Newsletter 1

March 2010

Welcome to VAST!

Tara Murphy and Shami Chatterjee

Welcome to the first newsletter for the VAST Design Study. We will be producing a newsletter every quarter, with the aim of keeping everyone informed about the latest VAST progress, results and upcoming events. We hope this will be something that everyone in the VAST collaboration contributes to, so please get involved.

The main news in this edition is that VAST is now officially underway. Working groups have formed (and had their kick-off meetings), collaboration policies are being developed, and we have our first VAST postdoctoral fellow, Paul Hancock, starting work this week. Now the initial organisational details are sorted out, we should have a productive year starting the science, survey design and software development for VAST.

Finally, we have a new logo! Thanks to Meghan Kennedy for the great design.

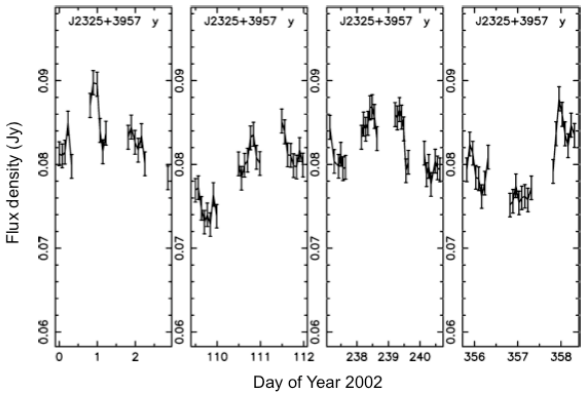
Science Report

Finding VLBI calibrators in VAST-Wide

Hayley Bignall, Dave Jauncey, Jim Lovell, Roopesh Ojha and Cormac Reynolds

We presented a poster paper entitled "Finding Extremely Compact Sources Using the ASKAP VAST Survey" at the Sixth IVS General Meeting held in Hobart, Tasmania, from 7-13 February. The IVS is the International VLBI Service for Astrometry and Geodesy, and the meeting was aimed at those with interests in various applications of VLBI such as geodesy, astrometry, Earth sciences, and related fields.

For both astrometric and geodetic applications, it is important to observe a large number of sources that are very compact and stable on milliarcsecond scales. In the past, the density of such sources known in the southern hemisphere has been relatively sparse. VLBI observations of intraday variable (IDV) quasars found in the MASIV[1] survey (a 5 GHz VLA Survey of 500 flat-spectrum sources in the northern sky) have shown that these sources are extremely compact, often unresolved, on milliarcsecond scales, and more core-dominated than their non-IDV counterparts.



MASIV survey data for a typical IDV (Lovell et al. 2008)

We argue that scintillating sources found in the VAST Survey will be very compact, and hence that interstellar scintillation (ISS) may be an effective means of selecting compact sources that do not have significant extended structure on milliarcsecond scales. At higher frequencies, where astrometric observations are generally carried out, the 1.4 GHz scintillating sources could be expected to be even more compact, and also relatively bright as they generally have flat or inverted radio spectra. Moreover, higher frequency VLBI observations avoid the most severe effects of interstellar scattering, such as refractive apparent position shifts and angular broadening, which would decrease astrometric accuracy.

Based on radio source counts, approximately 3 flat-spectrum radio sources with flux density S > 10 mJy are expected per square degree. Based on the findings of the MASIV Survey, a large fraction of these would be expected to show refractive

[1] Lovell et al. 2008, ApJ, 689, pp. 108-126

interstellar scintillation (RISS) at 1.4 GHz, implying angular sizes typically no larger than ~0.1 mas. While only the most extreme variables would be detected at a 10 mJy flux density limit, VAST should be able to reliably detect variations down to a few percent in sources with flux density S > 0.1 Jy.

Due to the strong frequency dependence of the timescale of ISS (expected to be close to λ^2 in the refractive scintillation regime), timescales of variability at 1.4 GHz are expected to be an order of magnitude longer than those at 5 GHz, thus instead of the variability on timescales of days observed in the MASIV Survey, VAST will observe variability on timescales of weeks. The shallow, wide-field component of VAST could be expected to find thousands of good candidate calibrators in the southern hemisphere. The detection of scintillating sources in VAST will also help to provide potential phase-reference calibrators in the vicinity of any transients detected, for rapid VLBI follow-up, e.g. to measure proper motions of Galactic transients and pin down their origin.

Profile – Paul Hancock

Paul is our newest VAST collaboration team member, starting his first postdoctoral research position at the University of Sydney this week.

How did you get to where you are now?

I grew up in Tasmania, firstly in the countryside of the north and then in Hobart in the south. In 2001 I moved to Sydney to enroll in a BSc (Adv.) at the University of Sydney and later went on to complete my PhD here as well.

What was the highlight of your PhD work?

Traveling to Europe for a conference was a huge highlight as I had never been before, and the chance to meet with the authors of papers that I had read so often was really informative.

What papers are you working on at the moment?

I am working on two papers, both of which are chapters from my PhD thesis. The first is a description of the hardware and software that is unique to the Australia Telescope 20 GHz survey (AT20G)[2]. The second paper looks at the high-frequency properties of young radio galaxies that were identified with AT20G. Some of these galaxies appear to be young radio sources that have risen from the ashes of a previous epoch of activity.

What will you be working on in VAST?

Initially I will be focusing on source detection and characterizing how well different source detection methods work. This may involve writing new programs, or modifying already existing ones. The ultimate goal of this work is to have a source detection scheme that we know and trust.

What do you enjoy outside astronomy?

I enjoy the brewing and consumption of beer, and the cooking and enjoyment of many different foods. To counter the effects of these interests I also enjoy tennis, swimming, and riding.

How will you celebrate your first pay cheque?

A few of these over dinner with family and friends.

Working Group Reports

WG1 – Simulations and Imaging

Randall Wayth

WG1 is gathering information about transient and variable source populations that should be included in simulations. We are providing feedback and ideas to ATNF for upcoming simulations that include transient sources.

WG2 – Source Finding

Tara Murphy

WG2 had a successful kickoff meeting and will start by evaluating existing source-finding tools to see if they are suitable for VAST. We are holding a source-finding meeting in April to work on common problems faced by all ASKAP projects.

WG3 – Survey Strategy

Shami Chatterjee

One of our key problems is to build a survey strategy that accommodates our diverse scientific

[2] http://www.atnf.csiro.au/research/AT20G

interests while also accounting for continuous commensal observing and realistic limits on the dedicated observing time we are likely to be granted. After a kickoff telecon, WG3 members have begun building a library of transient light curves that will be used in simulations to test different observation strategies and cadences.

WG4 – Hardware and Commissioning

Simon Johnston

This working group deals with commissioning and thinking about projects we can do with BETA (the test array) which will hopefully be ready for first light in just over a year's time (March 2011). We expect this group to be fairly quiet at first, but have a lot more to do once we get closer to commissioning.

WG5 – Data Format and Access

Hayley Bignall

WG5 had its introductory telecon on 19th January. It is intended that this working group will provide in the first year of the Design Study an initial data model and an estimate of the image data storage volume and catalogue storage volume. In order to determine the requirements for the catalogue and online light curve database, a few use cases are needed for some of the key VAST science areas. Please contact me if you'd like to help with this!

WG6 – Transient Detection Pipeline

David Kaplan

WG6 has begun productive exchanges with groups representing the LOFAR, ATA, and MWA transient efforts. We will summarise the relevant portions of those programs, and begin determining what elements (survey design, source detection strategy, software) would be most useful for VAST. We are also discussing expansion of the Virtual Observatory Event notifications into the radio regime with the VOEvent project.

WG7 - Ongoing Science Projects

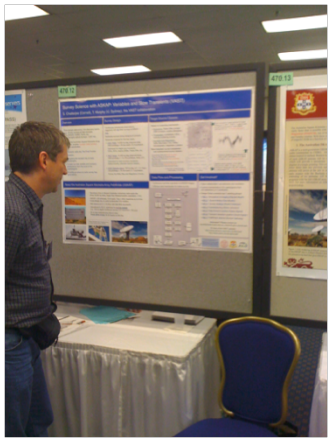
Duncan Galloway

Members of WG7 met in a preliminary teleconference on January 10th. The main outcome of the meeting was a list of current and planned science projects directly related to, or having significant overlap with, VAST science goals. These projects, involving observations with ATCA, MOST, VLA, and other facilities, are now described briefly in the relevant section of the VAST wiki. I encourage all VAST members to become familiar with the ongoing projects and check back from time to time for progress reports and new additions.

News and Updates

VAST at the AAS

We presented a poster on VAST at the 215th AAS Meeting in Washington, D.C., at the session on Surveys and Large Programs on 6th January 2010 (470.12 - Survey Science with ASKAP: Variables and Slow Transients[3]). The poster was very well attended, and resulted in interesting discussions with members of various other transient survey collaborations, including Fermi and LSST.



Right: An astronomer captivated by the VAST poster.

Source-find Challenges for ASKAP

Source-finding - extracting astronomical objects of interest from images or data cubes - is critical to across most of the ASKAP Survey Science Projects. Next month we are holding a 1-day workshop on automatic source-finding techniques. The aims are:

- To find common challenges in spectral-line, continuum and polarisation source-finding for ASKAP Survey Science Projects.
- To discuss existing and future solutions – what can we learn from past surveys.
- To plan the way forward for cross-SSP work on source-finding.

More information is available online at

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

A New Golden Age for Radio Astronomy

A number of VAST team members plan to attend ISKAF2010, in the Netherlands in June. We plan to get together with the LOFAR transients team and discuss areas of common interest.

[3] http://adsabs.harvard.edu/abs/2010AAS...21547012C