

Please join NRAO at the AAS Meeting in Indianapolis for the following special events!

An invited plenary presentation by NRAO Director, Tony Beasley

ALMA: A New Window on the Universe (<https://science.nrao.edu/science/aas/222/aas-plenary-session>)

Tuesday 4 June @ 11:40 - 12:30 EDT

Wabash Ballroom 1, Indiana Convention Center

A Splinter Session to assist AAS members unfamiliar with radio-wavelength observing

Proposal & Observing Prep with NRAO Telescopes (<https://science.nrao.edu/science/aas/222/aas-splinter-session>)

Tuesday 4 June @ 12:30 - 3:30 p.m. EDT

Room 107, Indiana Convention Center

Other Upcoming Events



NAIC-NRAO Single-Dish School (<http://www.naic.edu/~astro/sdss7>)

Jul 10 - 17, 2013 | Arecibo Observatory, Puerto Rico



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 04, 2013 | Santa Fe, NM

ALMA: A New Window on the Universe

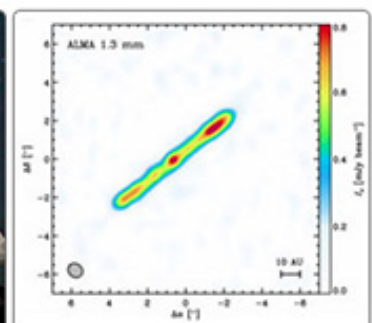
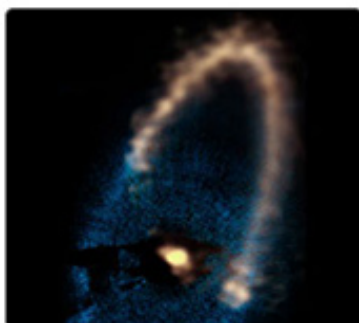
Plenary Talk by Tony Beasley (NRAO Director)

American Astronomical Society 222nd meeting - Indianapolis, IN

Tuesday 4 June 2013

11:40 – 12:30 EDT

Wabash Ballroom 1, Indiana Convention Center



The Atacama Large Millimeter/submillimeter Array (ALMA) is the largest ground-based global astronomy endeavor in history. Composed of 66 high-precision antennas located on an excellent site at 5000m+ elevation on the Chajnantor plateau in northern Chile, ALMA is delivering the astronomy community orders of magnitude improvements in millimeter-wavelength sensitivity, frequency coverage, resolution, imaging, and spectral capabilities, impacting most fields of astrophysics and opening multiple new scientific frontiers. ALMA's capabilities span wavelengths from 9.6 to 0.3 mm (31-950 GHz), a key part of the electromagnetic spectrum for observing the first stars and galaxies, directly imaging planetary formation, and studying the energy output from supermassive black holes in starburst galaxies. ALMA's inauguration on 13 March 2013 marked the Project's transition to operation as a fully-fledged Observatory.

This session will review ALMA's origins and history, current technical capabilities, and describe its primary scientific goals. Innovative aspects of its design, construction, operation, and governance will be highlighted, including the key roles of the North American ALMA Science Center at the National Radio Astronomy Observatory in Charlottesville, Virginia and the Joint ALMA Observatory in Chile. Development of the state-of-the-art technologies that are enabling the highest impact science will be described. Science operations were initiated 30 September 2011, and research results will be presented from both the Cycle 0 and Cycle 1 Early Science opportunities. This session will conclude with the vision for the Development Program that will maintain ALMA's capabilities at the forefront of modern astronomy.

ALMA is a partnership of North America, Europe, and East Asia in cooperation with the Republic of Chile. ALMA is funded in North America by the U.S. National Science Foundation, in cooperation with the National Research Council of Canada, and the National Science Council of Taiwan.

Proposal & Observing Prep with NRAO Telescopes

AAS-Indianapolis Splinter Session

4 June 2013, 12:30-3:30 pm

Room 107, Indiana Convention Center

NRAO will host a Splinter Session at the summer American Astronomical Society meeting in Indianapolis to assist users with proposal preparation for the next Call for Proposals for all NRAO facilities, including the Green Bank Telescope (GBT), Jansky Very Large Array (VLA), Very Long Baseline Array (VLBA), and the Atacama Large Millimeter/submillimeter Array (ALMA).



This Splinter Session will be held on Tuesday, 4 June 2013, from 12:30 - 3:30 p.m., directly after the AAS Plenary Session presentation on ALMA by NRAO Director Tony Beasley.

This Session will guide new users in how to create proposals for each of the NRAO telescopes and will include brief overviews of new capabilities these telescopes are bringing to the scientific community. The Session will also include interactive walk-throughs of the proposal preparation tools for each facility, and guided, hands-on tutorials hosted by NRAO scientific staff.

No previous experience is necessary to attend and benefit from the Session, and we strongly encourage new and potential users to attend. Questions, comments, or suggestions on this Splinter Session should be directed to **Anthony Remijan (#)**, Division Head of Scientific User Support Services.

Telescope Time Allocation for Semester 2013B

Joan Wrobel

The Observatory has completed the Semester 2013B **time allocation process** (<https://science.nrao.edu/observing/proposal-types/peta>) for the **Very Large Array** (<https://science.nrao.edu/facilities/evla>) (VLA), the **Very Long Baseline Array** (<https://science.nrao.edu/facilities/vlba>) / **High Sensitivity Array** (<https://science.nrao.edu/facilities/vlba/proposing/HSA>) (HSA), and the **Green Bank Telescope** (<https://science.nrao.edu/facilities/gbt>). A total of 354 proposals were received for the 1 February 2013 submission deadline. In aggregate the proposals covered the broad spectrum of modern research in astronomy and astrophysics. A total of 1349 unique authors submitted proposals to the Observatory, with 956, 392 and 227 proposers competing for time on the VLA, GBT and VLBA/HSA, respectively.

Eight Science Review Panels (SRPs) evaluated the proposals on the basis of scientific merit; NRAO staff reviewed the proposals for technical feasibility. Reviews were completed in October and then reconciled by the Time Allocation Committee (TAC) during its meeting 15-17 April 2013 at Associated Universities, Inc., in Washington, D.C. The TAC consists of the chairs of the SRPs and was charged with recommending a science program for Semester 2013B to the NRAO Director. The **recommended program** (<https://science.nrao.edu/observing/proposal-types/directorsreview>) was reviewed and approved on 6 May 2013.

A disposition letter was sent to the principal investigator and co-investigators of each proposal on 17 May 2013. A **TAC report** (<http://www.aoc.nrao.edu/~schedsoc/tac2013b.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>), has been posted to the NRAO science website.

The Observatory welcomes community feedback on its process for telescope time allocation. Please provide such feedback via the Proposal Review department of the Observatory's **Helpdesk** (<http://help.nrao.edu>).

CASA 4.1.0 Released

Juergen Ott



We are pleased to announce release 4.1.0 of the Common Astronomy Software Applications (CASA) package.

The CASA package is being developed by NRAO, ESO, and NAOJ and is used for the offline reduction and analysis of both ALMA and Jansky VLA data. CASA is fully scriptable. Full support is provided for ALMA and VLA, but almost any data that can be written in uvfits format can be imported and reduced in CASA (e.g. CARMA, SMA, ATCA).

Linux and MacOS distributions of CASA 4.1.0 are now available from the **CASA webpage** (<http://casa.nrao.edu/>):

New features in CASA 4.1.0 include:

- implementation of narrow-band A-projection algorithm
- flagdata and flagcmd can now flag based on calibration tables (e.g. on Tsys)
- plotms can now display calibration tables and allows multi-panel plotting
- new task imreframe to change the spectral frame in which the velocity/frequency is reported
- expanded use of obsid in all calibration tasks
- task simalma uses feather to combine interferometer and total power images
- new task impv to create position-velocity diagrams
- new viewer features: histogram plotting and fitting, global color option, transfer function can be set by a histogram of values, spatial brightness profiles, position-velocity diagram creation
- Nobeyama filler: options to control frequency reference frame, proper handling of dual polarization data, support for data from SAM45
- new grid functions GAUSS (Gaussian) and GJINC (Gaussian * Jinc) are available for sd imaging, sdtp imaging, and sdgrid

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

We encourage you to subscribe to either or both of the following subscription lists:

Casa-announce is 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>)

Casa-users notes 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>)

Please visit the [NRAO helpdesk \(http://help.nrao.edu\)](http://help.nrao.edu) for VLA–VLBA–GBT questions, and the [ALMA helpdesk \(http://help.almascience.org\)](http://help.almascience.org) for ALMA questions.

A Rare Multiple Quasar Imaging Event Caused by Refraction in the Interstellar Medium

Alexander Pushkarev

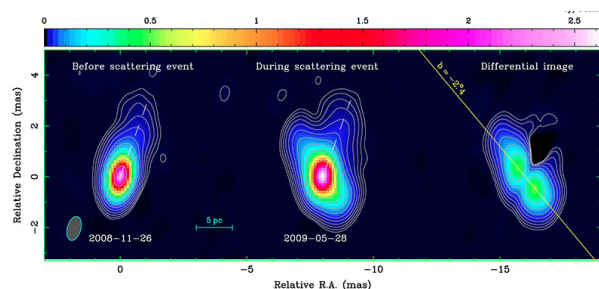


Figure 1. Extraction of the refraction-induced structure from the naturally weighted 15.4 GHz VLBA images of 2023+335.

 Zoom

The first detection of multiple imaging of an AGN jet due to refractive foreground scattering in our galaxy has been reported by Alexander Pushkarev et al. (2013). This rare phenomenon was first predicted several

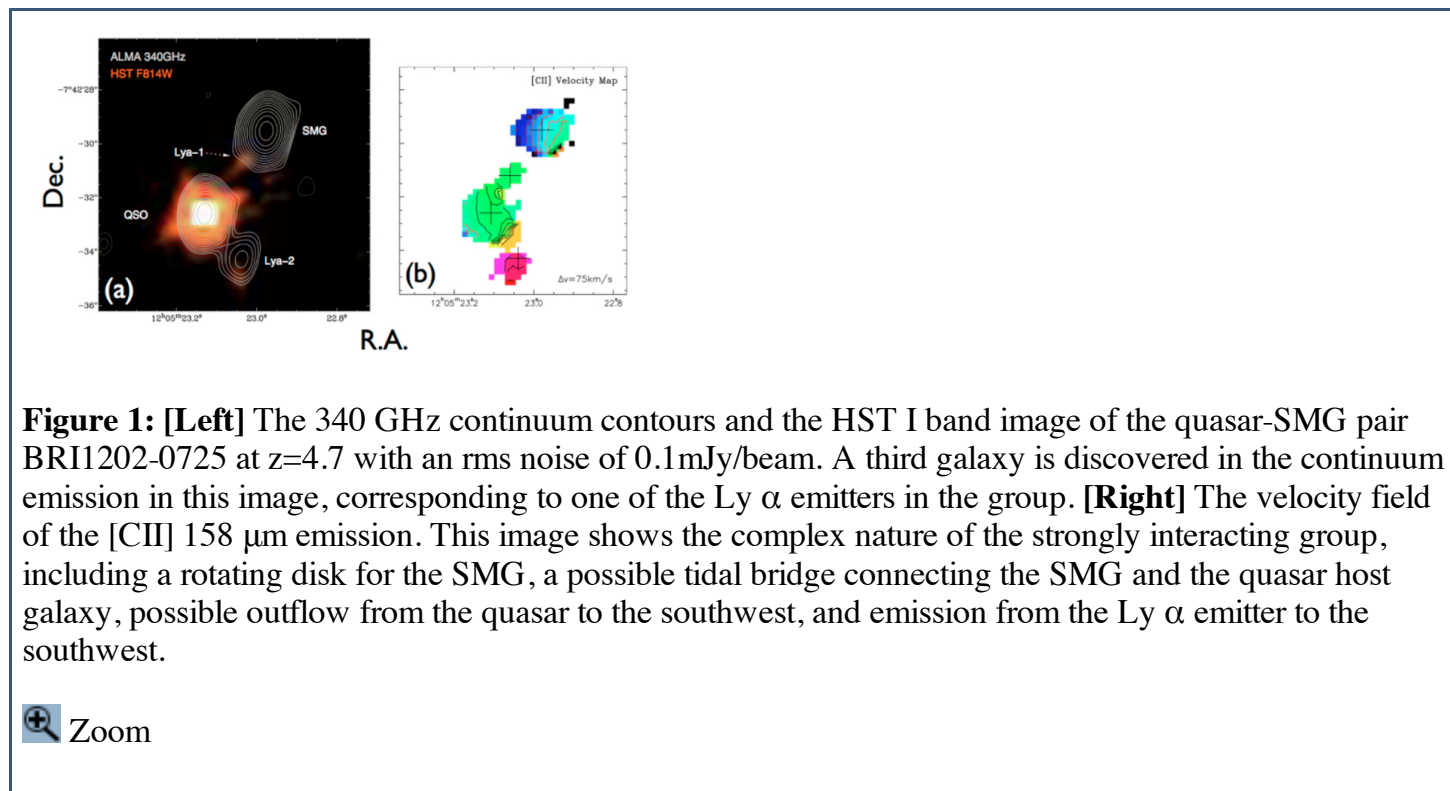
decades ago and is based on the refractive properties of AU-scale electron density enhancements in the ionized component of the Galactic interstellar medium. The predicted effect has now been seen in the low galactic latitude quasar 2023+335, one of a large sample of AGNs monitored by the **MOJAVE VLBA Key Science Project** (<https://science.nrao.edu/science/key-science-projects/monitoring-of-jets-in-active-galactic-nuclei-with-vlba-experiments-mojave>) . The strongest event showed a refractive image approximately 1/10th as bright as the primary image on 28 May 2009 at 15 GHz, when the source was undergoing an extreme scattering event. The VLBA image was taken serendipitously during a special phase when a caustic spike associated with the lens edge passed over the source. While the parsec-scale jet of the source normally extends along an angle of -20 degrees, a highly significant multi-component pattern of secondary images induced by strong refraction appears stretched out roughly along the constant galactic latitude line at an angle of $+40$ degrees. This suggests that the direction of relative motion of the lens is parallel to the galactic plane, as expected for an orbiting cloud.

Reference:

A.B. Pushkarev, Y.Y. Kovalev, M.L. Lister, T. Hovatta, T. Savolainen, M.F. Aller, H.D. Aller, E. Ros, J.A. Zensus, J.L. Richards, W. Max-Moerbeck, A.C.S. Readhead, 2013 A&A, in press. [arxiv:1305.6005](https://arxiv.org/abs/1305.6005). (<http://arxiv.org/abs/1305.6005>)

This Month @ the NAASC

ALMA Observations of the Redshift 4.7 Quasar System BRI 1202-0725



In a follow-up paper to **Wagg et al. 2013 research** (<https://science.nrao.edu/enews/5.10/index.shtml>) described in the 2012 October eNews, **Carilli et al.** (<http://adsabs.harvard.edu/abs/2013ApJ...763..120C>) provide a more in-depth analysis of the 25-minute on-source ALMA science verification observations of BRI 1202-0725. This redshift of 4.7 system consists of a hyperluminous infrared quasar host and an optically-obscured submillimeter galaxy (SMG). In addition, two Ly α selected galaxies (Lya-1 and Lya1 in Figure 1) lie in close proximity to the quasar host and SMG. As seen in Figure-1, a [C II] 158 μm velocity map, the Ly α galaxies are detected along with the quasar host and SMG, showing the strength of Early

Science ALMA (in this case, with 17 antennas) to detect this major cooling line even from high redshift UV-selected galaxies. The Ly α galaxies are estimated to have star formation rates in the range of 19 - 170 solar masses per year based on a combination of their [CII] and FIR luminosities. These rates are an order of magnitude or more less than that of the quasar host and the SMG. The authors also detect a broad [C II] emission line wing associated with the quasar host and attribute it to gas outflowing from the host at a rate of 80 solar masses per year. At such a rate, the available supply of molecular gas would be swept out of the host in $\sim 6 \times 10^8$ years. This time scale is, however, a factor of at least 10 longer than the star formation consumption timescale estimated under the assumption that all of the far-infrared emission from the host is due to star formation.

ALMA Project Status

Al Wootten



During the last two months excellent progress has been made both with ALMA array stability and infrastructure enhancements. Consequently, Cycle 1 Early Science observing will continue at nominal priority in June.

In order to fully test new observing modes that will be offered in Cycle 2 and to be able to deliver Cycle 1 highest priority projects to PIs in a timely manner, it has been decided to extend Cycle 1 and modify the timeline for Cycle 2, as follows:

1. Cycle 1 Early Science observations will continue until the end of May 2014 and **Cycle 1 Director's Discretionary Time (DDT) proposals (<https://almascience.nrao.edu/proposing/ddt-proposals>)** will be accepted until that date.
2. The call for Cycle 2 Early Science proposals will be made in October 2013 with a deadline for proposal submission in early December 2013. Cycle 2 Early Science observations are expected to start in June 2014.

The detailed timelines for Cycle 2, including the number of observing hours and the length of the Cycle 2 period, as well as the science capabilities will be announced in the call for proposals.

A **final report on ALMA Cycle (<http://almascience.nrao.edu>) 0** is now available. This report, presented as a downloadable pdf-format file, provides the final status of ALMA Cycle 0 observations as well as an overview of how observing progressed, including performance statistics per band, LST range, and other parameters. It also provides a historical record of what was done in Cycle 0, and should help proposers to prepare observations for future Cycles.

There are now 59 antennas at the ALMA Array Operations Site (AOS) in northern Chile. The 18th AEM antenna (DA58) to be placed at the AOS arrived from the lower elevation Operations Support Facility on 27 May. The configuration of the 12m antennas is similar to C32-3, an intermediate Cycle 1 configuration. Several antennas have been placed on baselines out to 2.5km for testing.

Call for ALMA Development Projects

Al Wootten

A **Call for Development Projects (<https://science.nrao.edu/facilities/alma/alma-development-2014/call-for-project-proposals>)** will be issued **3 June 2013**. To support this new Call, an **informational workshop**

<https://science.nrao.edu/facilities/alma/naasc-workshops/alma2013>) was held on Thursday, 18 April, at NRAO headquarters in Charlottesville, VA. An overview of the current ALMA Development Plan and studies now under way was given and presentations are available on-line.

This Call is to invite proposals to conduct studies of ideas that may be further developed and implemented in a subsequent funding cycle. The primary aims of this Call for Project Proposals are to:

- encourage the flow of development ideas from the North American ALMA community into the ALMA Development Program Plan;
- support the development of conceptual and detailed designs by the North American ALMA community for possible future inclusion in the ALMA Development Program Plan; and
- support ALMA-relevant, long-term research and development by the North American community.

Limited funding is available from NRAO to support North American-based Projects and will be allocated on a competitive basis. Projects partly or fully supported from external sources are also solicited and, if presented, will be considered in the preparation of the ALMA Development Plan. Prototype/pre-production and full production initiatives (hereafter referred to as “Projects”) are typically funded every two (2) years. Calls for Projects will be governed by, and conducted through, a different (albeit similar) process. All members of the North American ALMA partnership, and the North American radio astronomy community at-large, are invited to participate in the ALMA Development Program.

The release date for the Fiscal Year (FY) 2014 Call for Project Proposals is 3 June 2013. The period of performance for funded Projects will run from the award date, **20 September 2013**, to no later than **30 September 2015** (approximately two years).

Proposers are requested to submit a **Notice of Intent by 17 June 2013**. The **closing date will be 16 August 2013**. Proposals received after the closing date may be rejected, at NRAO’s sole discretion.

Further details are can be found in the Conditions Governing the Call for Project Proposals, available via the Proposal Documents table at the [ALMA Development webpage for this Call](https://science.nrao.edu/facilities/alma/alma-development-2014/call-for-project-proposals) (<https://science.nrao.edu/facilities/alma/alma-development-2014/call-for-project-proposals>).

A total of \$4.3M USD is available for funding Projects during the FY2014 Development Program cycle (subject to the FY2013 Federal Budget and allocation of funds). As a guideline, the NRAO expects to fund at least two Projects. No individual Project will be funded in excess of \$1.5M USD.

Disclaimer: the entirety of available funds will not necessarily be awarded. Acceptance of the Project proposal and granting an Agreement for the Project does not guarantee that the upgrade will be implemented at the Observatory as part of the ALMA Development Plan.

Please submit questions concerning the present Call for Project Proposals, including any request for documentation referred to in this document, to the Knowledgebase–Development Program portion of the [ALMA Helpdesk](https://help.almascience.org/index.php?Knowledgebase/List/Index/7/development-program) (<https://help.almascience.org/index.php?Knowledgebase/List/Index/7/development-program>) by **28 June 2013**. Queries will be directed to, and answered by, appropriate persons unassociated with this Call.

Band 2 Workshop Recap

Al Wootten

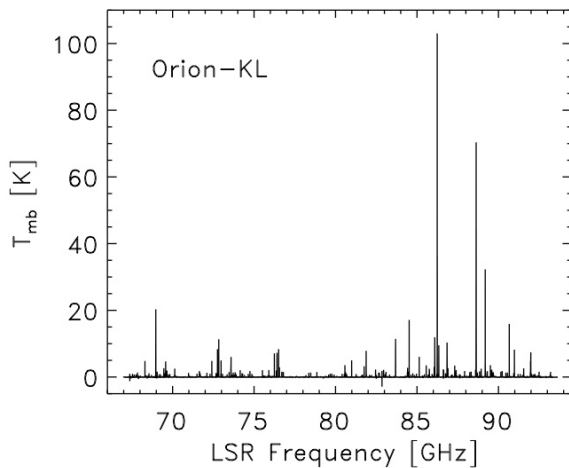


Figure 1: This Green Bank Telescope spectrum of Orion KL demonstrates the wealth of spectral lines in the 4mm (ALMA Band 2) window.



Zoom

Twenty-five astronomers and students gathered at the North American ALMA Science Center in Charlottesville, VA for a workshop devoted to science that would be enabled by equipping ALMA with receivers covering 67-90 GHz, ALMA Band 2. The workshop was available via webcast; several others attended remotely. **[Presentations are available at the Workshop website \(https://science.nrao.edu/facilities/alma/naasc-workshops/alma-band-2-science-workshop/facilities/alma/naasc-workshops/alma-band-2-science-workshop/program\)](https://science.nrao.edu/facilities/alma/naasc-workshops/alma-band-2-science-workshop/facilities/alma/naasc-workshops/alma-band-2-science-workshop/program)**. The excellent local support enabled distant participants to appreciate the science to be done should ALMA be equipped with Band 2 receivers. No radio interferometers currently operate in this band, although there has been a receiver at the Arizona Radio Observatory 12m antenna on Kitt Peak for many years. The Green Bank Telescope has recently been equipped with a very sensitive 4mm receiver. These receivers, and prospects for a similar design for ALMA, were reviewed in a discussion leading into science drivers for ALMA operation in that band.

One focus of 4mm science concentrates on the fundamental $J=1-0$ transitions of a number of deuterated molecules which fall into this band. Deuterium becomes enhanced over its cosmic abundance in molecules at low temperatures owing to exchange reactions in ion-molecule chemistry. These lines are therefore good probes of specific cold regions in astrophysical environments. They may be particularly useful when coupled with ALMA's high spatial resolution for identifying cold regions in the mid planes of protoplanetary disks. Similarly, the cold regions probed by these lines provide insights into the conditions in starless cores, which may subsequently evolve to star-centered cores. Of particular interest are those molecules that persist at low temperatures in the gas phase, such as N_2D^+ and NH_2D , which were discussed by several speakers.

Important probes of the nearby Universe also lie in the 4mm band, among which the formaldehyde resonance transition figures prominently. Other lines migrate into the window as a function of the redshifts of their host galaxies; the window gives a view into an important period of evolution of the Universe. CO emission shifted to $z \sim 0.6$ provides a window into galaxies during the last ~ 5 Gyr of evolution, a period in which the tremendous bursts of star formation began to quiet down. ALMA's superior sensitivity and spatial resolution – up to 1 arcsec in Band 2, or about 6kpc – will be important to our understanding of galaxy evolution.

NRAO Summer Student Program 2013

Jeff Mangum

Over the next coming weeks, NRAO will welcome 28 summer research interns to Socorro, Green Bank and Charlottesville, the 54th class in the NRAO summer student program. The students who will participate in the 2013 program, their NRAO advisors, and their research projects are each listed below.

Socorro

- **Lorraine Bowman** is a graduate student studying Physics at New Mexico Tech. Lorraine is working with Juergen Ott and David Westpfahl on *Power Law Structure of the ISM: HI, CO, and IR Lacunarity and Fractal Dimension Analysis in Nearby Galaxies* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013LorraineBowman>) .
- **Rick Cosentino** is a graduate student studying Physics at New Mexico Tech. Rick is working with Bryan Butler on *Simulations of Outer Planets Atmospheric Dynamics and Circulation* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013RichardCosentino>) .
- **Ryan Duffin** is a rising second year studying Astrophysics and Computer Science at the University of Virginia. Ryan is working with Minnie Mao on *Large Radio Sources Hosted by Spiral Galaxies* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013RyanDuffin>) .
- **Jacob Jencson** is a rising senior studying Astronomy, Physics, and German at The Ohio State University. Jacob is working with Miller Goss on *21-SPONGE: Searching for the Warm Neutral Medium in the Milky Way.* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JacobJencson>) .
- **Kara Kundert** is a rising junior studying Astrophysics and Electrical Engineering at Oberlin College. Kara is working with Urvashi Rau and Sanjay Bhatnagar on *Evaluating the VLA L-Band Primary Beam Models in the Context of Wide-Field Imaging* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013KaraKundert>) .
- **Julia Mayeshiba** is rising senior studying Astronomy and Physics at the University of Wisconsin at Madison. Julia is working with Frazer Owen and Urvashi Rau on *Quantifying Deep-Imaging Limits with the VLA* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JuliaMayeshiba>) .
- **Samuel Mellon** is a rising junior studying Physics and Music at Westminster College. Samuel is working with Laura Perez on a *Study of the Outflow and Disk Surrounding a Post-Starburst FU-Orionis Star* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013SamuelMellon>) .

Green Bank

- **Kyle Blanchard** is a rising junior studying Physics and Astrophysics at the University of California at Berkeley. Kyle is working with John Ford on the *Transient Search Receiver* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013KyleBlanchard>) .
- **Ryan Bossler** is a rising senior studying Astronomy, Physics, Philosophy, and German at the University of Wisconsin at Madison. Ryan is working with Alyson Ford on *The Effects of Energetic Events in the Milky Way's Nucleus on HI Gas in the Lower Halo* (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013RyanBossler>) .

[year1=2013&year2=2013&site=All&program=All#2013RyanBossler](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013RyanBossler)) .

- **Susan Schmitz** is a rising junior studying Physics, Astronomy, Mathematics, and Spanish at the University of Iowa. Susan is working with Amanda Kepley on [Magnetic Fields in the Irregular Galaxy NGC 1156](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013SusanSchmitz) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013SusanSchmitz>) .
- **Chris Thibodeau** has a bachelor's degree in Astrophysics from Towson University. Chris is working with Jay Lockman on [Green Bank Telescope Observations of a Milky Way Satellite](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013ChristopherThibodeau) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013ChristopherThibodeau>) .
- **Olivia Wilkins** is a rising junior studying Chemistry, Mathematics, and Physics at Dickinson College. Olivia is working with Toney Minter on [HI Absorption Towards Pulsars](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013OliviaWilkins). (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013OliviaWilkins>)

Charlottesville

- **Ajamu Abdullah** is a rising senior studying Physics at Howard University. Ajamu is working with Aaron Evans on [Dissecting Luminous Starburst Galaxy Mergers](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber>) .
- **Laiya Ackman** is a rising junior studying Astronomy, Physics, and Feminist Gender and Sexuality Studies at Wesleyan University. Laiya is working with Jen Donovan Meyer on [Probing the Rejuvenation of NGC 2685](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013LaiyaAckman) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013LaiyaAckman>) .
- **Daniel Calem** is a rising second year studying Astronomy at the University of Virginia. Daniel is working with Bob Dickman on [Searching for the Signature of Cold Dark Matter \(CDM\)](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013DanielCalem) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013DanielCalem>) .
- **Ekene Elodimuor** is a rising senior studying Computer Science at Howard University. Ekene is working with Aaron Evans on [Dissecting Luminous Starburst Galaxy Mergers](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber>) .
- **Norland Hagen** is a rising sophomore studying Geology and Astronomy at the University of Montana. Norland is working with Arielle Moullet on [Interpreting Thermal Lightcurves of Rocky Solar-System Bodies](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013NorlandHagen) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013NorlandHagen>) .
- **Anna Ho** is a rising senior studying Physics, Astronomy, and Science Writing at MIT. Anna is working with Scott Ransom on [Rotation Measures for Globular Cluster Pulsars as a Unique Probe of the Galactic Magnetic Field](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013AnnaHo) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013AnnaHo>) .
- **Jennifer Kadowaki** is a rising senior studying Physics at the University of California at Los Angeles. Jennifer is working with Adam Leroy on [Recombination Line Emission in Nearby Mergers](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JenniferKadowaki) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JenniferKadowaki>) .
- **Jared Keown** is a rising senior studying Physics at the University of Louisville. Jared is working with Scott Schnee on [Correlating Physical and Chemical Properties in Starless and Protostellar Cores](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JaredKeown) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013JaredKeown>) .
- **Nicholas Kern** is a rising junior studying Astrophysics and Physics at the University of Michigan. Nick is working with Jeff Mangum on [Imaging the Spatial Density within Starburst Galaxies](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013NicholasKern) (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013NicholasKern>) .

[year1=2013&year2=2013&site=All&program=All#2013NicholasKern](http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013NicholasKern)).

- **Adrian Lucy** is a rising senior studying Astrophysics and History of Science at the University of Oklahoma. Adrian (L) is working with Al Wootten and Nuria Marcelino on **Study of Deuteroammonia in the Orion Molecular Cloud** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013AdrianLucy>).
- **Sinclair Manning** is a rising senior studying Physics and Spanish at Howard University. Sinclair is working with Aaron Evans on **Dissecting Luminous Starburst Galaxy Mergers** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber>).
- **Adrian Mead** is a rising third year studying Astrophysics and Mathematics at the University of Virginia. Adrian (M) is working with John Tobin on **Examining the Initial Conditions of Star Formation Through Dense Gas Kinematics** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013AdrianMead>).
- **Zaarah Mohamed** is a rising sophomore studying Physics and Philosophy at Case Western Reserve University. Zaarah is working with Kim Scott and Kartik Sheth on **Evolution in the Interstellar Medium of Luminous Infrared Galaxies Since $z = 1$** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013ZaarahMohamed>).
- **Diana Powell** is a rising junior studying Astrophysics, Physics, and French at Harvard University. Diana is working with Kartik Sheth and Kim Scott on **The Influence of Bars in Triggering Star Formation at High Redshift** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013DianaPowell>).
- **Sierra Smith** is a graduate of James Madison University with Bachelors and Masters degrees in History with a concentration on science history. Sierra is working with Ellen Bouton and Ken Kellermann on **Open Skies: The Story of NRAO** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013SierraSmith>).
- **Aara'L Yarber** is a rising sophomore studying Physics and Art at Howard University. Aara'L is working with Aaron Evans on **Dissecting Luminous Starburst Galaxy Mergers** (<http://www.nrao.edu/php/students/archive/projects.php?year1=2013&year2=2013&site=All&program=All#2013Aara%27LYarber>).

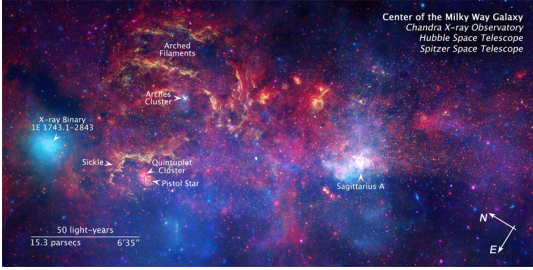
Members of the Observatory's scientific staff mentor students and coordinate the many student activities at each NRAO site. Jeff Mangum leads the NRAO summer student program. NRAO scientific staff members Amy Mioduszewski, David Frayer, and Jeff Mangum lead and coordinate the summer student program in Socorro, Green Bank, and Charlottesville, respectively. The efforts of dedicated NRAO technical and administrative staff—including Tracy Halstead, David Halstead, Carolyn Hunsinger, Dan Klopp, and Jessica Utley—are also vital to the program's success. NRAO is fortunate to have such dedicated persons to support this valued and important education and career development effort.

The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus

Lorant Sjouwerman, Cornelia Lang & Juergen Ott

This fall, the Galactic Center community is assembling at International Astronomical Union Symposium 303 to share the latest research results related to the inner regions of our Galaxy.

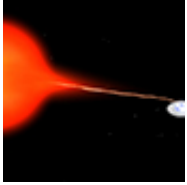
This 5-day symposium will be held in Santa Fe, New Mexico, USA from 30 September through 4 October



2013. A preliminary program of invited and contributed presentations is available on the [symposium website](https://science.nrao.edu/science/meetings/IAU303-GC2013) (<https://science.nrao.edu/science/meetings/IAU303-GC2013>).

Registration is now open. Please consult the symposium website for important information on registration and presentation of additional scientific contributions. For further information and questions please contact iau303@nrao.edu (<mailto:iau303@nrao.edu>).

Recent Press Releases



(<http://www.nrao.edu/pr/2013/sscyg/>)

Accurate Distance Measurement Resolves Major Astronomical Mystery

(<http://www.nrao.edu/pr/2013/sscyg/>)

23 May 2013

Astronomers have resolved a major problem in their understanding of a class of stars that undergo regular outbursts by accurately measuring the distance to a famous example of the type. **Read more...** (<http://www.nrao.edu/pr/2013/sscyg/>)

Career Opportunities

New Postings

Electronics Engineer, Senior: (<https://careers.nrao.edu/applicants/Central?quickFind=50919>) The Joint ALMA Observatory (JAO) in Santiago, Chile is seeking an Electronics Engineer, Senior to be a member of the Array System Group within the ALMA Department of Engineering. The department is responsible for all aspects of the technical operation of the Array. This includes: antenna assembly, integration and verification, preventive and corrective maintenance for major array sub-systems; problem reporting & tracking; antenna transportation and array re-configuration; and support of development projects.

Software Engineer II (<https://careers.nrao.edu/applicants/Central?quickFind=50867>) : The National Radio Astronomy Observatory in Socorro, NM is recruiting for a Software Engineer II. He/she will be working as software developer in the Control and Correlator subsystems, developing new features and completing and extending the current functionalities. The ideal candidate will be a skilled developer that can assume an end-to-end perspective, and develop an understanding of the system all the way from high level user interfaces to low level hardware details.

Test Developer (<https://careers.nrao.edu/applicants/Central?quickFind=50926>) : The National Radio Astronomy Observatory 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.

ALMA Control System Developer (<https://careers.nrao.edu/applicants/Central?quickFind=50893>) :

The NRAO in Socorro, NM is seeking an ALMA Control System Developer. The selected candidate for this position will participate in the development of new features across this architecture, as well as be responsible for maintaining the existing code, debugging problems and providing support for the telescope operations in Chile.

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.

Software Engineer II (<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.

STEM Education Development Officer-AUI (<https://careers.nrao.edu/applicants/Central?quickFind=50843>) :

Associated Universities Inc. (AUI), in Washington, DC is recruiting for a STEM Education Development Officer. The incumbent will be based at the National Radio Astronomy Observatory (NRAO) in Charlottesville, VA and work closely with the NRAO Education and Public Outreach (EPO) team, under the supervision of the Assistant Director for EPO. The STEM Education Development Officer will identify and implement opportunities for AUI to contribute to the advancement of STEM (science, technology, engineering, and math) education via partnerships, grants, and the leveraging of existing NRAO and other AUI assets, which include a large staff of scientists and engineers and a talented, geographically dispersed EPO staff.

VLBA Station Electronics Technician (<https://careers.nrao.edu/applicants/Central?quickFind=50870>) :

The NRAO in Socorro, NM is accepting applications for a VLBA Station Electronics Technician. The successful candidate will be responsible for repairs and maintenance at the Very Long Baseline Array (VLBA) Station, including the 25-meter antenna and support equipment. The technician must respond to emergency repair situations as dictated by the impact on the station's ability to perform intended functions.

From the Archives

Ellen Bouton



About this month's photo: Students participating in NRAO summer student programs arrive at their respective NRAO sites in late May and early June. Since its inception in 1959, the summer student program has engaged close to 1,000 young people in scientific research, and many NRAO summer students have gone on to distinguished careers in astronomy and other physical sciences. The list of former NRAO summer students now includes women and men who represent a wide range of career stages, research interests, geographic locations, and ethnic backgrounds. In this photo from

1987, Green Bank summer students Mark Johnston, Richard Ross, Tim Ellis, Kate Borowec, Tony Will, Steve Churchwell, and Bjorn Stevens are in front of the cafeteria with Erich Bloch (NSF Director), Pat Bautz (NSF Astronomy Division Director), and George Seielstad, NRAO Assistant Director for Green Bank.

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](mailto:mtadams@nrao.edu?subject=NRAO%20eNews%20Editor))



(<http://twitter.com/TheNRAO>)



(<http://www.facebook.com/pages/Charlottesville-VA/National-Radio-Astronomy-Observatory-NRAO/22534272968#!/pages/Charlottesville-VA/National-Radio-Astronomy-Observatory-NRAO/22534272968>)

Staff | Policies | Diversity



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