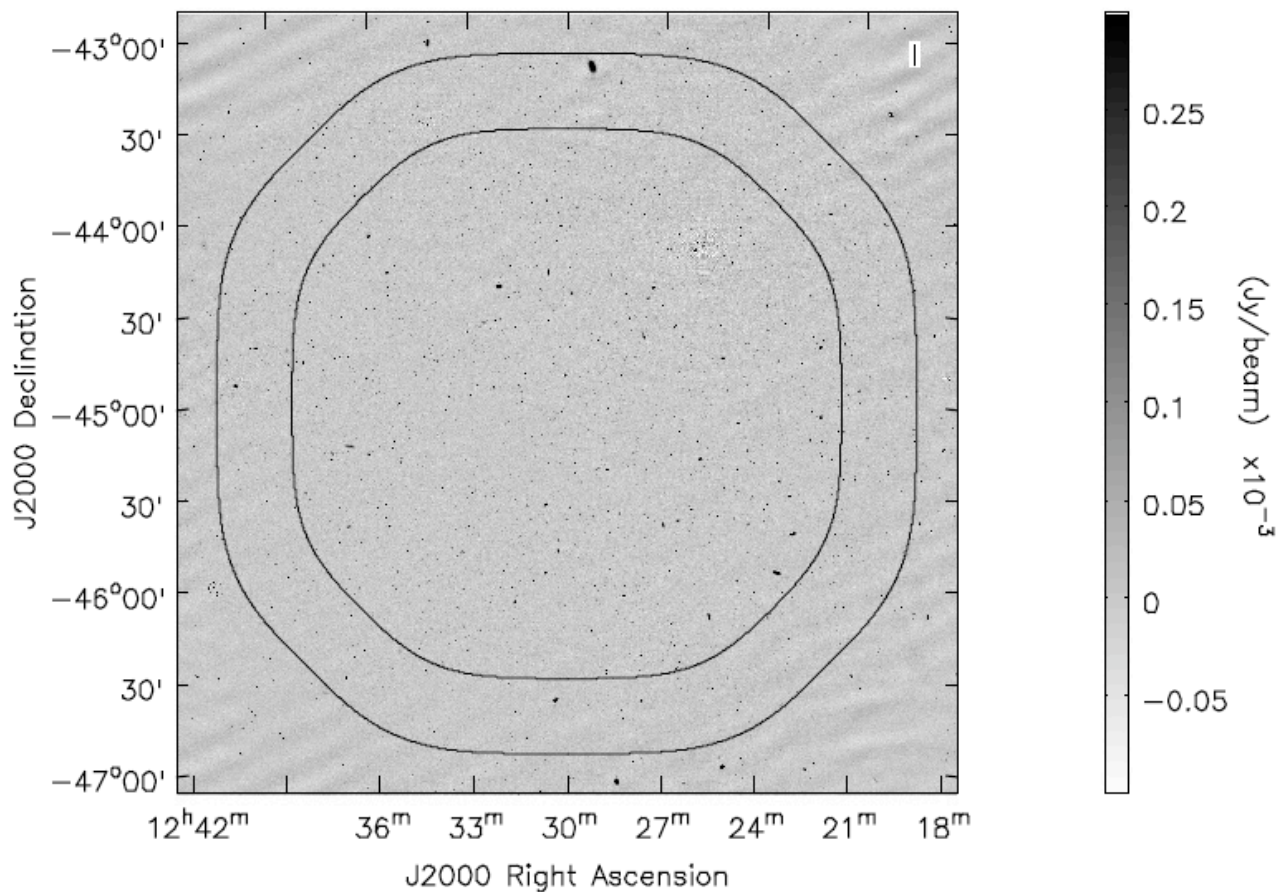
Shami Chatterjee

The development of a survey strategy for radio transients suffers from a chicken-and-egg problem: creating the perfect survey strategy would require perfect knowledge of the underlying source population statistics, and this knowledge would make the survey redundant. As the first step in breaking this circle, WG3 members are developing a source population simulation, in which real and model source lightcurves are placed at random on the ASKAP-viewable sky and sampled by model surveys. The degree of source completeness and the fidelity with which essential characteristics of the lightcurves are reproduced help quantify the effectiveness of a given survey strategy.

WG4 – Hardware and Commissioning

Simon Johnston

The ASKAP project scientists have decided to split



The 21st of May 2010 release of the continuum simulation from the ASKAP Computing team. The source population is from SKADS S3-SEX. More simulations and information on how they were generated are available on the ASKAP wiki at http://pm.atnf.csiro.au/askap/wiki/sup/Wiki_sup_wg_1_simucont_3

WG4 into two subgroups. WG4a will focus on external hardware required for the survey science projects. WG4b will focus on BETA and ASKAP commissioning. We will have a meeting of WG4b in late July to discuss ideas for BETA observing.

WG5 – Data Format and Access

Hayley Bignall

The kickoff meeting for ASKAP Working Group 5, chaired by Ray Norris, was held on 7th May. Most of the discussion was to clarify the role of this working group, what ASKAP requires of WG5 and what is required by the SSPs. A summary of the discussion is on the ASKAP wiki. The "ASKAP Science Data Archive: Draft Requirements Document" was discussed during the meeting and placed on the wiki for further comments to be added. At this stage the general requirements look well aligned with those of VAST.

WG6 – Transient Detection Pipeline

David Kaplan

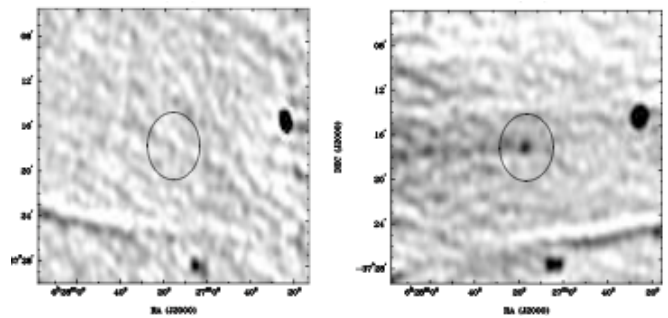
We have continued to work through preliminary MWA data to assess the difficulty and prospects of using the array for transient identification. They are a very rich data set, but also present interesting calibration problems. Correcting for the changing and complex primary beam over the image is the main challenge so far.

WG7 - Ongoing Science Projects

Duncan Galloway

One of the ongoing science projects that has new results is Keith Bannister's analysis of the Molonglo archive. He reports:

We have recently completed one of the widest (~1000 square degrees), deepest (5 sigma = 10 mJy/beam) and longest (~22 years), blind radio variability surveys performed to date and measured light curves of over 30,000 sources. We have discovered 15 candidate transient sources and 53 candidate highly variable sources. Three of the transient sources have been previously identified (SN1987A, Nova Muscae 1991, GRO 1655-40) with the remainder unknown. One transient source and three highly variable sources are positionally coincident with resolved optical galaxies with known redshifts, but the radio light curves and luminosities are unlike any known source class.



Transient source detected in the Molonglo archive search. The upper limit on the flux density in the first image is 5 mJy/beam. In the second image the source flux density is 15 mJy/beam.

These results will be presented at the upcoming ASA meeting and submitted to MNRAS.

News and Updates

Super Science Fellowships

Elaine Sadler, Bryan Gaensler and Tara Murphy have been successful in obtaining funding for three postdoctoral fellows as part of the Australian Government "Super Science" initiative. One of the three positions will be associated with VAST. More information available at:

<http://astronomyaustralia.org.au/superscience.html#USyd1>

The application deadline is the 15th of July.

Publication Policy

VAST now has a publication policy (available on the wiki under Organisation/Policies). We are also developing a membership policy which will be circulated later this year. We welcome feedback on any aspect of the policy.

End of Year Review

CASS³ will review all of the Survey Science Projects during the 1st – 4th of Nov. this year. This will involve a public colloquium given by the PIs of each project, and an interview with a committee. There will also be a 3-day Survey Science Project workshop in Sydney on 29th Nov. to 1st Dec. that all collaboration members are invited to attend.

³ CASS is the new CSIRO division of Astronomy and Space Science, which includes the ATNF. More information available online at <http://www.csiro.au/org/CASS.html>