NRAO eNews

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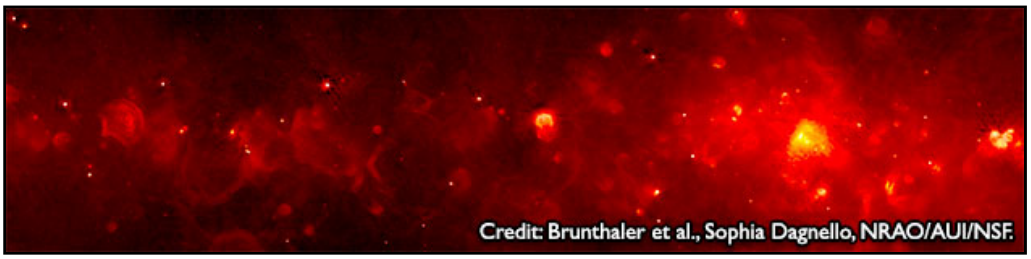


Upcoming Events

NRAO Town Hall (https://science.nrao.edu/science/meetings/2022/aas239/nrao-town-hall)
Jan 11, 2022 | Salt Lake City, UT

ALMA Special Session: ALMA Status & Plans for Increased Capability (https://science.nrao.edu/science/meetings/2022/aas239/alma-special-session-alma-status-plans-for-increased-capability)
Jan 13, 2022 | Salt Lake City, UT

ngVLA Special Session: Chemical Probes of Astrophysical Systems (https://science.nrao.edu/science/meetings/2022/aas239/ngvla-special-session-chemical-probes-of-astrophysical-systems)
Jan 13, 2022 | Salt Lake City, UT

ngVLA Project News

Eric Murphy

ngVLA Summer Short Talk Series

The NRAO (https://science.nrao.edu/) and the Next Generation Very Large Array (ngVLA) Science Advisory Council (https://ngvla.nrao.edu/page/sciencecouncil) will continue the online ngVLA Summer Short Talk Series (https://ngvla.nrao.edu/page/2021sts) on Thursdays at 02:00 p.m. Eastern Daylight Time through 26 August. Each 20-25 minute talk highlights open science questions and their connection to present and future observing facilities at all wavelengths. A moderated, 15-20 minute, audience Q&A session accompanies each talk. The series schedule, registration information, and recordings of past talks are online (https://ngvla.nrao.edu/page/2021sts).

ngVLA Special Session: Chemical Probes of Astrophysical Systems

The NRAO and the ngVLA Project (https://ngvla.nrao.edu/) will convene a Special Session titled *Chemical Probes of Astrophysical Systems* (https://science.nrao.edu/science/meetings/2022/aas239/ngvla-special-session-chemical-probes-of-astrophysical-systems) on Thursday, 13 January 2022, at the winter American Astronomical Society (AAS) meeting. Astrochemistry has become a critical investigative tool for a large range of astrophysical studies, spanning Solar System objects to the most distant galaxies.

The investigation of extrasolar planetary systems is one of the defining pursuits of contemporary astronomy, having a fundamental goal of using complex chemical tracers to identify the conditions that ultimately lead to habitability. Extraterrestrial amino acids, the chemical building blocks of the biopolymers that comprise life as we know it on Earth, are present in meteoritic samples and in comets, but our understanding of the chemical

and physical pathways to the formation of (pre)biotic molecules remains incomplete. On galaxy scales, the presence of various molecules and associated isotopes are used to indicate the role of various energetic processes (e.g., shock, UV and cosmic-ray heating) affecting interstellar medium conditions and pathways to the formation of the next generation of stars.

While existing facilities are making transformative discoveries by pushing their capabilities to the limit of what can be detected, sample sizes remain small as detections of individual systems are limited to the nearest luminous sources. Informed by these pioneering efforts, suites of next-generation ground- and space-based facilities will deliver large, multi-wavelength surveys that will produce spectroscopic information across the entire electromagnetic spectrum. These data will deliver a much-improved theoretical understanding of the fundamental physics driving the formation of habitable planetary systems as well as the formation and evolution of galaxies over cosmic time.

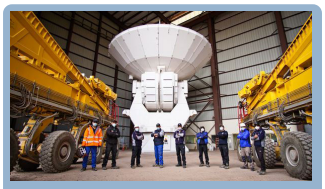
This Special Session will highlight recent scientific breakthroughs in astrochemistry enabled by current investigations using large optical/IR, (sub-)millimeter, and radio facilities; describe planned near- and long-term improvements for ground- and space-based facilities; discuss major scientific leaps likely to result from next-generation facilities across the electromagnetic spectrum; and review the highest-priority themes in the field of astrochemistry that will be accomplished by the state-of-the-art observatories that will be commissioned in the next decade.

Confirmed speakers include Brett McGuire (Massachusetts Institute of Technology), Kamber Schwarz (University of Arizona), Eliza Kempton (University of Maryland), Dominique Segura-Cox (University of Texas, Austin), Martin Cordiner (NASA GSFC), and David Meier (New Mexico Tech).

We encourage you to consider contributing to the associated poster session. When submitting a contributed poster abstract to the AAS, you will have the option of requesting that your presentation be included in this Special Session.

ALMA Program News

Al Wootten



Credit: P. Carrillo

Antenna PM02 has completed its tenth year overhaul, thanks to ALMA's excellent team of technicians and engineers and ALMA's antenna transporter "OTTO".

Joint ALMA Observatory Continues Cycle 7 Observations

ALMA has continued Cycle 7 PI observations with the Main Array in the C43-7 configuration and the Atacama Compact Array. Antenna relocations to the C43-8 configuration are nearing completion and relocations to a hybrid C43-9/10 array are planned to begin once the C43-8 configuration is completed.

Cycle 8 2021 ALMA Proposals and ACA Supplemental Call

Results of the Cycle 8 2021 proposal review will be sent to proposers in early August. The start of Cycle 8 2021 observations, in C43-8 configuration, will be 1 October 2021. An Atacama Compact Array (ACA) Supplemental Call for Proposals in ACA stand-alone mode is scheduled for release 8 September 2021, along with the opening of the archive for submission of supplemental call proposals. The deadline for the Cycle 8 2021 ACA Supplemental Call for Proposals will be 6 October 2021.

The ALMA Regional Centers continue to provide support to all ALMA users. If you have any questions, comments or concerns related to your projects or the situation at ALMA, please contact the ALMA Helpdesk (https://help.almascience.org/) .

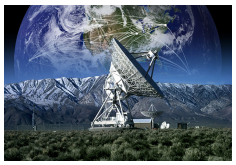
ALMA2030

As announced last month, two large development 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. A small project has also been selected for further consideration, which will complete the envisioned suite of Very Long Baseline Interferometry capabilities for ALMA. Together these critical North American contributions will help ensure that ALMA stays at the forefront of scientific discovery well into the next decade.

A Special Session at the winter American Astronomical Society (https://science.nrao.edu/science/meetings/2022/aas239/alma-special-session-alma-status-plans-for-increased-capability) meeting (13 January 2022, 2-3 p.m. MST) will describe ALMA news, capabilities, and expectations for ALMA performance and science in the next few years and plans for its upgrade in the 2030 timeframe. In that period, ALMA will complete its frequency coverage of the millimeter window. ALMA's bandwidth will be increased to enhance simultaneous spectral range and continuum sensitivity, even as its line sensitivity is increased via receiver upgrades, an upgraded correlator, and upgrades of the systems connecting them. Higher resolution imaging is being explored, both on the exceptional site and as part of extremely long baseline imaging arrays.

Pointing Problems Affecting Some 2019 VLBA Data

Jay Blanchard



During the transition from the Motorola Versa Module Europa (MVME) 147 single board station computers to a linux-based VLBA Executor control system similar to that used by the Very Large Array, pointing issues were introduced affecting Very Long Baseline Array (VLBA) data quality throughout parts of 2019.

Please see VLBA Test Memo 73 (https://library.nrao.edu/public/memos/vlba/test/VLBAT_73.pdf) for a full description of these issues and possible corrections. We are in the process of contacting Principal Investigators with data that were severely affected. If you feel your data are affected and you need help, please contact the NRAO helpdesk (https://help.nrao.edu/) .

6th U.S.-China Workshop on Radio Astronomy Science and Technology

Ken Kellermann & Karen Prairie

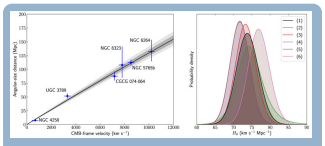
In June, NRAO, in collaboration with the Shanghai Astronomical Observatory, hosted the 6th U.S.-China Workshop on Radio Astronomy Science and Technology. To accommodate the significant time difference between the U.S. and China, the virtual workshop was held in the U.S. evening and Chinese morning during five sessions spaced across a ten-day period. Over 180 individuals participated, with 35% of the attendees from the U.S., 51% from China, and 13% joining from 15 other countries.

The presentations covered updates on current and planned facilities including: the Five-hundred-meter Aperture Spherical Telescope (FAST), Chinese space and ground Very Long Baseline Interferometry (VLBI), the next generation Very Large Array (ngVLA), Atacama Large Millimeter/submillimeter Array (ALMA), Arecibo Observatory, Very Long Baseline Array (VLBA), CCAT, the Square Kilometre Array (SKA), Green Bank Telescope, Tianlai, Leighton Chanjantor Telescope, Deep Synoptic Array 2000-antenna concept (DSA-2000), as well as new scientific results from FAST, the Monitoring Of Jets in Active galactic nuclei with VLBA Experiments (MOJAVE), the Megamaser Cosmology Project, the Bar and Spiral Structure Legacy Survey (BeSSeL), the Very Large Array Sky Survey (VLASS), the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), Breakthrough Listen, and the Event Horizon Telescope (EHT).

Recordings of all workshop presentations are available at the conference website (https://web.cvent.com/event/81d2c5fa-7830-47a4-904e-c6b882ab0534/websitePage:645d57e4-75eb-4769-b2c0-f201a0bfc6ce.) .

H_2O Megamaser Cosmology & Black Hole Masses with the ngVLA

Cheng-Yu Kuo (National Sun Yat-Sen University) & Jim Braatz (NRAO)



Credit: Pesce et al. 2020

[Left] Hubble diagram for maser galaxies. [Right] Hubble constant probability distribution from six different peculiar velocity treatments. Bayesian analysis yields H_0 = 73.9 ± 3.0 km/s/Mpc (~4% accuracy).

H_2O megamasers provide a direct determination of the Hubble Constant, H_0, independent of standard candles (Reid et al. 2013 (https://ui.adsabs.harvard.edu/abs/2013ApJ...767..154R/abstract)), and enable precise measurements of supermassive black hole masses, M_{BH} (Gao et al. 2017 (https://ui.adsabs.harvard.edu/abs/2017ApJ...834...52G/abstract)), via sub-milliarcsecond imaging of H_2O maser emission from disk maser systems, such as NGC 4258 (Herrnstein et al. 1999 (https://ui.adsabs.harvard.edu/abs/1999Natur.400..539H/abstract)).

In such a system, the masing gas resides in a subparsec-scale thin disk viewed almost edge-on and following near Keplerian rotation. These disk properties support M_{BH} measurements to percent level accuracy, and the disk maser geometrical and kinematic information can be modeled to provide a precise H_0 (Pesce et al. 2020 (https://ui.adsabs.harvard.edu/abs/2020ApJ...891L...1P/abstract)). From distance measurements of six maser galaxies within 150 Mpc, the Megamaser Cosmology Project team obtained H_0 = 73.9 ± 3.0 km/s/Mpc (~4% accuracy), independent of distance ladders and the cosmic microwave background (see Figure). Precise distances for maser galaxies beyond 200 Mpc are needed to further improve the accuracy of the maser-based H_0 determination.

Kuo et al. (2020) (https://ui.adsabs.harvard.edu/abs/2020MNRAS.498.1609K/abstract) studied a maser system, IRAS 08452−0011 (d ~ 213 Mpc), and for the first time applied the H_2O megamaser technique to a galaxy beyond 200 Mpc, measuring H_0 and M_{BH}. Our disk modeling yielded $M_{BH} = (3.3 \pm 0.2)\times10^7\ M_{sun}$. The analysis demonstrated that the H_2O megamaser technique can be applied with existing facilities to galaxies beyond 200 Mpc for M_{BH} measurement with an accuracy of better than 10%, sufficient for constraining the M_{BH}-σ relation. Based on our investigation of IRAS 08452−0011, which has high-velocity maser flux densities of ~40 mJy, we infer that M_{BH} measurements are feasible to d ~ 400 Mpc (z ~ 0.1) with 40 hours observing with the Very Long Baseline Array, augmented with the Green Bank Telescope.

While M_{BH} measurements are feasible to z~0.1 with available sensitivity and resolution, our analysis for IRAS 08452−0011 suggests that determining a galaxy distance to better than 10% accuracy using a single maser

galaxy becomes difficult beyond 200 Mpc, requiring at least a few hundred hours observing time to achieve sufficient maser position accuracy. Nevertheless, the inclusion of the next generation Very Large Array (ngVLA) in future Very Long Baseline Interferometer observations is promising. To yield an order of magnitude improvement in sensitivity, enabling a 1% H_0 measurement would require measuring ~10% (~7%) distances to 100 (50) maser galaxies (Braatz et al. 2019 (https://ui.adsabs.harvard.edu/abs/2019BAAS...51c.446B/abstract)). Including the ngVLA would extend the megamaser technique to galaxies beyond 400 Mpc for M_{BH} measurements since the necessity for extremely high maser luminosity ($L(H_2O) > 10{,}000\ L_{sun}$) will be significantly relaxed.

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) .

SMA Call for Standard Observing Proposals for 2021B Semester

Mark Gurwell (SAO Chair, SMA TAC)

We wish to draw your attention to the next Call for Standard Observing Proposals for observations with the Submillimeter Array (SMA). This call is for the 2021B semester, with an observing period 16 Nov 2021 - 15 May 2022.

Standard Observing Proposals Submission deadline: Thursday, 16 Sep 2021, 20:00 GMT

The full Call for Proposals, with details on time available and the proposal process, will be available by August 14 at the SMA Observer Center (SMAOC) at http://sma1.sma.hawaii.edu/call.html (http://sma1.sma.hawaii.edu/call.html) .

Details on the SMA capabilities and status can be found at http://sma1.sma.hawaii.edu/status.html (http://sma1.sma.hawaii.edu/status.html) ; proposal creation and submission is also done through the SMAOC at http://sma1.sma.hawaii.edu/proposing.html (http://sma1.sma.hawaii.edu/proposing.html) . We are happy to answer any questions and provide assistance in proposal submission; simply email sma-propose@cfa.harvard.edu (mailto:sma-propose@cfa.harvard.edu) with any inquiries.

Arizona Radio Observatory 2021B Call for Proposals

The Arizona Radio Observatory (ARO) solicits proposals for the 10-meter Submillimeter Telescope (SMT) located on Mount Graham, Arizona, for the period October 15, 2021 – February 15, 2022. Arizona (local) PIs may also apply for limited time (< 1.5 months available) on the ALMA Prototype 12-meter Telescope located on Kitt Peak, Arizona. No new community-PI proposals for the ALMA Prototype 12-meter Telescope (12m) will be accepted for the 2021B call as the majority of the 2021B semester period will be devoted to the TIME intensity mapping experiment. The 12-meter Telescope will be available for community-PI proposals in the 2022A call with expanded capabilities. Proposal candidates should submit up to three pages of scientific and technical justification (including figures, tables, and references) in addition to their Proposal Summary Sheet (https://aro.as.arizona.edu/sites/default/files/ARO_Proposal_Cover_Sheet.pdf) .

The 10m SMT currently supports dual-polarization sideband-separating (SBS) observations at 1mm (211 – 280 GHz) and dual-polarization double sideband observations at 0.8mm (325 – 370 GHz). The SMT control system supports both dual-polarization ("2 IF mode") and dual-polarization + dual-sideband observations ("4 IF mode") with tunable IF from 4.5-7.5 GHz, for position-switched, beam-switched, and OTF observations. Proposal candidates should consult the ARO Equipment Summary and Status sheet (https://aro.as.arizona.edu/?q=observing-aro/instrumentation) for additional technical specifications.

The SMT is currently restricted to remote observing. Observers **must supply fixed IP address(es) of the computer(s)** that will be used during observing on their Proposal Summary Sheet. For further information about remote observing and other operational questions, please contact the ARO Software Engineer Natalie Gandilo (mailto:ngandilo@email.arizona.edu) .

Proposals will be reviewed by the ARO TAC and scheduling of successful proposals will be done according to availability of the receivers requested. The SMT is expected to be available to the general astronomical community for a minimum of 10 percent of the scheduled time. Institutions (or individuals) outside of the State of Arizona that wish to acquire longer commitments of time through a limited duration agreement with The University of Arizona should contact Buell Jannuzi, Director (mailto:buelljannuzi@email.arizona.edu) .

Next deadline for proposals is 23:59 MST on September 2, 2021.
Proposals should be emailed in PDF format to:
astro-aroproposals@list.arizona.edu

Virtual VLA Tour: 40 Years of Science with the VLA

Summer Ash

Construction of the Very Large Array (VLA) began in the 1970s, and the array was officially completed and dedicated on 10 October 1980. In the 40 years since the dedication, astronomers using the VLA have made countless invaluable astronomical discoveries, greatly broadening our understanding of the Universe and serving the scientific community as the most scientifically productive ground-based telescope.

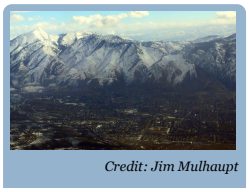
Please join us for a virtual tour (https://public.nrao.edu/event/virtual-vla-40-years-science-tour/) followed by a panel with several guest experts as we highlight some of the fascinating accomplishments the VLA has enabled through the years.

This virtual tour will take place on Saturday, 7 August 2021, from 1:00 – 3:00 p.m. Mountain Daylight Time [UTC/GMT – 6 hours].

This event will take place on Zoom. Registration is required.

Get an Early Start on Press for AAS 239

Amy Oliver


Credit: Jim Mulhaupt

Are you submitting an abstract for AAS 239 in Salt Lake City? If so, and you believe that your research may fit with a press conference format in addition to your session, please reach out to the News Group.

Salt Lake City, Utah is the site of AAS 239

What is a press conference?
A press conference is a session designed specifically for the media where select projects with a specific public interest are presented in short format (about 6 minutes). Our News Group can help you to vet and submit your abstract for this opportunity, create a shortened version of your presentation, and prepare you to provide your results to a live media/journalist audience. We may also create written and designed documents to accompany your press conference.

This is different than a press release, which is a written document prepared by our News Group and published for the media. In some cases, you may have both, but not always.

- For VLA: dfinley@nrao.edu (mailto:dfinley@nrao.edu)
- For ALMA: aoliver@nrao.edu (mailto:aoliver@nrao.edu)

Recent Media Releases

Scientists Observe Gas Re-accretion in Dying Galaxies for the First Time (https://public.nrao.edu/news/gas-reaccretion-seen-in-dying-galaxies/)
29 July 2021

New Study Reveals Previously Unseen Star Formation in Milky Way (https://public.nrao.edu/news/new-study-star-formation-milky-way/)
22 July 2021

From the Archives

Ellen Bouton

About this month's photo: This image was taken by Frank Ghigo at the end of a 2001 hike from the Observatory in Green Bank to the store at Cass, WV along the Allegheny Trail. The hike climbs from the western side of the Observatory along Slavin Hollow to the top of and then along the ridge of Little Mountain (which is at the western border of the Observatory) and finally down to and along the Greenbrier River. The hike is one that has happened almost every year over the past ~30 years as part of a summer workshop or school. It usually takes about 4 hours, so ice cream is a welcome reward. Enjoying their well-earned ice cream are [left to right, seated on porch] Dana Balser, Tim Boyd; [top step] Ardis Maciolek (now Herold), unidentified, Ron Maddalena, summer student Paul Robinson; [bottom step] Nate Van Wey, Tom Berlin, unidentified.

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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