NRAO eNews: August 2009 • Volume 2, Issue 8

The Expanded Very Large Array near Socorro, NM.

Upcoming Events

Assembly, Gas Content and Star Formation History of Galaxies
September 21-24, 2009 | Charlottesville, VA

SKA 2009 Science and Engineering Meeting
October 29-31, 2009 | Manchester, UK

NRAO Town Hall at the American Astronomical Society Meeting
January 5, 2010 | 6:30 - 8:30 PM | Washington, DC

EVLA Early Science: Second Announcement

Claire Chandler & Robert Dickman

In the **February 2009 NRAO eNews**, we announced the availability of the EVLA's WIDAR correlator for Early Science, beginning in March 2010 in the D configuration. Access to the EVLA will be through two observing programs: the Open Shared Risk Observing (OSRO) program for the general user community, and the Resident Shared Risk Observing (RSRO) program, which provides enhanced capabilities to those who are able to

spend a period of time in Socorro to help with EVLA commissioning. The science proposed under both programs will be peer-reviewed through NRAO's current refereeing and time allocation process.

A description of the mechanism by which users can apply for EVLA Early Science time is given under the descriptions of the OSRO and RSRO programs at the **EVLA Information for Astronomers** web page. These web pages also describe the expected capabilities to be offered under the OSRO and RSRO programs. The proposal deadline for this first round of EVLA proposals using WIDAR is October 1, 2009. OSRO proposals for the D configuration will be considered, along with RSRO proposals for all configurations. Proposals for both programs will continue to be considered at subsequent deadlines until further notice.

VLA/VLBA/VLBI Proposals and Scheduling

VLA/VLBA Scheduling Officers

VLA/VLBA Proposals and Scheduling

The table below shows the next deadline for regular and large proposals for the Expanded Very Large Array (EVLA) and the Very Long Baseline Array (VLBA). At the end of the VLA D configuration in January 2010, the VLA correlator will be turned off, and the VLA will not be available for an interval of up to 2 months while hardware is moved from the VLA correlator to the new EVLA correlator. When observing resumes with the EVLA, it will be in the D configuration. For the EVLA, the order of the configurations will then be: D, DnC, C, CnB, B, BnA, A.

Array	Deadline	Observing Period	Configuration
EVLA	2009 Oct 1	2010 Mar 01 - 2010 May 24	D
		2010 May 24 - 2010 May 28	Move
		2010 May 28 - 2010 Jun 14	DnC
VLBA	2009 Oct 1	2010 mid Jan - 2010 mid May	

- **EVLA details:** Shared-risk EVLA observing will begin March 1, 2010
- **VLBA details**
- **Proposal submission** (use your "my.nrao" account or create one)
- **Scheduling** (dynamic and fixed date)

VLBI HSA Proposals and Scheduling

The NRAO handles regular proposals for the VLBI High Sensitivity Array (HSA) at the same deadlines as for the VLBA. The HSA includes the VLBA, GBT, and Arecibo in the U.S., plus Effelsberg in Germany.

There will be an interval of up to 2 months, beginning in January 2010, during which the VLA will be unavailable to the HSA due to the

replacement of the VLA correlator with the new EVLA correlator. When observing resumes with the EVLA correlator, it will lack VLBI capabilities. Although it is expected that EVLA commissioning will eventually include VLBI capabilities, no definite timescale for implementing this has yet been set.

- **HSA details**
- **Proposal submission** (use your "my.nrao" account or create one)
- **Scheduling** (fixed date)

Global cm VLBI Proposals and Scheduling

The NRAO and the European VLBI Network (EVN) jointly handle proposals for observing time on the Global VLBI Network at centimeter wavelengths. The deadline is October 1, 2009 for the session in March 2010.

- **VLBA details**
- **EVN details**
- **Proposal submission** (use your "NorthStar" account or create one)
- Scheduling is on fixed dates during global sessions

Global 3mm VLBI Proposals and Scheduling

The NRAO and a set of European observatories jointly handle proposals for VLBI observing time at a wavelength of 3mm on the Global mm-VLBI Array (GMVA). The deadline is October 1, 2009 for the session in May 2010.

- **GMVA details**
- **Proposal preparation** (via a LaTeX template)
- Proposal submisson is via e-mail to **propsoc@nrao.edu** and **propvlbi@mpifr-bonn.mpg.de**
- Scheduling is on fixed dates during global sessions

ALMA Construction

Al Wootten

Figure 1. Two antennas constructed by Vertex ride on ALMA transporters at the Operations Support Facility (OSF) in Chile. An antenna constructed by Mitsubishi Electric Corporation (MELCO) is in the background. These three antennas have been conditionally accepted by ALMA and will participate in the first phase closure tests at the high-elevation Array Operations Site (AOS). © ALMA (ESO/NRAO/NAOJ)

Figure 2. The ALMA Central Local Oscillator has been successfully installed at the 5000m AOS Technical Building. Photo: W. Grammer.

Interferometry continued with the first two ALMA antennas at the Operations Support Facility (OSF) in northern Chile, with refinements to the baseline and to the system. Total power tests occurred on the third antenna, soon to include spectral line pointing using a second single baseline correlator that was delivered from the NRAO Technology Center in Virginia. This instrument had been used at the ALMA Test Facility last year.

The majority of the parts for sixteen ALMA antennas are now at the OSF. The Early Science array is projected to consist of sixteen antennas; it will most likely consist of an array of the antennas now present in Chile.

At its highest operating frequencies, ALMA performance is constrained by the atmosphere and by antenna performance. With three antennas under ALMA testing and thirteen more at the OSF in line for acceptance, a focus of activity has been to ensure that the antennas perform well. To achieve this, both antenna surface accuracy and pointing must be very well understood. Teams from the Joint ALMA Observatory (JAO) and from the ALMA Executives have performed a variety of tests on accepted antennas and on those still in the contractor areas that will soon move through acceptance. An ALMA transporter will soon move an antenna from the OSF to the 5000m Array Operations Site (AOS) for the first high-altitude trials. Preparation for this event has driven a number of activities at the AOS. The water vapor radiometers delivered by ESO were characterized at the OSF and at the AOS, for example, and they have been mounted on two ALMA antennas, where testing continues.

Another example has been the installation of equipment in the AOS Technical Building. A major technical challenge for ALMA has been the provision of a stable Local Oscillator (LO) signal over the wide range of ALMA operating frequencies, keeping the relative phase sufficiently stable after delivery of the signal to different antennas that may be separated by several kilometers. The specification for phase drift is that it be maintained within 2 parts in 10^{10}! This is the job of the Central LO, the first unit of which, capable of providing signals to 16 antennas, has been installed at the 5000m ALMA site.

For the LO, a reference frequency is generated as the difference between two laser signals generated in the infrared portion of the spectrum, at 1.5 microns. The frequency of one laser, the slave, is varied to produce the desired frequency at the antenna when mixed with the frequency of a master laser, both of which are located in the Array Operations Site Technical Building. The phase stable laser difference signal is used to phase-lock a signal generated locally at the antenna that in turn drives the signal for the mixers in the Front End. The phase drift and phase noise must be kept within stringent limits. The phase stability at the antenna is guaranteed by phase locking on the optical fringe, so the number of optical wavelengths must be kept constant over the round trip in the optical fiber. This effectively keeps the electrical length of the fibers, laid underground from the central building to each distant antenna, constant, and so guarantees a constant propagation delay and stable phase at each antenna even at the shortest wavelength (0.32mm) used by ALMA.

The first racks of the ALMA Central LO, which handle sixteen antennas, successfully underwent Provisional Acceptance In-House (PAI) at the NRAO Technology Center on June 24, 2009. The performance of the first unit was verified, and it was packed and shipped to the ALMA site. Upon arrival, the racks were assembled and cabled by W. Grammer, J. Meadows, J. Shelton, and J. Castillo, working in the oxygenated atmosphere of the AOS Technical Building. Bill Shillue, J.F. Cliche, Jason Castro, and Yoshi Masui have conducted on-site testing. Rodrigo Brito has provided invaluable logistical and technical assistance on-site to both teams. Recently the testing team verified passage of an 84 GHz LO signal between the newly installed racks and antenna pad No. 106, just outside the building, onto which an antenna will be moved during September. The lasers have tuned and locked reliably and the phase correction system is working well.

Integration into the ALMA computing system is also going well, allowing monitoring of phase drift data from San Pedro and, eventually, worldwide. The system will next undergo Provisional Acceptance on Site (PAS) and will be used for interferometry at the AOS in the coming months.

Career Opportunities

New Postings

Jansky Fellowships: The 2010 Jansky Fellowship provides outstanding opportunities for research in astronomy. Jansky Fellows formulate and carry out nvestigations within the wide framework of the Observatory. Candidates with interest in radio astronomy instrumentation, computation, and theory are encouraged to apply.

Scientists (NAASC): The North America ALMA Science Center (NAASC) seeks candidates with demonstrated independent research in areas related to the goals of ALMA. Moderate travel opportunities to Chile will be available, including brief "turns" as Astronomer-on-Duty at the ALMA observing Support Facility in northern Chile. Proficiency with one or more radio interferometric data processing languages such as CASA, AIPS, MIRIAD and GILDAS, particularly CASA, the adopted environment for ALMA. These positions will be filled at assistant, associate, or scientific levels based on experience.

NRAO Postdoctoral Fellow: The North American ALMA Science Center (NAASC) invites applications for a Postdoctoral Fellow to work with the NAASC scientific staff. The focus will primarily be on independent research with an emphasis on exercising ALMA end-to-end software and databases from a scientific perspective. Skills in molecular spectroscopy or automated line are desired.

Web Analyst/Developer: The North American ALMA Science Center is seeking a Web Analyst/Developer to work in consultation with observatory scientific, technical, and design staff to plan, develop, and maintain websites and web portals that communicate technical information to external users of observatory research facilities.

Assistant Scientist/A: The team of scientists at the Green Bank Telescope (GBT) is seeking an Assistant Scientist/A to provide full scientific support to the GBT and the NRAO. Responsibilities will include supporting observers who use the telescope as well as working on a diverse variety of projects, which may include the development and commissioning of new instrumentation on the telescope, working with the engineering staff to improve the overall telescope performance, and aiding with the data reduction pipelines needed for the GBT. The position will be filled at the assistant, associate, or scientist level, depending on experience.

Software Engineer II (NAASC): ALMA seeks a software engineer to help evaluate, deploy, maintain, and write applications for the NAASC user portal and support the configuration and operation of the NRAO helpdesk. Will require constructively evaluating and leveraging existing NRAO web services and content, ALMA and NRAO prototypes, and new technologies.

Software Engineer II: The Software Development Division in Green Bank, WV is seeking a Software Engineer to help design, develop, implement, and support the Dynamic Scheduling System for the Green Bank Telescope. The Dynamic Scheduling System is broken into three major components: a web application built with the Django web development framework, a series of custom user interfaces built with Ext GWT, and the core scheduler implemented in the functional programming language, Haskell. The Dynamic Scheduling team uses agile software development methods and automated unit testing to provide a working system for sponsors at every step of system development.

Software Engineer III: The Software Development Division in Green Bank, WV, is seeking a Software Engineer to provide support for the scientists who use the Green Bank Telescope (GBT). Work will be directed initially toward improvements in the post-observing data analysis and reduction software as well as developing data reduction and analysis software infrastructure for existing instrumentation.