NRAO eNews

Volume 6, Issue 8 • July 11, 2013

Upcoming Events

CASPER 2013 Annual Meeting (http://www.jb.man.ac.uk/meetings/casper2013/)
Sep 02 - 06, 2013 | Jodrell Bank Observatory, UK

The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus (https://science.nrao.edu/science/meetings/IAU303-GC2013)
Sep 30 - Oct 4, 2013 | Santa Fe, NM

NRAO Town Hall at the AAS (https://science.nrao.edu/science/meetings/2014/aas223/nrao-town-hall)
Jan 07, 2014 | National Harbor, MD

A New Sky Survey with the Jansky Very Large Array

T. Beasley & D. A. Frail

In the 20 years since the initial observations were made for the *NRAO VLA Sky Survey (NVSS)* (http://www.cv.nrao.edu/nvss/) and the *Faint Images of the Radio Sky at Twenty-Centimeters (FIRST)* (http://sundog.stsci.edu/top.html), these pioneering programs have defined the state-of-the-art in centimeter radio sky surveys and produced a steady stream of excellent science. Given the enhanced capabilities of the Jansky Very Large Array (VLA), now is an appropriate time to discuss the scientific potential of new centimeter-wavelength sky surveys.

The astronomy community has already recognized that several of the high priority science goals of the 2010 decadal survey *New Worlds, New Horizons in Astronomy and Astrophysics* (http://sites.nationalacademies.org/bpa/BPA_049810) could be addressed by a new VLA sky survey. At the May 2013 *Radio Astronomy in the LSST Era* (https://science.nrao.edu/science/event/RALSST2013) held at NRAO-Charlottesville, for example, many scientists expressed keen interest in employing the VLA to conduct new, wide-area centimeter wavelength sky surveys in support of multi-wavelength synoptic surveys using existing and future facilities, such as the Large Synoptic Survey Telescope (LSST).

Thus, we are announcing a NRAO VLA Sky Survey (VLASS) initiative that will explore the science and technical opportunities of a new centimeter-wavelength survey. A community-led Science Survey Group (SSG) will define the science program and key components of VLASS, and NRAO will support its technical definition and implementation. All VLASS data will be available immediately to the North American community.

By 1 September, we will formally announce the formation of the SSG and identify opportunities for interested community members to join the group. We will also announce a white paper solicitation that will provide critical input to the SSG and NRAO regarding survey science goals, techniques development, and design.

Additionally, a VLASS workshop for all interested community members is being organized adjacent to the January 2014 American Astronomical Society meeting at National Harbor, MD. Stay tuned to eNews for further information.

Kim Scott

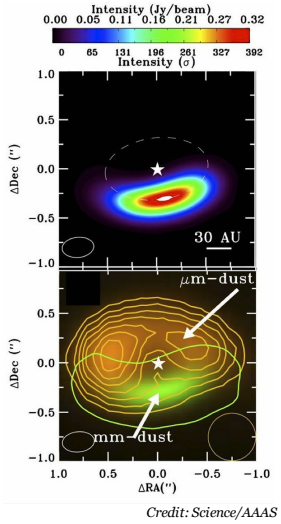
NRAO will provide an opportunity for universities and institutions across North America to host Astronomy Community Days, where we will travel to your institution to describe the science possibilities with ALMA, VLA, GBT and VLBA. Our goal is to communicate with astronomers about using NRAO's cutting-edge facilities for their science, and to provide tutorials on proposal and observation preparation and data reduction.

NRAO will collaborate with the host institution(s) to custom-design a 1-2 day program to best serve the local community / region. Further information and instructions for applying to host an NRAO Community Day will appear in the August eNews, so watch this space!

This Month @ the NAASC

ALMA Science Highlight

Aaron Evans



Credit: Science/AAAS

Recent ALMA observations of the star Oph IRS 48 by van der Marel et al. (2013 Science, 340, 1199 (http://www.sciencemag.org/content/340/6137/1199.full)) have revealed an asymmetric distribution of large mm-size dust grains at radial distances of 45 - 80 AU from the star (see Figure). These dust particles are embedded within a larger symmetric ring of smaller, micron-size grains (as traced by mid-IR 18.7 micron observations). ALMA observations of the CO(6-5) emission from the star system show gas to also be distributed in a ring with an inner cutoff radius of 20 AU. This inner cutoff is slightly smaller than observed for a hotter gas component (200-1000 K) traced by 4.7 micron CO line (~ 30 AU). The authors propose that the asymmetric distribution of large grains could be the result of a long-lived gas pressure bump: the large dust grains drift in the direction of the pressure gradient until they become trapped at the point where the gradient goes to zero. A substellar companion could cause such a local pressure maximum. A companion with a mass of at least 10 Jupiter masses at a distance of ~ 20 AU from the host star would also explain the sharp inner radius of gas as traced by CO emission. The smaller dust grains do not exhibit the accumulation in the pressure bump observed for the larger dust grains due to the tendency of small grains to be tightly coupled with the gas. Ultimately, such trapping of large dust grains may give rise to the formation of a Kuiper Belt around Oph IRS 48.

ALMA Update

Al Wootten

Credit: Diah Gunawan (ESO/NAOJ/NRAO)

Fig. 1: Although the ALMA transporter and antenna together weigh about a third of a million pounds, the Joint ALMA Observatory (JAO) team works to ensure high precision in the placement of the antennas. Any stress caused by improper placement may be apparent as inaccuracies in telescope pointing.

Continued progress with ALMA array commissioning and infrastructure has resulted in an increasing priority of Cycle 1 Early Science observing. Several Cycle 1 datasets have been observed and reduced using new versions of the ALMA software. Those datasets may be released to PIs upon software acceptance. Owing to the larger data volume in Cycle 1 and the more complex procedures used to obtain the data, there will be some changes in data delivery designed to make transfer of data packages efficient.

Fifty-eight antennas are at the 5000m AOS (Array Operations Site). The configuration of the 12m antennas is similar to C32-3, an intermediate baseline length Cycle 1 configuration, with some antennas on longer baselines for commissioning. Winter snows have caused some access problems to the antennas, deployed over baselines reaching to nearly 3 km. These problems are now resolved; good use is being made of the excellent winter transparency of the Chajnantor sky (0.3-0.8 mm of precipitable water vapor recently). In fact, observations have been made at the 3000m elevation Operations Support Facility (OSF) in the highest frequency ALMA bands (9 and 10) for verification of equipment being readied for deployment to the AOS.

An additional antenna was accepted during June and will be transferred from the contractor's facility to the OSF technical area for outfitting and testing. There remain only three antennas to be delivered during the construction phase. The first interferometric images were made in June with the receivers operating at 2mm (ALMA Band 4) using antennas of the Atacama Compact Array. Congratulations to our East Asian colleagues for this achievement!

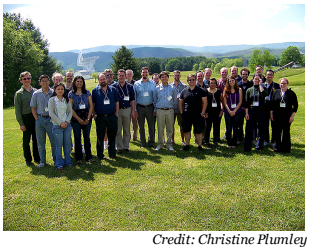
In May, NRAO issued a Call for ALMA Development Studies. Proposals are to be submitted by 12 July. The other ALMA Executives are issuing similar Calls; the ESO Call, for example, was published in June. Please visit the North American ALMA Science Center (NAASC) website (https://science.nrao.edu/facilities/alma) for details.

Materials from recent NAASC Workshops are available. Proceedings from the North American ALMA Science Center Workshop on *The Interstellar Medium in High Redshift Galaxies Comes of Age* edited by J. G. Mangum have been published. Presentations from the NAASC 7th annual science workshop *Transformational Science with ALMA: From Dust to Rocks to Planets – Formation and Evolution of Planetary Systems'* are available at the conference website (http://www.cv.nrao.edu/rocks/program.html). Presentations from the conference *The First Year of ALMA Science* conference held in Chile in December 2012 are also online (http://www.almasc.org/2012/index.php/program).

Green Bank Workshop: The Galactic Gas Supply

Jay Lockman, for the SOC

On 29-31 May 2013, a workshop on *The Galactic Gas Supply* was held at NRAO in Green Bank, WV. More than thirty people participated in the two and one-half days of presentations and late night discussions. The group was diverse and young: about half were postdocs or at earlier stages of their careers. The list of participants and the final schedule are on the workshop website



Credit: Christine Plumley

Attendees at the Galactic Gas Supply Workshop at NRAO-Green Bank.

(https://science.nrao.edu/science/meetings/2013/HI17/) , and many of the presentations will be uploaded soon.

We thank everyone who made the workshop such a success.

VEGAS Mode 1 Released at GBT

D. Anish Roshi, on behalf of the VEGAS team

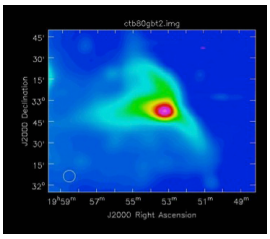


Fig. 1: A continuum image of the CTB80 supernova remnant made with Mode 1 VEGAS. Observations were done near 1.4 GHz with the GBT. The flux density scale in the image is not fully calibrated.

Commissioning of the new Versatile Astronomical Spectrometer (VEGAS) for the Green Bank Telescope (GBT) is progressing rapidly. Mode 1 provides a bandwidth of 1250 MHz, a spectral resolution of 1.4 MHz, a minimum integration time of 0.5 msec, and has been released for shared risk observations.

When fully commissioned, the spectrometer will support about 29 different observing modes (http://www.gb.nrao.edu/vegas/modes/) . The new backend will significantly enhance GBT capabilities, enabling new and exciting science. The different modes are implemented in the eight parallel operational spectrometers of VEGAS. By combining data from all eight spectrometers, VEGAS can process a total bandwidth of 8 x 1250 MHz or 10 GHz. VEGAS mode 1 is ideal for wide bandwidth continuum as well as high frequency (above 30 GHz) spectral line observations. A continuum image of the CTB80 supernova remnant made with Mode 1 near 1.4 GHz is shown in Figure 1.

VEGAS is a joint project of NRAO and the Collaboration for Astronomy Signal Processing and Electronics Research (CASPER, University of California). The West Virginia University – Center for Astrophysics team also actively participated in the project. VEGAS is funded by the National Science Foundation Advanced Technologies and Instrumentation (NSF-ATI) program.

DiFX Software Correlator Version 2.2

Walter Brisken, on behalf of the DiFX developers

On 23 December 2009, the Distributed FX (DiFX) software correlator became the sole correlator used by NRAO to process VLBA data. Since then development of this correlator has continued. On 12 June 2013 a new release, version 2.2, was announced and shortly thereafter the VLBA adopted this upgraded version. In addition to a fairly large number of operational improvements this version added improved support for the VDIF data format – used by the Very Large Array and an increasing number of VLBI antennas globally – which remains an area of continued development. Substantial improvements have also been made in the processing of geodetic data, including more flexible processing of mixed sidebands, and formal support for "zoom bands" which allow processing of mismatched baseband channels. DiFX can also now be compiled without reliance on the Intel Integrated Performance Primitives (IPP) library. This will result in reduced performance but will vastly simplify use on non-Intel architectures and in cases where IPP is not available.

Development of DiFX and its supporting libraries continues. Key developers span the globe at institutions such as the ASTRON (Netherlands), US Naval Observatory (Washington D.C.), Haystack Observatory (Westford, Massachusetts), NASA Goddard Spaceflight Center (Greenbelt, Maryland), University of Western

Australia (Perth, Australia) Curtin University (Perth), ATNF (Sydney, Australia), MPIfR (Bonn, Germany), KASI (South Korea), ASIAA (Taiwan), and NRAO (Socorro, New Mexico). Many additional institutions host staff that have been extremely valuable in testing and reporting problems or services that simplify the lives of the developers. Thanks to all organizations supporting the development of DiFX!

VLBI Fringe Detections between the VLBA and the Large Millimeter Telescope

Shep Doeleman

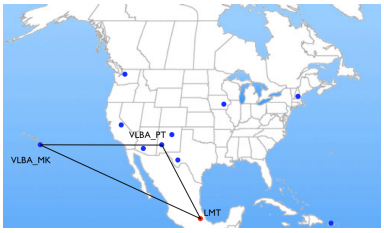


Fig. 1: A map of the relative locations of the antennas involved in the successful Very Long Baseline Interferometry (VLBI) test between the Large Millimeter Telescope (LMT) and several Very Long Baseline Array (VLBA) stations.

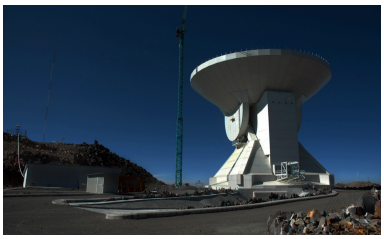


Fig. 2: The Large Millimeter Telescope (LMT), at the summit of Volcan Sierra Negra (4600m elevation) in Mexico.

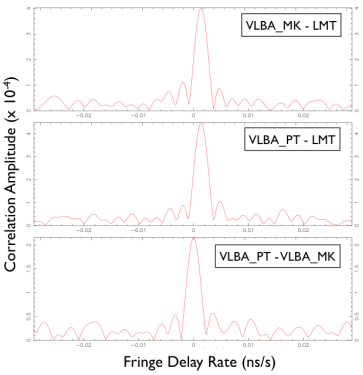


Fig. 3: VLBI fringe detections obtained 26 June between the LMT in Mexico and VLBA sites in the US at Mauna Kea, Hawaii (MK) and Pie Town, New Mexico (PT).

An international team of US and Mexican scientists has completed a successful Very Long Baseline Interferometry (VLBI) test between the Large Millimeter Telescope Alfonso Serrano (LMT) and several Very Long Baseline Array (VLBA) stations (Figure 1). The LMT is a 50m diameter millimeter-wave telescope at the summit of Volcan Sierra Negra at an elevation of 4600m (Figure 2). Because of its high elevation and geographical location, the LMT promises to be a scientifically important addition to the VLBA at 3mm and to the Event Horizon Telescope (EHT) project at 1.3mm. As a first step toward full LMT participation in these networks, the team assembled a full VLBI system at the LMT, consisting of an IF downconverter – to process the IF from the facility 3mm Red Shift Search Receiver – a VLBI Digital Backend, and a Mark5b VLBI recorder. Because a hydrogen maser could not be installed for this test, a precision quartz oscillator, which has stability comparable to a hydrogen maser on integration times shorter than 10 seconds, was used as the fundamental VLBI frequency reference.

Robust and clear VLBI fringe detections were obtained on 26 June between the LMT and VLBA sites at Mauna Kea and Pie Town (Figure 3). These detections confirm that the LMT facility 3mm receiver has phase stability characteristics suitable for VLBI, and that the LMT can deliver significant added sensitivity to the VLBA. These successful tests pave the way for high sensitivity VLBI projects at 3mm wavelength that will target, among other objects, AGN and astronomical masers. At 1.3mm wavelength, in conjunction with the EHT, the LMT will add important capability to efforts aimed at resolving and imaging the black hole event horizons of SgrA* and M87.

Building on these tests, the team is now making plans for permanent installation of a hydrogen maser and instruments that will allow the LMT to participate fully in Global VLBI observations. Institutes involved in the test include: MIT Haystack Observatory, University of Massachusetts, NRAO, the Instituto Nacional de Astrofísica Óptica y Electrónica, and the Smithsonian Astrophysical Observatory.

AIPS Update

Eric Greisen

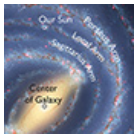
The Astronomical Image Processing System (AIPS) project has released its semi-annual newsletter, which is

available from the AIPS web site (http://www.aips.nrao.edu/) along with all previous AIPSLetters. Highlights include a substantially improved interactive Gaussian fitting task (XGAUS), along with a new interactive rotation-measure fitting task (RMFIT). New task DSKEW will correct the geometry of optical images read into AIPS from FITS files.

Recent Press Releases

'Dust Trap' around Distant Star May Solve Planet Formation Mystery (http://www.nrao.edu/pr/2013/dusttrap/)
6 June 2013

Based on a treasure trove of recent discoveries, astronomers now know that planets are remarkably plentiful in our galaxy and may be common throughout the Universe. Read more... (http://www.nrao.edu/pr/2013/dusttrap/)



Earth's Milky Way Neighborhood Gets More Respect (http://www.nrao.edu/pr/2013/localarm/)
3 June 2013

Our Solar System's Milky Way neighborhood just went upscale. We reside between two major spiral arms of our home galaxy, in a structure called the Local Arm. Read more... (http://www.nrao.edu/pr/2013/localarm/)

Career Opportunities

New Postings

Front End Engineer II (https://careers.nrao.edu/applicants/Central?quickFind=50927)**:** The NRAO in Socorro, NM is accepting applications for a Front End Engineer. The successful candidate will draw on prior knowledge of microwave antenna design, cryogenically cooled electromagnetic structure design, electromagnetic theory, electromagnetic computer simulation software, circuit design, and RF/microwave tests and measurements, develop microwave components for radio telescope receivers.

Systems Administrator I (https://careers.nrao.edu/applicants/Central?quickFind=50937)**:** The NRAO in Green Bank, West Virginia is seeking a Systems Administrator to 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.

Project Manager (https://careers.nrao.edu/applicants/Central?quickFind=50932)**:** The NRAO in Socorro, NM is recruiting for a Project Manager. He/she will manage, plan, and coordinate activities of projects to ensure that goals or objectives are accomplished within prescribed time frame and funding parameters. This is a one year term appointment.

Web Software Developer (https://careers.nrao.edu/applicants/Central?quickFind=50934)**:** The NRAO in Charlottesville, VA is accepting applications for a Web Software Developer. The successful candidate will be responsible for providing operational and development support for Web based applications, under general supervision, supporting in particular developments that are relevant for the ALMA user community. This is

a two-year term appointment.

Test Developer (https://careers.nrao.edu/applicants/Central?quickFind=50926) **:** The NRAO in Socorro, NM invites applications for a Test Developer to maintain test infrastructure, working with other software engineers to ensure adequate testing at the unit test level and develop system-level integration tests, testing aspects of the system that are not usually tested when developing new features, such as the general system scalability, and performance.

CASA Software Test Engineer (https://careers.nrao.edu/applicants/Central?quickFind=50904) **:** The NRAO in Socorro, NM is seeking a Common Astronomy Software Applications (CASA) Software Test Engineer to work with CASA developers, project scientists, and stakeholders to design and implement a comprehensive test program. Duties will include assuming responsibility for existing test systems, improvement of existing test, and evaluation of test coverage for new capabilities.

Deputy Assistant Director (https://careers.nrao.edu/applicants/Central?quickFind=50910) **:** The NRAO in Charlottesville, Virginia is recruiting for a Deputy Assistant Director to manage the Software Division of the Observatory including programmatic, technical, and all personnel aspects. The incumbent will direct all line management software group managers at the NRAO, some of whom are also functionally/matrix managed to telescope operations or projects (matrix management). The Software Division is part of the Data Management and Software Department and includes all the groups developing software at various NRAO sites (Charlottesville, Virginia; Green Bank, West Virginia and Socorro, New Mexico).

LO/IF Technician (https://careers.nrao.edu/applicants/Central?quickFind=50889) **:** The NRAO in Socorro, NM is recruiting for a LO/IF Technician. Under general supervision from scientists and engineers the LO/IF Technician devises, layouts, fabricates, calibrates, tests, analyzes, troubleshoots and/or repairs astronomical research related equipment such as: computers, electronics, electrical, cryogenics, and lasers.

Science Support and Archive (SSA) Software Group Lead (https://careers.nrao.edu/applicants/Central?quickFind=50878) **:** The NRAO in Socorro, NM is seeking a Science Support and Archive (SSA) Software Group Lead to manage the Science Support and Archive (SSA) software group. The SSA group is responsible for most NRAO software with which astronomers directly interact.

Science Support and Archive (SSA) Software Group Programmer (https://careers.nrao.edu/applicants/Central?quickFind=50909) **:** The NRAO in Socorro, NM is accepting applications for a Science Support and Archive (SSA) Software Group Programmer. The SSA software programmer will be responsible for developing and maintaining software for various software products, which are in regular use for observatory operations.

Software Engineer II, Control/ObOps (https://careers.nrao.edu/applicants/Central?quickFind=50908) **:** The NRAO in Socorro, NM invites applications for a Software Engineer II. The successful candidate will participate in the development of user interfaces, working half of the time on the Observatory Operations Support Software (ObOps) group, based in Garching, Germany; and the other half of this time on the Control Software group, in Socorro, New Mexico. As this position is based in Socorro, the candidate will interact directly with the Control team, but will coordinate development activities remotely with the ObOps team. The candidate is expected to participate in all aspects of the software development effort.

From the Archives

Ellen Bouton

About this month's photo: A variety of telescopes used for studying the influence of the atmosphere on radio astronomy observations surround the Beard House in Green Bank in summer 1962. The elevated dish on the right is the 20-foot parabolic antenna, installed in June 1962 to detect radiation from water in atmospheric vapor clouds and rain at a wavelength of about 6 cm. The "Sugar Scoop" on the left is the 4-foot parabolic horn reflector antenna for detecting similar radiation at 3 cm. The third dish is the 12-foot parabolic antenna used earlier for investigations at 3.75 cm. The results of the investigations were expected to influence the choice of suitable frequency for a proposed very large antenna.

From the Archives is an ongoing series illustrating NRAO and US 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 (#) .

Contact the Editor (mailto:mtadams@nrao.edu?subject=NRAO eNews Editor)

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