NRAO eNews

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(https://science.nrao.edu/observing/call-for-proposals/2022a/)

NRAO Call for Proposals: Semester 2022A

The National Radio Astronomy Observatory (NRAO) invites scientists to participate in the Semester 2022A Call for Proposals (https://science.nrao.edu/observing/call-for-proposals/2022a/) for the Karl G. Jansky Very Large Array (VLA) and the Very Long Baseline Array (VLBA), High Sensitivity Array (HSA), and Global 3mm VLBI Array (GMVA).

The submission deadline for Semester 2022A proposals is Monday, 2 August 2021, at 17:00 EDT (21:00 UTC).

We would like to highlight that NRAO is continuing to offer staff assistance with VLBA observation setup and data reduction for new and novice VLBA users. For more information see the VLBA, HSA and GMVA Proposal Guide (https://science.nrao.edu/observing/call-for-proposals/2022a/vlba-proposal-guide) .

Proposal preparation and submission are handled via the NRAO Proposal Submission Tool (PST) available at NRAO Interactive Services (http://my.nrao.edu/) . Proposers who need assistance with proposal preparation or have questions regarding the Call for Proposals or NRAO telescope capabilities should contact Observatory staff via the NRAO Helpdesk (https://help.nrao.edu/) . Note that using these tools (both the PST and the Helpdesk) requires registration.

Upcoming Events

The Past, Present, and Future of the VLA: Celebrating 40 Years (https://go.nrao.edu/vla40)
Aug 4 - 7, 2021 | Virtual

2021 Jansky Lectureship Awarded to Mexican Astronomer


Dr. Luis Rodriguez

Associated Universities, Inc. (AUI) (https://aui.edu/) and the National Radio Astronomy Observatory (NRAO) (https://public.nrao.edu/) have awarded the 2021 Karl G. Jansky Lectureship to Professor Luis F. Rodriguez of the National University of Mexico (UNAM). The Jansky Lectureship is an honor established by the trustees of AUI to recognize outstanding contributions to the advancement of radio astronomy.

Rodriguez is being honored for his significant contributions to the understanding of star formation and X-ray emitting binary star systems, his distinguished career as an educator and popularizer

of astronomy, and as a mentor to a generation of radio astronomers. As a member of one of two teams that co-discovered outflows from regions of star formation, he contributed to shaping the current paradigm of star formation. With Felix Mirabel, he discovered the first microquasars in the Milky Way — nearby and smaller analogs to quasars at the hearts of distant galaxies. They received the American Astronomical Society's Bruno Rossi Prize in 1996 for that work.

In 1992, Rodriguez obtained a grant from the Mexican government to equip the VLA (https://public.nrao.edu/telescopes/vla/) with its first 43-GHz receivers, enabling some of the first images of dust emission from protoplanetary disks around young stars — disks that eventually will produce planets. He was the founding director of the Institute of Radio Astronomy and Astrophysics at UNAM, and is considered the father of radio astronomy in Mexico. As a professor at UNAM since 1979, he has directed 28 student theses. He is author or coauthor of more than 500 scientific publications that have received more than 25,000 citations.

Rodriguez earned a B.S. in Physics from UNAM in 1973 and a Ph.D in Astronomy from Harvard University in 1978. He has received the Mexican Award of Sciences, the most important such recognition given in that country, the Robert J. Trumpler Award of the Astronomical Society of the Pacific, and is one of only 40 members of Mexico's National College, which brings together the country's foremost scientists and artists. He is a foreign member of the U.S. National Academy of Sciences and of the Spanish Royal Society of Exact, Physical and Natural Sciences.

He now is a Professor Emeritus of UNAM's Institute of Radio Astronomy and Astrophysics, and also is Coordinator of the Mesoamerican Center for Theoretical Physics in Chiapas, Mexico. He is working with NRAO on selecting locations in Mexico for key antennas of the proposed Next Generation Very Large Array (https://public.nrao.edu/ngvla/) .

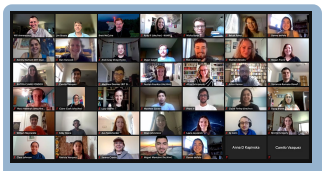
As Jansky Lecturer, Rodriguez will give presentations, the details of which will be announced later.

First awarded in 1966, the Jansky Lectureship is named in honor of the man who, in 1932, first detected radio waves from a cosmic source. Karl Jansky's discovery of radio waves from the central region of the Milky Way started the science of radio astronomy.

A complete list of past recipients is here (https://science.nrao.edu/science/jansky-lecture) .

A Banner Year for NRAO Student Programs

Jim Braatz



Students at the NRAO/GBO Radio Astronomy Workshop after a lecture on astrochemistry by MIT Professor Brett McGuire.

Working with our partners at the Green Bank Observatory (GBO), NRAO is hosting its largest ever class of summer student researchers, with a total of 55 students affiliated with the sites in Charlottesville, Socorro, and Green Bank. The suite of summer student programs is anchored by the Research Experience for Undergraduates (REU) and also includes students participating in the National Astronomy Consortium (NAC), Physicists Inspiring the Next Generation (PING), the National and International Nontraditional Exchange (NINE), as well as other graduate and undergraduate internships.

Students are conducting their research remotely this year, as most mentors continue to work from their homes as well. The summer program began with a remote Radio Astronomy Workshop geared to the undergraduate students. The workshop, affectionally nicknamed the Radio Astronomy Bootcamp, provided students a

foundation in radio astronomy through a series of lectures and activities. Students learned about NRAO and GBO telescopes and facilities, had remote tours of the observatories, and participated in career development panel discussions and presentations. Students also worked in small teams to conduct remote observations with the Green Bank 20m telescope and gave a short presentation at the conclusion of the workshop.

After the Bootcamp, the primary focus of each student's summer experience is the research project they conduct under the supervision of an NRAO or GBO staff member. Undergraduate participants will write a research report and present a talk on their research to observatory staff at the end of the summer in the NRAO / GBO Summer Student Symposium. This year, with the Observatories re-opening to staff and students, the Symposium will be a hybrid event with some students attending in person at the GBO.

In addition to its participants at NRAO, the NAC program coordinates virtual meetings and activities for a cohort of 10 additional students mentored by NAC partners at Princeton University, the Space Telescope Science Institute, the University of Wisconsin-Madison, and Michigan State University.

The summer student program is part of a suite of opportunities by NRAO to train the next generation of radio astronomers and promote STEM careers, especially for students from under-represented groups. The NRAO student programs include the Student Observing Support (SOS) program to fund students working with NRAO telescopes; the Reber Predoctoral Fellowship, which provides an opportunity for graduate students to complete up to the final 2 years of their thesis under the supervision of an NRAO staff member at one of the NRAO sites; Co-Op programs to provide hands-on training for undergraduates; and other internships that can support graduate and undergraduate research for periods typically up to 6 months. Student programs are described at the NRAO science website (https://science.nrao.edu/opportunities/student-programs) .

ngVLA Project News

Eric Murphy

Overview Presentation

My updated overview presentation on the next-generation Very Large Array (https://ngvla.nrao.edu/) is available online (https://ngvla.nrao.edu/download/MediaFile/24/original) .

Summer Short Talk Series

The ngVLA Summer Short Talk Series (https://ngvla.nrao.edu/page/2021sts) will take place Thursdays through 26 August, organized by the ngVLA Science Advisory Council (https://ngvla.nrao.edu/page/sciencecouncil) and supported by the National Radio Astronomy Observatory (http://science.nrao.edu/) .

The series aims to engage a global audience interested in open astronomy problems, by facilitating discussions on important and/or timely topics. The talks will cover a broad range of research areas while also drawing connections to present or future facilities. The series is free and we are especially interested in reaching early-career researchers and students.

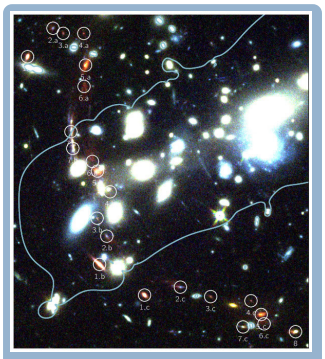
The series will be held online via Zoom each Thursday at 2 p.m. Eastern Daylight Time. Each 20-25 minute talk will be targeted to a general scientific audience. A moderated, 15-20 minute, audience Q&A session will accompany each talk. The series schedule and registration information are online (https://ngvla.nrao.edu/page/2021sts) .

ngVLA Memo Series

We wish to draw attention to the growing body of scientific, technical, and computing memos published in the ngVLA Memo Series (https://ngvla.nrao.edu/page/memos) and the ngVLA-Japan Memo Series (https://ngvla.nao.ac.jp/researcher/memo/) . Browse titles and download memos of interest. Contributions to both series are welcomed. Submission instructions appear on the cited pages.

Molecular Gas in High Redshift Galaxies

Jeff Shen (University of Toronto) and Allison Man (University of British Columbia)



White circles in this HST composite color image show the target galaxies at z = 2.9. There are several projected images for some of the galaxies (e.g., 2.a, 2.b and 2.c are three images of the same background galaxy). This effect is caused by gravitational lensing. Blue line indicates the lensing model's critical line, across which galaxy images are reflected. Adapted from Shen et al. 2021.

To obtain a complete picture of star formation and galaxy evolution, we must look to high-redshift galaxies in the early Universe. They hold the key to understanding how the galaxies of the past become the galaxies of the present. A crucial epoch is the so-called cosmic noon from z = 2 to 3, when star formation peaked (Madau and Dickinson 2014 (https://ui.adsabs.harvard.edu/abs/2014ARA%26A..52..415M/abstract)). Understanding star formation at these redshifts is often done by observing the carbon monoxide molecule (CO), a tracer for cold gas, which is the immediate fuel for forming stars. This is typically done with powerful radio telescopes. Our team used ALMA to make observations of the CO(3-2) transition in several galaxies at z = 2.9 (Shen et al. 2021 (https://arxiv.org/abs/2105.11572) ; see figure).

Given that galaxies in the early Universe are very distant, CO observations at these redshifts tend to be biased toward the most extremely star-forming galaxies which harbor large reserves of molecular gas. We use gravitational lensing, whereby a massive foreground galaxy cluster between Earth and the target galaxies magnifies the incoming light from the target galaxies. This allows us to observe galaxies, previously identified in other wavelengths (Borys et al. 2004 (https://ui.adsabs.harvard.edu/abs/2004MNRAS.352..759B/abstract) , Mackenzie et al. 2014 (https://ui.adsabs.harvard.edu/abs/2014MNRAS.445..201M/abstract)), which are far less bright and massive than is typically observed in galaxies at comparable redshifts. To determine the gas mass, we need to convert our CO(3-2) observation into a CO(1-0) equivalent, which introduces significant systematic uncertainty. In the case of the most magnified galaxy, we find gas masses that are an order of magnitude below the typical gas masses of z > 1 galaxies from the literature. This analysis of more "normal" galaxies (i.e., representative of the general galaxy population) is made possible by the fortuitous lensing of the target galaxies, but in the future the ngVLA may make these kinds of observations commonplace.

The ngVLA would allow for phenomenally detailed observations of cold gas in distant galaxies. With its long baselines, the ngVLA will be able to spatially resolve molecular gas in early galaxies, allowing us to characterize the gas dynamics and obtain virial mass estimates. Additionally, the ngVLA will be able to directly observe the CO(1-0) line, avoiding the uncertainty associated with the conversion from a higher J transition (Casey et al. 2015 (https://ui.adsabs.harvard.edu/abs/2015arXiv151006411C/abstract)). These observations will be possible at sensitivities better than ever before, and perhaps more excitingly, it will be possible to detect CO(1-0) across a large range of redshifts, allowing for a more comprehensive view of galaxies through time (Decarli et al. 2018 (https://ui.adsabs.harvard.edu/abs/2018ASPC..517..565D/abstract)).

Since 2015, the acronym ngVLA has appeared in 700+ publications indexed in the SAO/NASA Astrophysics Data System. This article continues a regular feature intended to highlight some of those publications. We are especially interested in showcasing work done by early-career researchers. Anyone wishing to volunteer to author a feature should contact Joan Wrobel (mailto:(jwrobel@nrao.edu?subject=ngVLA%20articles) .

The North American ALMA Development Program Takes First Steps Toward a Major Digital Upgrade

Crystal Brogan

Based on the highest priorities of the ALMA Development Roadmap (ALMA Memo 612 (http://library.nrao.edu/public/memos/alma/main/memo612.pdf)), the ALMA Partnership is embarking on a major initiative for a *Wideband ALMA 2030 Sensitivity Upgrade* which aims to: expand ALMA's digitized bandwidth by up to a factor of four, increase the correlated bandwidth by at least a factor of two (with a future expansion path to 4x larger bandwidth), improve the digital efficiency of the system (for added spectral sensitivity), and to deploy the first wideband receivers (IF 3x to 4x wider than current 2SB receivers) by 2030 for both continuum and spectral sensitivity. The resulting efficiency gains from the digital improvements alone (~13%) are equivalent to affording of order 1000 more hours of 12m-array ALMA observing time per year. The increased bandwidth will improve continuum sensitivity by at least sqrt(2), as well as the observing efficiency of spectral scans. Indeed, spectral line studies will never again need to trade bandwidth for the requisite spectral resolution. The increased spectral grasp of the new correlator–total spectral bandwidth, channelization, and flexible bandpass tuning–will allow some projects to save multiple factors of observing time through simultaneous observation of lines of interest, not possible before.

As described in previous eNews articles, the NA ALMA Development Program issued a call for development projects that aligned with the goals of the ALMA Development Roadmap earlier this year. Six highly competitive proposals were received, with contributions from a total of nine institutions and 41 co-investigators. After an independent review by an 18-person panel, (including technical experts and expert ALMA users) and consent by the NSF, two large projects have been selected to move forward to the next stage of review by the ALMA Executives and Board in FY2022: (1) Construction of a 2nd generation ALMA correlator; and (2) Development of a production-ready upgraded Band 6 cold cartridge assembly. We have also selected a small project for further consideration (3), which will complete the envisioned suite of Very Long Baseline Interferometry (VLBI) capabilities for ALMA. Together these critical NA contributions will help ensure that ALMA stays at the forefront of scientific discovery well into the next decade.

1. *TALON Frequency Slice Architecture Correlator/Beamformer for ALMA*, Carlson et al. (NRC / NRAO / MIT-Haystack): This large project to build the 2nd Generation Correlator will double the correlated bandwidth of ALMA, while providing vastly more channels, increased efficiency, and flexibility in placement. It forms an essential cornerstone of the overall *Wideband ALMA 2030 Sensitivity Upgrade*, and its design can be straightforwardly upgraded in the future to quadruple the current bandwidth. We plan to prepare this project for consideration at the April 2022 ALMA Board meeting. Prior to consideration by the ALMA Board, a successful system-level review of the full digital upgrade path in the February 2022 time frame is required, together with commitments from the ALMA partnership for the complementary components of the upgrade.
2. *ALMA Band 6v2 Receiver Upgrade*, Navarrini et al. (NRAO): This large project to build and test a production-ready 2nd Generation Band 6 cold-cartridge, will at least triple the Band 6 IF bandwidth, significantly improve its noise performance, and have the ability to simultaneously observe multiple diagnostic spectral lines. Of the current eight ALMA receiver bands, Band 6 is the most used, and 53% of all ALMA publications to date include Band 6 data. This project will culminate in a Critical Design Manufacturing Readiness Review. In conjunction with the *Wideband ALMA 2030 Sensitivity Upgrade*, the Band 6 continuum sensitivity will be improved by at least sqrt(2). We plan to prepare this project for consideration at the November 2021 ALMA Board meeting.

3. *Enabling New VLBI Science with the ALMA Phasing System - Phase 3*, Matthews et al. (MIT-Haystack): This is a small project to complete the full suite of VLBI capabilities that we will prepare for ALMA Director consideration in time for the November 2021 ALMA Board meeting.

ALMA Program News

Al Wootten

Credit: P. Carrillo

Winter snows, even in the Tropics, can hinder ALMA observing, but with a dedicated crew and appropriate equipment the array again produces data

Joint ALMA Observatory Continues Cycle 7 Observations

Personnel numbers have increased to 105 staff at the Operations Support Facility. The Review Panel has reaffirmed its recommendation for a planned total of 120 people at the OSF starting on the shift of July 8th depending on conditions at that time. This marks the maximum number of people at the OSF in the context of the protocols in place for Baseline Science Operations. The ALMA remains in the C43-6 configuration and continues Cycle 7 Principal Investigator (PI) observations after recovery from a recent significant snowstorm. Some Band 8 observations have been taken through clear winter skies. Antenna relocation to the C43-7/8 configuration has begun. PI observing on the Atacama Compact Array re-started on June 29, with typically 9 antennas, after a brief snowstorm-induced hiatus.

Cycle 8 2021 Proposal Submission Statistics

A detailed report of the Cycle 8 2021 Proposal Submission Statistics (https://almascience.nrao.edu/news/cycle-8-2021-proposal-submission-statistics) is available on the ALMA science portal (https://almascience.nrao.edu/) . The report provides a summary of items such as the number of submitted proposals (1737) and time requested, subscription rates, and comparisons with the number of hours requested in previous Cycles. Proposal reviews are now in and are being assessed; notifications will be sent to PIs in early August.

ALMA Band 3

An upgrade is underway for the Band 3 Cold Cartridge Assembly, improving total power performance by reducing azimuth dependent power variations. A report is available (https://science.nrao.edu/facilities/alma/science_sustainability/Band3magnetandheater.pdf) .

The ALMA 2030 Vision: A next generation of front-end receivers

An ESO online Workshop on 27-30 September 2021, The ALMA 2030 Vision: A next generation of front-end receivers (https://indico.cern.ch/event/1049946/) is open for registration. The aim of this conference is to discuss receiver development in the context of the ALMA Development Roadmap (ALMA Memo 612 (http://library.nrao.edu/public/memos/alma/main/memo612.pdf)).

ALMA & SOFIA Science Summer Webinar Series Continues

George Privon

The ALMA + SOFIA Summer Webinar Series, jointly organized by the North American ALMA Science Center and the SOFIA Science Center, continues each Thursday at 3:30 p.m. EDT, through 22 July. This series explores science combining millimeter and infrared observations. Each week, the series features a 40 to 45-minute talk, followed by a Q&A / discussion session. The series will span a range of astrophysical topics, exploring synergies between radio / millimeter and infrared science.

The remaining program is listed below. The full schedule and recordings of talks are available on the SOFIA website (https://www.sofia.usra.edu/science/meetings-and-events/sofiaalma-summer-series) . You can register for the remaining talks in the series here (https://nrao-edu.zoom.us/webinar/register/WN_xnBNS7dhS_KPBB3klYaqlg) .

Event	Event Date	Speaker	Affiliation
The Force Awakens: How a Growing Black Hole Affects its Host Galaxy (https://www.sofia.usra.edu/science/meetings-and-events/events/force-awakens-how-growing-black-hole-affects-its-host-galaxy)	Thursday, July 08, 2021 - 12:30pm PDT	Allison Kirkpatrick	University of Kansas
Tracing the formation and evolution of planetary debris disks with multiwavelength approaches (https://www.sofia.usra.edu/science/meetings-and-events/events/tracing-formation-and-evolution-planetary-debris-disks)	Thursday, July 15, 2021 - 12:30pm PDT	Kate Su	University of Arizona
Mapping the surfaces properties of icy and rocky Solar System worlds (https://www.sofia.usra.edu/science/meetings-and-events/events/mapping-surfaces-properties-icy-and-rocky-solar-system-worlds)	Thursday, July 22, 2021 - 12:30pm PDT	Katherine de Kleer	Caltech

Have a Paper That Might Make a Great Press Release?

Amy C. Oliver

Credit: ALMA (ESO/NAOJ/NRAO)/T. Paneque-Carreño (Universidad de Chile), B. Saxton (NRAO)

When sending your request for press review, please be sure to include the following:

- Your draft paper (your result cannot be considered for a press release without it)
- Any applicable FITS files
- The publication you are submitting to (or have submitted to) and the date of submission.

If you have an upcoming paper for the Very Large Array or Very Long Baseline Array, send it to Dave Finley at dfinley@nrao.edu (mailto:dfinley@nrao.edu) .

If you have an upcoming paper for the Atacama Large Millimeter/submillimeter Array, or news about the National Radio Astronomy Observatory or Central Development Lab, send it to Amy C. Oliver at aoliver@nrao.edu (mailto:aoliver@nrao.edu)

Recent Media Releases

Student Summer Research Programs at NRAO Get a Boost from Going Remote (https://public.nrao.edu/news/student-summer-research-programs-at-nrao-get-a-boost-from-going-remote/)
7 July 2021

Nine Children of NRAO Staff Among Recipients of 2021 AUI Scholarship (https://public.nrao.edu/news/children-of-nrao-staff-among-recipients-of-2021-aui-scholarship/)

1 July 2021

AUI and NRAO Establish NAC Bridge Scholarship Award (https://public.nrao.edu/news/aui-and-nrao-establish-nac-bridge-scholarship-award/)
30 June 2021

Mind the Gap: Scientists Use Stellar Mass to Link Exoplanets to Planet-Forming Disks (https://public.nrao.edu/news/scientists-use-stellar-mass-to-link-exoplanets-to-protoplanetary-disks/)
23 June 2021

2021 Jansky Lectureship Awarded to Mexican Astronomer (https://public.nrao.edu/news/2021-jansky-lectureship-awarded-to-mexican-astronomer/)
21 June 2021

Study of Young Chaotic Star System Reveals Planet Formation Secrets (https://public.nrao.edu/news/chaotic-young-star-reveals-planet-formation/)
17 June 2021

From the Archives

Ellen Bouton

About this month's photo: In the Associated Universities, Inc. (AUI) offices in Washington, D.C., participants celebrate the 11 July 2005 signing with Vertex of the contract for 25 ALMA production antennas. [Left to right] Adrian Russell (partly visible), Bob Dickman (then at the National Science Foundation), Brian Schrader (VertexRSI Project Director), Chris Marzilli (General Dynamics Executive Vice Preisdent), Bill Porter, Tony Beasley, Judy Sunley (NSF), and Al Wootten. Thanks to Bill Porter and Al Wootten for help identifying people, and to Pat Donahoe for verifying the location.

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 (mailto:archivist@nrao.edu).

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