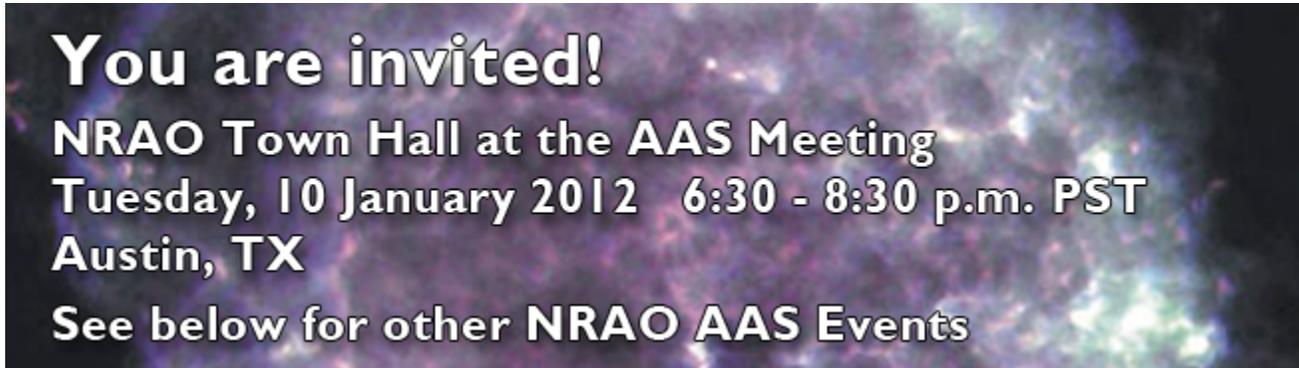


NRAO eNews

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Upcoming Events



<https://science.nrao.edu/science/aas/219/nrao-town-hall-at-the-219th-aas>



NRAO Community Day (<https://science.nrao.edu/facilities/evla/early-science/community-days/university-of-maryland-15-december-2011>)
Dec 15, 2011 | University of Maryland



NRAO Town Hall at the 219th AAS (<https://science.nrao.edu/science/aas/219/nrao-town-hall-at-the-219th-aas>)
Jan 10, 2012 | Austin, TX



ALMA Special Session at the 219th AAS (<https://science.nrao.edu/science/aas/219/alma-special-session-at-the-219th-aas>)
Jan 11, 2012 | Austin, TX



Proposing to Use NRAO Telescopes (<https://science.nrao.edu/science/event/aas-2012/proposing-to-use-the-nrao-telescopes>)
Jan 11 - 12, 2012 | Austin, TX



NRAO Community Day (<https://science.nrao.edu/facilities/evla/early-science/community-days/UC-Berkeley-13-january-2012>)
Jan 13, 2012 | UC Berkeley



Caltech CASA Radio Analysis Workshop (<https://science.nrao.edu/opportunities/courses/casa-caltech-winter2012>)
Jan 19 - 20, 2012 | Caltech



2nd EVLA Data Reduction Workshop (<https://science.nrao.edu/facilities/evla/early-science/DRW-spring2012>)
Feb 22 - Mar 1, 2012 | Socorro, NM



Outflows, Winds and Jets Workshop (<https://science.nrao.edu/facilities/alma/naasc->



[workshops/jets2012\)](#)

Mar 3 - 6, 2012 | Charlottesville, VA



[Synthesis Imaging Workshop \(http://www.aoc.nrao.edu/events/synthesis/2012/\)](http://www.aoc.nrao.edu/events/synthesis/2012/)

May 29 - Jun 5, 2012 | Socorro, NM

From the Director: NRAO and the NSF-AST Portfolio Review

Fred K.Y. Lo

With Early Science underway on the EVLA and ALMA, the National Radio Astronomy Observatory (NRAO) is delivering transformational scientific capabilities to the community via a suite of four world-class telescopes, thereby enabling the US (and international) astronomy community to make new discoveries and answer outstanding fundamental astrophysical questions underlying the science objectives described in the Astro2010 Decadal Survey report, *New Worlds, New Horizons in Astronomy and Astrophysics* (NWNH).

The NRAO suite of telescopes includes: the international Atacama Large Millimeter/submillimeter Array (ALMA), the Expanded Very Large Array (EVLA), the Robert C. Byrd Green Bank Telescope (GBT), and the Very Long Baseline Array (VLBA). Each telescope is the world leader in its observing domain. Collectively, these telescopes will enable astronomers to observe from sub-millimeter to meter wavelengths with an order of magnitude or more improvement over current capabilities in resolution, sensitivity, frequency coverage, or field of view. Used individually or in combination, the NRAO telescopes will provide the novel capabilities required to address many of the science themes outlined in NWNH, such as placing constraints on the nature of Dark Energy, imaging the first galaxies in the epoch of reionization, and observing directly the formation of planets in protoplanetary disks.

ALMA will provide for the first time detailed images of stars and planets in formation, young galaxies being assembled throughout the cosmic history of star formation, and generally open new windows into the cold Universe via the tremendous increase in sensitivity and resolution at millimeter and submillimeter wavelengths. The US astronomy community's strong anticipation for ALMA was demonstrated by the more than 7:1 oversubscription for observing time in the first Early Science opportunity. As you read this message, the first ALMA Early Science data packages have been delivered to investigators. ALMA full science operations is expected within another two years according to plan.

At the adjacent centimeter-wavelength range, the EVLA scientific capabilities are comparable to those of ALMA, but exceed those of the Very Large Array by one to four orders of magnitude, depending on the parameter. EVLA construction is on schedule and on budget, while meeting its technical specifications and scientific objectives. Even as construction is ongoing, Early Science programs have started in early 2010. Already, a special issue of the *Astrophysical Journal Letters* devoted to EVLA Early Science results was published in September 2011, describing cutting-edge research from the Solar System to the farthest reaches of the Universe. In late 2012, the completed EVLA will transition to full science operation as the world's most capable and versatile centimeter-wave imaging array.

With comparable collecting area and sensitivity to ALMA and EVLA, the 100m GBT is the preeminent filled-aperture radio telescope operating at meter to millimeter wavelengths. Its more than 2-acre collecting area, unblocked aperture, and excellent surface accuracy enable precision pulsar timing to detect gravitational wave radiation, testing the strong field limit of General Relativity, mapping the gas inflow into galaxies, detecting 21 cm HI emission at $z \sim 1$ via the novel Intensity Mapping approach, revealing the merging process of clusters, and probing the chemistry of the Universe. Based on an affordable plan driven by key science projects, the GBT is being augmented by new cameras that can greatly increase imaging speed and significantly enhance its science impact in the coming decade.

The VLBA is the premier fully dedicated VLBI array in the world. Astrometry with the VLBA has reached the precision of a few micro-arcseconds, enabling distance and proper motion measurements of objects in the solar neighborhood, across the Milky Way, within the Local Group, and moving with the Hubble flow. Its scientific capabilities continue to improve as a major bandwidth expansion to increase sensitivity is completed by January and new C-band receivers are installed by September 2012. I should also point out that scientifically the VLBA is comparable but complementary to the Gaia mission to be flown in 2013. When VLBA is used in conjunction with the phased EVLA and the GBT, the resultant High Sensitivity Array greatly enhances the sensitivity for VLBI observations and broadens the range of novel scientific research. To place future VLBA operations on a solid footing, we are developing a new operating model to incorporate the US and international partners for its operation and development according to five-year plans.

Looking towards the future, we are also focusing on developing forefront technology. Taking advantage of the outstanding technical expertise across NRAO that has kept our facilities at the forefront, the Coordinated Development Lab (CDL) oversees a science-driven program aiming to help realize key NWNH science goals, such as the detection of gravitational waves via pulsar timing (NANOGrav), the study of the epoch of reionization via the highly redshifted 21 cm HI line (PAPER/HERA), the development of the Frequency Agile Solar Radiotelescope (FASR), and prepare for other next generation facilities.

In order to carry out the myriad of tasks under realistic budgets, the NRAO continues to refine the most cost effective operating model, the 'One Observatory' approach, based on Observatory-wide planning, prioritization and coordination to utilize optimally the collective expertise and resources. More details about the current status and future plans of the NRAO can be found in the **[NRAO Long Range Plan](https://science.nrao.edu/legacy/2013LRP/)** (<https://science.nrao.edu/legacy/2013LRP/>).

Currently, the US and world economies are struggling and there are budgetary pressures at all levels. Clearly the ambition of astronomers must be tempered by the budget realities. So, I urge everyone in the astronomy community to actively participate in the NSF-AST Portfolio Review that is now underway. This Review's goal is to recommend how support for all existing AST facilities, programs, and activities should be prioritized and interleaved with new initiatives recommended by the Astro2010 Decadal Survey, within the limitation of realistic future budgets. The outcome of this Review will result in significant near-future changes to the structure and capabilities of US astronomy, and thus it deserves everyone's attention.

The NSF-AST has now explicitly invited community input to the Portfolio Review Committee and

the NSF staff, and a description of the types of community input being sought is available **online** (http://www.nsf.gov/mps/ast/ast_portfolio_review.jsp#link1). The input window is open until 31 January 2012. A recent update of the NSF-AST budget and planning status is available via a briefing presented by Director James Ulvestad to the **Astronomy and Astrophysics Advisory Committee** (http://www.nsf.gov/events/event_summ.jsp?cntn_id=117920&org=AST) at their October 2011 meeting.

While a periodic portfolio review is obviously a prudent exercise, it is important to examine the premise of the Portfolio Review, in order to avoid decisions that might lead inadvertently to irreparable damage to the competitiveness of the US astronomy enterprise. So, this is a critical time for the voices of the community to be heard by our funding agency.

The NRAO has created an **online forum** (<https://science.nrao.edu/forums/>) for discussing the community's priorities, concerns, and issues with respect to the Portfolio Review and the Observatory. If you would prefer to provide a direct private input to the NRAO, please e-mail us at **community@nrao.edu** (<mailto:community@nrao.edu>). Input received via this address will be available only to the NRAO senior management team.

After more than five decades of continual improvement, NRAO comprises the nation's core competency in radio astronomy, an invaluable resource for the astronomy community in the US, and indeed the world. We will work together with the community to meet our budget challenges and continue to enable forefront research into the Universe at radio wavelengths.

Proposal Evaluation and Time Allocation for Semester 2012A

Tim Bastian and Joan Wrobel

The Observatory has completed the second semester of the new proposal evaluation and time allocation **process** (<https://science.nrao.edu/observing/proposal-types/peta>) for the Expanded Very Large Array (**EVLA** (<https://science.nrao.edu/facilities/evla>)), the Very Long Baseline Array (**VLBA** (<https://science.nrao.edu/facilities/vlba>)/High Sensitivity Array (**HSA** (<https://science.nrao.edu/facilities/vlba/proposing/HSA>))), and the Green Bank Telescope (**GBT** (<https://science.nrao.edu/facilities/gbt>)). A total of 400 proposals were received at the 1 August 2011 submission deadline for Semester 2012A. In aggregate the proposals covered the broad spectrum of modern research in astronomy and astrophysics.

Proposals were assigned to one of eight **science categories** (<https://science.nrao.edu/observing/proposal-types/proposalssciencecategories>) and released to the relevant community-based Science Review Panels (SRPs). Proposals also underwent technical reviews by NRAO staff. Reviews were completed in October 2011 and then cross-reconciled by the Time Allocation Committee (TAC) during its meeting in Green Bank, WV, on 2-4 November 2011. A new Proposal Handling Tool (PHT) supported the TAC's consideration of EVLA and VLBA/HSA proposals. The TAC consists of the chairs of the SRPs and is charged with recommending a science program for Semester 2012A to the NRAO Director.

After approval of the science program, a disposition letter for each proposal was prepared and sent 6 December 2011 to all authors of the proposal. A TAC **report** (<http://www.aoc.nrao.edu/~schedsoc/tac2012a.shtml>) containing information for proposers and observers, including statistics and telescope

pressure plots, was released the same day. The approved [science program \(https://science.nrao.edu/science/science-program\)](https://science.nrao.edu/science/science-program) will be posted soon.

The Observatory welcomes community feedback on its new [process \(https://science.nrao.edu/observing/proposal-types/peta\)](https://science.nrao.edu/observing/proposal-types/peta) for proposal evaluation and time allocation. Please provide such feedback via the Proposal Review department of the Observatory's [Helpdesk \(http://help.nrao.edu/\)](http://help.nrao.edu/).

NRAO Outreach Events

NRAO Community Days

Gustaaf van Moorsel

NRAO is pleased to announce two community days. The first is designed to serve astronomers in the northeast U.S., will be hosted by the University of Maryland on 15 December 2011. The second Community Day is designed to serve astronomers in the western states, especially California, and will be hosted by UC, Berkeley on 13 January 2012.

Our goal is to showcase the NRAO instruments and provide information regarding how to propose and observe with ALMA, EVLA, VLBA, and GBT. In the morning session of these Community Days, we will provide an overview of the capabilities of each of our instruments, and present possible synergies between them. The afternoon session will be an opportunity for hands-on experience with the various proposal and observation preparation tools, and with the post-processing system CASA. Additional information and registration is available [on-line \(https://science.nrao.edu/observing/community-days\)](https://science.nrao.edu/observing/community-days).

ALMA Community Day Events for Cycle 1 Early Science

Carol Lonsdale

The NRAO North American ALMA Science Center is planning to hold a small number of Community Day Events (CDEs) during the month of February 2012 to assist community members in planning their proposals in response to the ALMA Cycle 1 Call for Proposals, which is expected in Spring 2012.

The Cycle 1 CDEs will be modeled on the recent series of events held in [preparation for ALMA Cycle 0 observing \(https://science.nrao.edu/facilities/alma/community1\)](https://science.nrao.edu/facilities/alma/community1). Cycle 1 CDE events could be hosted at new locations, or could be short “refresher” style events at previous host locations.

Community members interested in the possibility of hosting an ALMA Cycle 1 CDE are encouraged to contact Carol Lonsdale at [clonsdal@nrao.edu \(mailto:clonsdal@nrao.edu\)](mailto:clonsdal@nrao.edu).

Caltech CASA Radio Analysis Workshop

Miriam Krauss

NRAO, in conjunction with Caltech and IPAC, is pleased to announce a new workshop on the analysis of EVLA and ALMA data with the CASA software package. This workshop will be held on the Caltech campus 19-20 January 2012. No prior knowledge of CASA or radio analysis is needed.

The workshop will include both presentations and hands-on sessions. The presentations will cover topics such as:

- Interferometry basics
- Introduction to the CASA package
- CASA data structures
- EVLA reduction techniques
- ALMA reduction techniques
- Scripting CASA with Python
- Writing CASA tasks

The hands-on sessions will give participants the opportunity to reduce data using one of our online tutorials, which include both EVLA and ALMA topics, as well as to practice writing CASA scripts and tasks. Participants should plan to bring their own laptops to take part in the hands-on sessions.

Although there is no registration fee, registration is necessary to take part in this workshop. Please visit the **[workshop web site \(https://science.nrao.edu/opportunities/courses/casa-caltech-winter2012\)](https://science.nrao.edu/opportunities/courses/casa-caltech-winter2012)** for more information and to register. Registration will be capped at 40 participants.

2nd EVLA Data Reduction Workshop

Gustaaf Van Moorsel

NRAO is pleased to announce the 2nd EVLA Data Reduction Workshop, which will be held 22 February – 1 March 2012 at the Pete V. Domenici Science Operations Center in Socorro, NM. The aim of the workshop is to help participants cope with the new challenges posed by the increased power and complexity of the EVLA. The focus will be on reducing data taken in the wide-band WIDAR modes available to the observing community since 30 September 2011.

Unlike the September 2011 workshop, this workshop will consist of two distinct parts. The first part, 22-24 February, will be organized much like the workshop held in September 2011, with presentations and hands-on tutorials. As in September, the number of participants will be limited to 40.

During the second part, 27 February – 1 March, participants will be given the opportunity to reduce their own EVLA data during which local staff will be available for consultation. Due to the increased resources required we have to limit the number of participants for this part to 30 persons.

Those interested can register for part 1, part 2, or both. For part 1, we will give preference to those who have not attended the workshop in September 2011. Since part II will require experience gained during either part 1 of this workshop, or the September 2011 workshop, we will give preference to those who have attended either of those events.

This is an advanced workshop, and unlike our Synthesis Imaging summer schools, is not intended for those who are new to radio interferometry. Prior experience with AIPS, CASA, or MIRIAD is required. We will be using CASA as our main data reduction package, but may use AIPS as well for some process steps, as needed. A working knowledge of CASA would be helpful.

If interested, please register at the [Workshop's website \(https://science.nrao.edu/facilities/evla/early-science/DRW-spring2012\)](https://science.nrao.edu/facilities/evla/early-science/DRW-spring2012) which contains further information and a preliminary program. We look forward to welcoming you to Socorro.

Jets 2012 – Registration is Open!

Anthony Remijan



([images/figure7_1.png](#))

Registration (<https://science.nrao.edu/php/alma/jets2012/reg.php>) and **abstract submission** (<https://science.nrao.edu/php/alma/jets2012/abs1.php>) for the North American ALMA Science Center (NAASC) 6th annual science workshop – *Outflows, Winds and Jets: From Young Stars to Supermassive Black Holes* – in Charlottesville, Virginia, 3-6 March 2012 are now OPEN! The preliminary science program is also **on-line** (<https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012/program>).

The full registration fee is \$375, but to encourage their participation, the student registration fee is only \$125. Students who have requested financial support through this reduced registration fee must notify the LOC via jets2012@nrao.edu (<mailto:jets2012@nrao.edu>) and submit an abstract to present at least a poster at the meeting. However, all students are strongly encouraged to request a contributed talk. Students also receive half-price hotel rates, so those students sharing a room will have their entire lodging paid for by the workshop. Please email the LOC if you would like to find a roommate to take full advantage of this opportunity.

On Sunday evening, workshop representatives will host a "Taste of Charlottesville". The LOC has made arrangements to host dinners for conference participants sampling the wide range of fare

available by local Charlottesville restaurants on the historic Downtown Mall. The price for this "Taste of Charlottesville" is \$50. Please keep that in mind when you register for the meeting. Other information about the meeting, including child-care options, is available through the **conference logistics website** (<https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012/jets-2012-logistics>).

Full registration will remain open until we reach our maximum capacity; abstract submission will be open until **15 December 2011**. After that time, all abstracts will be sent to the SOC, and the full scientific program will be finalized.

If you have any problems, questions or concerns or if you have problems with the registration process, please contact LOC Chair Anthony Remijan at jets2012@nrao.edu (<mailto:jets2012@nrao.edu>).

ALMA Early Science Status

Al Wootten



[\(images/2_1.png\)](#)

Figure 1. In mid-November ALMA had placed 24 telescopes at the 16,500 ft elevation Array Operation Site (AOS); 26 telescopes were at the AOS by the end of the month. Credit: J. Stoke, NRAO/AUI/NSF

 [Zoom \(images/2_1.png\)](#)



[\(images/3_1.png\)](#)

Figure 2. Ed Fomalont explains the mysteries of self-calibration at the recent ALMA Data Reduction Workshop in Charlottesville

 [Zoom \(images/3 1.png\)](#)

The first packages of ALMA Early Science data were delivered to Principal Investigators in the ALMA partner regions in early December. Observations from five blocks of Early Science observing time were complete by early December.

The NRAO [North American ALMA Science Center](http://science.nrao.edu/alma) (NAASC) invited investigators from the highest rated North American Community ALMA Cycle 0 programs to a [Data Reduction Workshop](https://science.nrao.edu/facilities/alma/naasc-workshops/almadata) in Charlottesville 1-2 December 2011.

Adam Leroy and Carol Lonsdale, from the NAASC User Services Group, organized the Workshop. NRAO Computing staff outfitted the Edgemont Road auditorium with terminals and 29 visiting investigators used the new NAASC data reduction cluster to work through training material built around ALMA science verification data.

NAASC staff presented background material on ALMA and the [CASA](http://casa.nrao.edu/) software package to the local attendees and several remote participants. Then the local attendees worked hands-on with actual ALMA data sets, learning how to use CASA for calibration, imaging, and self-calibration. During the hands on sessions, NAASC staff provided one on one assistance. The first ALMA datasets were delivered the following week. One of the PIs who attended the workshop received his ALMA data in this distribution.

The Workshop [program](https://science.nrao.edu/facilities/alma/naasc-workshops/almadata/program) with presentations is on-line.

By 31 December, the electrical and fiber connections to the complement of inner array antenna stations will be complete, setting the stage for redeployment of the antennas to the extended array during the February shutdown period, when external power will be supplied to the AOS antennas, which are currently powered by inefficient local power generation.

With stationing of the 16th Vertex antenna at the AOS in late November, the array grew to 26 antennas. Six antennas are going through their Integration and Verification tests at the lower-elevation Operations Support Facility, and are being readied for transport to the AOS. During the month, construction began on the 22nd Vertex antenna.

Important milestones for the project were reached with the final deliveries of assembled cartridges for two of the ALMA receiver bands. The ALMA Band 3 Receiver (3mm) team at the National Research Council's Herzberg Institute of Astrophysics in Victoria, BC, Canada assembled the 73rd and final, receiver. After in-house testing, it will be shipped to an ALMA Front End Facility. The Band 3 project has been a ten-year effort and is reaching completion on-time and on-budget. Meanwhile, in Europe, the final Band 9 (450 μ m) production cartridge was delivered, and it completed verification on 24

November. This delivery completed the 73 item production run for Band 9.

NRAO Science Forums Open for Business

Anthony Remijan



Interested in what other NRAO users are doing? Have you developed a great reduction script or observing strategy that you want to share with others in the community? Are you interested to know whether other NRAO users have the same questions you do? Need a place to bounce around ideas?

The NRAO Science Forums are now open! The Forum provides the observatory's users with an interactive, online environment for general discussions on science, project planning, observing strategies, data reduction, data analysis and archive access. Users are free to exchange questions, offer ideas and suggestions and share tips and tricks with each other. Overall, we hope the NRAO Science Forum will be a great source for user education, communication, and troubleshooting.

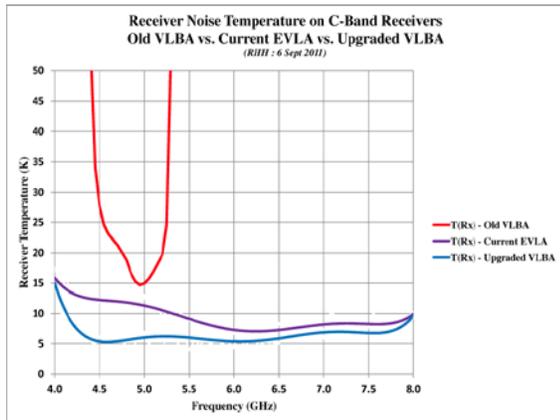
Access to the forums is available at <http://science.nrao.edu/forums> (<http://science.nrao.edu/forums>). User forums and discussions can be viewed by the entire community and are fully searchable through all standard search engines (e.g. Google). To post to a forum topic, users must be authenticated through the NRAO portal at <https://my.nrao.edu> (<https://my.nrao.edu>). In addition to viewing threads on interesting discussion topics, the Science Forum can be customized by a user to receive alerts when a new post is added to a topic, to tag each topic with common elements, and to post to the database scripts and procedures for discussion by the user community.

Since this is a forum for users to exchange and discuss their problems, ideas, reduction scripts, NRAO staff will play a limited moderation role. If a problem cannot be solved from within the group of users, we prefer that a Helpdesk ticket be submitted via our NRAO portals: <http://help.nrao.edu> (<http://help.nrao.edu>) (all NRAO questions outside ALMA) and <http://help.almascience.org> (<http://help.almascience.org>) (ALMA).

For questions about the NRAO Science Forum, please contact Anthony Remijan, Manager of Observatory Science Operations, at aremijan@nrao.edu (<mailto:aremijan@nrao.edu>).

Detection of the 6.7 GHz Methanol Maser with the New 4-8 GHz VLBA Receiver

Craig Walker and Bob Hayward on behalf of the VLBA Upgrade Project

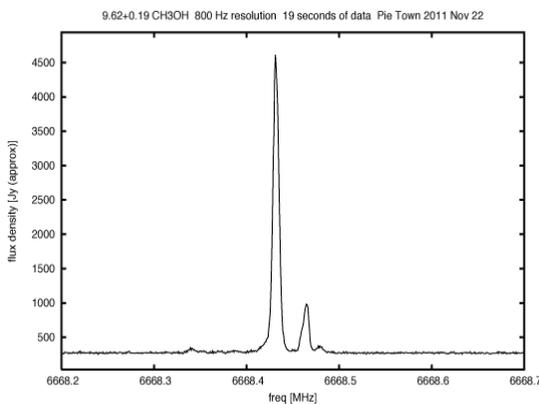


[\(images/8_1.png\)](#)

Figure 1. Receiver noise temperature performance of an old VLBA receiver, an EVLA receiver, and a new VLBA receiver, as a function of frequency.



[Zoom \(images/8_1.png\)](#)



[\(images/8_2.png\)](#)

Figure 2. The first spectrum of the 6.7 GHz methanol maser in 9.62+0.19 made using the new VLBA 6cm receiver at Pie Town.



[Zoom \(images/8_2.png\)](#)

The 6cm receivers on the VLBA are being upgraded to more sensitive systems that can observe over a much wider frequency range. The new systems, based on EVLA technology, cover 3.9 to 7.9 GHz, compared to 4.5 to 5.2 GHz previously. The dewar and receiver control package are being reused in the new system but critical components, such as the narrowband polarizer and cooled GAsFET amplifiers, are being replaced by the new 4-8 GHz EVLA-style polarizer and InP amplifiers. Many of the warm RF microwave components are being replaced as well. The old linear tapered feed horn is being replaced by a compact corrugated feed to cover the new wider bandwidth requirement.

Support for the wider bandwidth requires that the IF converter be replaced. A new IF converter design has been adopted that will support two polarization pairs of output signals, each 512 MHz wide. Other VLBA converters can only produce one pair of outputs. The two pairs can be tuned independently to anywhere in the band. The new IF converter required new RF switch controls so, rather than enhance the old on-line control computer, which is nearing its end-of-life, a new RF switch control module is being added and control is being handed to the computer that already controls the new wide band backend and recording system and will eventually control the whole site.

The primary scientific driver for this project is to measure the structure of our Galaxy through parallax observations of the 6.7 GHz methanol maser line. This line is significantly better than other available lines for such work because it is brighter than most and more stable, as required for the year-long parallax observations, than the strong water masers. It is one to two orders of magnitude stronger than the 12 GHz methanol line which has been a mainstay of past galactic structure observations. There are an inadequate number of sufficiently bright 12 GHz masers to do the job properly and nearly all of them have already been observed. The added brightness of the 6.7 GHz line means that far more sources will be observable. Note that the 6.7 GHz line was not covered by the original VLBA receivers because it was discovered after the VLBA was built. While the maser lines drive the need for the new receivers, the high sensitivity and the ability to span a very wide frequency range in the portion of the radio spectrum where VLBI works best will be of significant benefit to many continuum observations, including those requiring detection of weak sources, those needing accurate delays for astrometry or geodesy, and those wishing to measure Faraday rotation.

The initial receiver was installed on the Pie Town antenna 7 June 2011, followed by Owens Valley, Fort Davis, and Brewster to date. The new IF converter and RF switch controller were not yet available so the initial testing and observing had to be done through the old IF converter, which limits the frequency range. The methanol line could not be observed with that system. But in the range that could be tested, the performance has been spectacular. One goal was to equal the sensitivity of the new EVLA system. Thanks to a redesigned thermal isolation system on the input waveguide, that goal has been surpassed. The system temperatures on the sky are about 20K and the System Equivalent Flux Density (SEFD) – a good measure of overall system performance – is about 200 Jy. Most of the older VLBA systems are 300 Jy and above.

Figure 1 shows the performance of one of the new receivers in the lab over the full frequency range. Curves are shown for the old VLBA receiver, a current EVLA receiver, and a new VLBA receiver. There is a clear improvement of about 10 deg over the old receiver in addition to the far wider bandwidth. There is also a significant improvement over the EVLA receiver. Note that the system temperature on the telescope is about 15K higher than the numbers shown here because of contributions from spillover, atmosphere, and microwave background.

The new RF switch controller and IF converter were installed at Pie Town 15 November 2011. Control of those units was assumed by the new control computer. A concerted effort to shake out bugs is ongoing, but the system works for most observations. On the night of 21-22 November, the 6.7 GHz methanol lines in W3(OH) and 188.95+0.89 were seen strongly in pointing observations. W3(OH) more than doubled the system temperature in a 500 kHz bandwidth. The following day, a spectrum (Figure 2) was made using a capability to read and transform a small amount of VLBI data at the station. The source is 9.62+0.19, one of the brightest methanol masers

known. Note that the amplitude scale is approximate and the baseline is very flat despite lack of any corrections. This is the first ever spectrum of a 6.7 GHz methanol line from the VLBA.

The installation of the receivers is proceeding on schedule and the installation of the new IF converters and other hardware is starting with completion expected in August 2012. As that date is approached, the exciting science made possible with this new system will begin.

We would like to thank the many people throughout the Observatory who made this project possible. In particular, we acknowledge the key contributions of Matthias Bark (software), Walter Brisken (science and software), Gordon Coutts (OMT), Terry Cotter (IF Converter), Hollis Dinwiddie (mechanical design), Steven Durand (management), Jim Jackson (system design), Wayne Koski (digital control), Marian Pospieszalski (amplifiers), and Sri Srikanth (feeds). In addition, we thank the Max Plank Institute for Radio Astronomy for the significant role they played in making this project possible.

NRAO Summer Student Research Assistantships

Jeff Mangum



[\(images/9_1.png\)](#)

Figure 1. The participants in the 2011 NRAO Summer Student Research Assistantship program based in Charlottesville, VA.



[Zoom \(images/9_1.png\)](#)



[\(images/9_2.png\)](#)

Figure 2. The participants in the 2011 NRAO Summer Student Research Assistantship program based in Green Bank, WV.



[Zoom \(images/9_2.png\)](#)



[\(images/9_3.png\)](#)

Figure 3. The participants in the 2011 NRAO Summer Student Research Assistantship program based in Socorro, NM.



[Zoom \(images/9_3.png\)](#)

NRAO is now accepting applications for the 2012 NRAO Summer Student Research Assistantships program. Each summer student conducts research under the supervision of an NRAO staff member at one of the NRAO sites, on a project in the supervisor's area of expertise. The project may involve any aspect of astronomy, including original research, instrumentation, telescope design, or astronomical software development. Examples of past summer student research projects are on-line at the [Summer Student website \(http://science.nrao.edu/opportunities/summerstudents.shtml\)](http://science.nrao.edu/opportunities/summerstudents.shtml).

Supervisors choose their own student candidates from the received applications, and the site to which

a summer student is assigned depends on the location of the NRAO supervisor who chose them. Students are encouraged to review the NRAO staff web pages to learn more about the types of research being conducted at the NRAO. On their application, students may request to work with a specific staff member, to work on a specific scientific topic, or to work at a specific site.

The program runs 10-12 weeks each summer, from early June through early August. At the end of the summer, participants present their research results in a student seminar and submit a written report. These projects often result in publications in scientific journals. Financial support is available for students to present their summer research at an American Astronomical Society meeting, generally at the winter meeting following their appointment.

In addition to their research, students take part in other activities, including social events and excursions, and an extensive lecture series that covers many aspects of radio astronomy and astronomical research. Students also collaborate on their own observational projects using the EVLA, VLBA, and/or GBT.

There are three types of Summer Student programs available at the NRAO.

The *NRAO Research Experiences for Undergraduates (REU)* program is for undergraduates who are citizens or permanent residents of the United States or its possessions, and is funded by the National Science Foundation (NSF) Research Experiences for Undergraduates (REU) program.

The *NRAO Undergraduate Summer Student Research Assistantship* program is for undergraduate students or graduating college seniors who are U.S. citizens, are from an accredited U.S. Undergraduate Program, or are otherwise eligible to work in the U.S. This program primarily supports students or research projects that do not meet the REU guidelines, such as graduating college seniors, some foreign undergraduate students, or projects involving pure engineering or computer programming.

The *NRAO Graduate Summer Student Research Assistantship* program is for graduate students who are citizens or permanent residents of the United States or its possessions, enrolled in an accredited U.S. Graduate Program, or otherwise eligible to work in the U.S.

The stipends for the 2012 Summer Student Program will be \$628 per week for undergraduates and graduating seniors, and \$672 per week for graduate students. These stipends include an allowance for housing, since housing is not provided.

Students who are interested in Astronomy and have a background in Astronomy, Physics, Engineering, Computer Science, and/or Math are preferred. The same **[online application form and process \(http://science.nrao.edu/opportunities/summerstudents.shtml\)](http://science.nrao.edu/opportunities/summerstudents.shtml)** is used for all three programs. Required application materials include an on-line application form (including a statement of interest), transcripts, and three letters of recommendation. The deadline for receipt of application materials is Tuesday, 1 February 2012.

2011 NRAO Summer Students at the Austin AAS Meeting

Twenty-two of the 2011 NRAO Summer Student program participants will present the results of their research projects at the January 2012 American Astronomical Meeting in Austin, TX. A **[detailed table \(images/10_2.png\)](#)** lists these presentations along with session and schedule information. We encourage everyone to visit these student presentations and discover first-hand how impressive these promising young scientists are.

CASA Release 3.3.0

Jurgen Ott for the CASA team

We are pleased to announce release 3.3.0 of the Common Astronomy Software Applications package (CASA). CASA is being developed by NRAO, ESO, and NAOJ, and is used for the offline reduction and analysis of both ALMA and EVLA data. CASA is fully scriptable. Full support is provided for ALMA, VLA, and EVLA formats, but almost any data that can be written in uvfits format can be imported and reduced in CASA (for example, CARMA, SMA, ATCA).

Linux and MacOS distributions of CASA 3.3.0 are now available from the CASA webpage: **<http://casa.nrao.edu>** (**<http://casa.nrao.edu>**) Please Follow the links to "Obtaining CASA".

New features in CASA 3.3.0 include the following.

- New CASA region file format to unify region and annotation specifications (including experimental support in the viewer (and a reference to the documentation –newregions)
- gaincal: gaintype='K' is implemented to solve for antenna based delays
- Data selection based on scan intents and observation id is now supported in most calibration tasks
- setjy: A spectral index is now supported as input for flux calibration
- bandpass, gaincal, applycal: The opacity parameter can now be a list of opacities, one entry for each spectral window
- EVLA switched power calibration available in gencal
- testautoflag: new, experimental task for autoflagging data based on piecewise fitting of the bandpass in the time and frequency domains
- Previous uvcontsub2 has been renamed and is now replacing uvcontsub
- The simdata task has been split into two tasks, sim_observe and sim_analyze, to reduce the complexity for new users, and facilitate the combination of multiple arrays.
- fixvis: new parameter phasecenter to change the direction of the phase center of the visibilities
- impbcor, ia.pbcor() new task and tool method for primary beam correction of images
- immath: a stretch parameter in the mask selection will extend a smaller mask to the full size of the data cube (e.g. a moment0 mask to all channels)
- Full ICRS coordinate support
- Upgrades to importasdm and exportasdm to support ASDM v1.3
- Viewer upgrades include an elliptical selection tool, a distance measurement tool, errorbar plotting and error cube support, spectral plotting derived from averaged, median, sum and weighted data averages
- imfit: now optionally performs fits on a plane-by-plane basis if given multiple channels
- imstat: now derives statistics in slices of data, e.g. across RA/DEC per channel map
- sdbaseline: Automated sinusoidal fitting based on FFTs

- More uniformity in infile/outfile parameter naming throughout the single dish package
- Experimental code for parallel processing

For a full list, see the [on-line release notes \(http://casa.nrao.edu\)](http://casa.nrao.edu).

We encourage users to discuss CASA related problems on the NRAO Science Forums:
[http://science.nrao.edu/forums \(http://science.nrao.edu/forums\)](http://science.nrao.edu/forums)

If you are interested in CASA, you may subscribe to either or both of the following subscription lists:

- ***Casa-announce*** for announcement of new releases, workshops, etc.; please subscribe at [http://listmgr.cv.nrao.edu/mailman/listinfo/casa-announce \(http://listmgr.cv.nrao.edu/mailman/listinfo/casa-announce\)](http://listmgr.cv.nrao.edu/mailman/listinfo/casa-announce)
- ***Casa-users*** for critical bugs and code updates; please subscribe at [http://listmgr.cv.nrao.edu/mailman/listinfo/casa-users \(http://listmgr.cv.nrao.edu/mailman/listinfo/casa-users\)](http://listmgr.cv.nrao.edu/mailman/listinfo/casa-users)

If you have any questions, please consult the NRAO helpdesk: [http://help.nrao.edu \(http://help.nrao.edu\)](http://help.nrao.edu) or [http://help.almascience.org \(http://help.almascience.org\)](http://help.almascience.org) for all ALMA-related questions.

Video Library for the Astronomy Community

Marsha Bishop

The NRAO Library is posting videos of interest to the astronomy community at our web site. At present there are 8 Jansky Lecture videos available, as well as the Green Bank Telescope Dedication video, and the 140-Foot Telescope Construction video. Visit the [Library video web page \(http://www.nrao.edu/library/Videos/videohome.shtml\)](http://www.nrao.edu/library/Videos/videohome.shtml) to access these videos. This content can also be accessed from the [Library's home page \(http://www.nrao.edu/library\)](http://www.nrao.edu/library) via the 'Library Resources' in the left column. While the NRAO Library continues to post videos, we also will 'post on demand' any available NRAO video.

Recent Press Releases

[VLBA Distance Measurement Is Key to Producing First "Complete Description" of a Black Hole \(http://www.nrao.edu/pr/2011/cygx1/\)](http://www.nrao.edu/pr/2011/cygx1/)

17 November 2011

For the first time, astronomers have produced a complete description of a black hole, a concentration of mass so dense that not even light can escape its powerful gravitational pull. Their precise measurements have allowed them to reconstruct the history of the object from its birth some six million years ago. [Read More. \(http://www.nrao.edu/pr/2011/cygx1/\)](http://www.nrao.edu/pr/2011/cygx1/)

Career Opportunities

New Postings

[Head of Observatory Budgets \(https://careers.nrao.edu/applicants/Central?quickFind=50745\)](https://careers.nrao.edu/applicants/Central?quickFind=50745): The National Radio Astronomy Observatory in Charlottesville, VA is seeking a Head of Observatory Budgets to manage, conduct and develop the Observatory-wide budgeting activities for NRAO, monitor for budget conformance and develop recommendations for adjustments; coordinate detailed financial analysis and research, monitor status of budgets and ledger reports; as well as assist project managers and various budgeting entities in submitting accurate and viable budget proposals.

[Data Analyst \(https://careers.nrao.edu/applicants/Central?quickFind=50720\)](https://careers.nrao.edu/applicants/Central?quickFind=50720): The National Radio Astronomy Observatory in Green Bank, West Virginia is recruiting for a Data Analyst. The key responsibility for this position will be user documentation, both cleaning up the existing documentation and also working with the Green Bank staff to improve the layout and content of the Green Bank web pages. The successful candidate may also handle NRAO helpdesk tickets, and will be trained as part of the existing group of data analysts supporting NRAO's suite of telescopes at the EVLA, VLBA, ALMA, and GBT.

[Systems Administrator I \(https://careers.nrao.edu/applicants/Central?quickFind=00302\)](https://careers.nrao.edu/applicants/Central?quickFind=00302): The National Radio Astronomy Observatory in Charlottesville, VA is seeking a Systems Administrator I to provide support for a number of telescopes and science operations and collaborates with other NRAO facilities to provide Green Bank Telescope (GBT) and ALMA telescope and science computing support. This position will support local technical and scientific staff Redhat Linux systems and assist in the development and maintenance of the GBT data archive, high performance computing systems.

[Software Engineer II \(https://careers.nrao.edu/applicants/Central?quickFind=50654\)](https://careers.nrao.edu/applicants/Central?quickFind=50654) : **<https://careers.nrao.edu/applicants/Central?quickFind=50664>** The NRAO in Socorro, NM is accepting applications for a Software Engineer II. The successful candidate will work on one or more of the following applications: Observation Preparation Tool, Observation Scheduling Tool, and Archive Access Tool as well as perform routine maintenance and add new features to these tools. Initially the Software Engineer II will work primarily, but not exclusively, on user interface code for our web applications.

From the Archives

Ellen Bouton

[\(images/archives.png\)](#)



About this month's photograph: The VLA was used with Jet Propulsion Laboratory's Deep Space Network in Goldstone CA to track NASA's Voyager 2 encounter with Neptune in 1989. NRAO began planning and preparations in 1982, and



test phased array observing on Voyager and planets began several years before the encounter as more VLA antennas became outfitted for X-band. NRAO devoted 340 hours of VLA observing time to system tests and reception of Voyager's telemetry, and there were 40 scheduled telemetry passes from 26 April through 28 September 1989. This November 1985 sketch by Socorro's Paul Harden shows Bill Brundage (NRAO) and Ron Logan (JPL) with the test instrument setup at the VLA.

From the Archives is an ongoing series illustrating NRAO and U.S. radio astronomy history via images selected from our collections of individuals' and institutional papers. If readers have images they believe would be of interest to the Archives, please contact Ellen Bouton, ebouton@nrao.edu (<mailto:ebouton@nrao.edu>).

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