NRAO eNews

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NRAO/GBO Status

Tony Beasley (NRAO Director, AUI Vice President for Radio Astronomy)

This is week nine in Infectious Disease Operating Status (IDOS). The North American NRAO/GBO instruments are all operational. IT systems are working well. There are no confirmed reports of NRAO or GBO staff receiving medical care for COVID-19. We are planning to remain in IDOS until at least Monday, 1 June 2020. In Chile, the Joint ALMA Observatory has begun planning to bring ALMA online in coming months, though our colleagues in Santiago went into a city-wide lockdown this week. We hope the situation in Chile improves quickly.

Upcoming Events

[Rescheduled as Virtual Workshop] 17th Synthesis Imaging Workshop (http://www.cvent.com/events/17th-synthesis-imaging-workshop/event-summary-0d59eb6cd1474978bce811194b2ff961.aspx)

Jun 29 - Jul 17, 2020 | Registration opens May 14

Compact Objects and Energetic Phenomena in the Multi-Messenger Era Mini Conference (http://go.nrao.edu/ngvla20)

Jul 14 - 15, 2020 | Virtual

Postponed Events

The following NRAO-related conferences have been postponed owing to concerns about the COVID-19 coronavirus. Please consult the conference website (link below) for details.

Multiphase Gas in Galaxy Groups (http://go.nrao.edu/gasingroups2020)

New Dates TBD | Charlottesville, VA

ngVLA Project News

Eric Murphy

ngVLA in 550 Publications

Since 2015, the acronym ngVLA (next generation Very Large Array) has appeared in 550 publications indexed in the SAO/NASA Astrophysics Data System. This metric quantifies the remarkable role of the scientific and engineering communities in advancing the ngVLA concept.

Virtual Multi-Messenger Mini-Conference: 14-15 July 2020

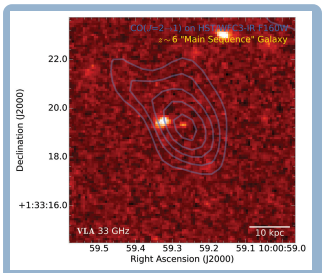
We are excited to announce a virtual *Compact Objects and Energetic Phenomena in the Multi-Messenger Era* (https://go.nrao.edu/ngvla20) mini-conference this summer on 14-15 July 2020. Each day will consist of one 2-hour session, during which we will hold a series of six 15-minute talks (12 minute talk + 3 minute questions). Additionally, we will have virtual breakout rooms where attendees can continue their discussions of particular subject areas.

The talks will cover twelve topic areas pivotal to the future of multi-messenger astronomy, and bring together scientists with expertise in a wide range of fields to discuss current progress, future directions, and how to best utilize the suite of multi-messenger facilities for the 2020s and beyond. Registration, as well as the schedule and invited speaker list, are online (https://go.nrao.edu/ngvla20) .

And please stay tuned for more information on our live multi-messenger conference, scheduled to be held next summer, 23-25 June 2021 in Saint Paul, Minnesota.

Charting the Evolution of the Cold Gas Content of Star-Forming Galaxies Back to the First Billion Years of Cosmic Time with the ngVLA

Dominik Riechers & Riccardo Pavesi (Cornell University)



The VLA detected the cold CO gas reservoir in the "main sequence" galaxy COSMOS-hz10 in emission. Blue VLA contours are overlaid on a HST WFC3 image. The line emission is redshifted from 230 GHz at the source to 33 GHz at the VLA, which spent ~ 30 hours on sky under excellent conditions. The ngVLA will obtain a similar result in only 15-20 minutes, while observing a larger sky region at higher spatial resolution.

Stars form due to gravitational collapse of cold dense molecular clouds. Tracing the cold gas content of galaxies throughout cosmic history is key to understanding how the stars and planetary systems we find in galaxies at present day were made, and thus, how galaxy evolution takes place. This evolution began less than one billion years after the Big Bang, when galaxies first formed.

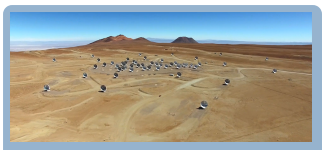
While we were able to study the cold gas content of the most massive, intensely star-forming galaxies back to the first billion years for a decade now thanks to the upgrade of the Karl G. Jansky Very Large Array (VLA); e.g., Riechers et al. 2010 (https://ui.adsabs.harvard.edu/abs/2010ApJ...720L.131R/abstract) , Riechers et al. 2020 (https://ui.adsabs.harvard.edu/abs/2020arXiv200410204R/abstract) and the rise of new facilities like the Atacama Large Millimeter/submillimeter Array (ALMA), it became possible only recently to push these studies to fainter, so-called star forming "main sequence" galaxies that are more representative of the general population at these early epochs (Pavesi et al. 2019 (https://ui.adsabs.harvard.edu/abs/2019ApJ...882..168P/abstract) , see figure).

These new observations are a major step forward, but at the same time, detection of a single such galaxy currently requires more than a full day of observing time under the best weather conditions. To elevate this field from case studies to studies of significant galaxy samples across representative regions of the Universe, a major leap in survey capabilities at centimeter to millimeter wavelengths is required. The next-generation Very Large Array (ngVLA) is designed to ideally match this current gap in our ability to carry out such surveys, which is one of its key science goals (e.g., Decarli et al. 2018 (https://ui.adsabs.harvard.edu/abs/2018ASPC..517..565D/abstract) , Murphy et al. 2018 (https://ui.adsabs.harvard.edu/abs/2018ASPC..517....3M/abstract)). In a single day of observations, the ngVLA will find tens to hundreds of galaxies in the early Universe based on the emission from the star-forming gas within them, while at the same time mapping the distribution and kinematic structure of the gas down to the size scales of individual molecular clouds. Enabled by broad support from the world-wide astronomical community, these future studies will transform our understanding of galaxy formation and evolution across cosmic history.

This article continues a regular feature intended to highlight contributions to the ngVLA Science Book (https://ngvla.nrao.edu/page/scibook). 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%20science%20in%20eNews).

ALMA Program News

Al Wootten



Credit: Benjamín Valdés & David Fernández – ALMA (ESO/NAOJ/NRAO)

ALMA Operations Suspended

The COVID-19 crisis has continued to affect the global community, including ALMA users and staff. ALMA operations remain suspended, as announced on 20 March. Only caretaking personnel are on site; only minimal power is available and travel options to the site are limited. Due to the extension of ALMA data proprietary period, the ALMA Archive remains available but it will be some weeks before additional projects are ingested.

ALMA will resume operations when the evolving situation permits. It is anticipated that the Cycle 8 Call for Proposals will open again in March 2021. ALMA Cycle 7 will continue through September 2021, with currently non-completed projects ranked A, B, and C remaining in the observing queue. The ALMA Board is considering various courses of action for returning ALMA to Cycle 7 observing, currently suspended. New timelines for Cycle 7 (extended through September 2021) and Cycle 8 (expected to begin 1 October 2021) will be announced on the Science Portal in the coming weeks as the global situation evolves.

Unprecedented stress and challenges face our community members and their families. Our thoughts go out to all those affected by the current situation. The Regional ARCs continue to provide support to their communities. Please contact the ALMA Helpdesk (https://help.almascience.org/) if you have any questions or concerns.

Cycle 8 Call for North American Development Study Proposals Closed

The deadline for the Cycle 8 call for North American Development Study Proposals has passed; several proposals were received and will be evaluated internally and by an external review in the coming months.

ALMA and You!

Anthony Remijan & Melissa Hoffman

Win prizes like exclusive NAASC mugs and other cool limited-edition swag!

At the North American ALMA Regional Science Center (NAASC), we are making the best of staying at home by virtually getting to know our users and potential users alike. If you attended the Winter 2020 American Astronomical Society meeting in Honolulu, you may have noticed the fantastic prizes offered for simply filling out some information on your use of ALMA and the NRAO outreach programs.

To help us better understand you, the ALMA user (and possibly more importantly, the non-ALMA user), we ask you to take a short survey (seriously, will only take a minute or less) to gauge demographics, scientific interests, and familiarity with ALMA and NAASC programs in the hopes that we can better provide resources and information to the scientific community. The survey is online (https://naasc.typeform.com/to/t2SATh).

Because no survey would be complete without a prize, we're offering "a grab bag of NRAO swag" with limited edition prints and artwork, stickers, mugs, and other gifts to hopefully brighten your day! Winners will be chosen randomly as surveys come in.

The first winner will be announced 15 May 2020, so get your survey in early! We also encourage you to share this survey among friends and colleagues in the scientific community who are not already ALMA users. Note that only one survey entry is allowed per user!

Volunteers Needed to Serve on VLA, GBT & VLBA Science Review Panels

Dale A. Frail

Members of NRAO's Science Review Panels (SRP) play a very important role in identifying the Science Programs for these world-leading radio telescopes.

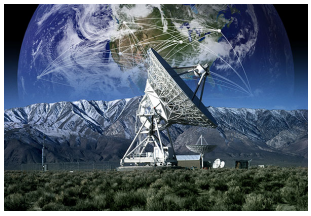
Being a reviewer could help you to:

- Learn what science other astronomers are interested in;
- Get a sense of what makes the most compelling proposals;
- Build your group of professional contacts and potential collaborators;
- Understand the review process for a major observatory.

If you are interested, volunteer to be an SRP member by filling out a simple form (https://www.aoc.nrao.edu/~mclausse/newex.html) .

VLBA to Discontinue Support for Mark5 Recorders & Data Modules

Walter Briskin



The Very Long Baseline Array (VLBA) began using Mark5C data recorders in 2011 after a transition from the earlier generation Mark5A units. This transition allowed a four-fold increase in data rates, from 512 Mbps to 2 Gbps. In 2018, the VLBA began its transition to the newer Mark6 4+ Gbps recording systems with array-wide recording and correlation capability in the first half of 2019. The motivation for this migration are manifold, including: (1) the ability to record at even greater data rates; (2) improved interoperability with modern data acquisition systems; (3) the use of purely commercial off-the-shelf electronics leads to lower cost maintenance and forward compatibility; and (4) increased agility in data access and utility in electronic transfer of data.

The Mark6 system has been in successful operation across the VLBA antenna array and the VLBA correlator for a year. Observing at 4 Gbps is now possible, doubling the data rate over the VLBA Mark5C implementation. Mark6 recorders have been deployed at the Jansky Very Large Array and the Green Bank Telescope as well.

All of the Mark5C units at the VLBA stations have been removed and are being converted to Mark6 "expansion units" which are to be used to increase the amount of recording media mounted at each site. At the VLBA correlator in Socorro, nine Mark5 units remain. These units will be turned off in June 2020 and converted to additional Mark6 units over the course of the next year. Unlike for the Mark5A to Mark5C transition, the correlator will have no backward compatibility for data recorded on previous generation data modules.

Backup Control Rooms Ready for VLA, VLBA, GBT

Dave Finley

Operator Kenneth Gibson in the new VLA backup control room in Socorro.

Ensuring that NRAO and GBO telescopes can continue uninterrupted operation in the COVID-19 era requires preparing for many "What If?" scenarios. One of those is, what if a telescope operator tests positive for the virus and the control room must be shut down for deep cleaning?

The answer, in both Socorro and Green Bank, is to prepare new, completely separate control rooms for each telescope.

The Very Large Array (VLA) control room is at the VLA site, and the Very Long Baseline Array (VLBA) is controlled from a dedicated area in the Domenici Science Operations Center (DSOC). Alternate control rooms now have been set up for both. These alternates are in the opposite side of the DSOC from the current VLBA control room. Access to both alternates now is restricted to ensure that they remain uncontaminated.

In Green Bank, an alternate for the Green Bank Telescope control room in the Jansky Lab has been set up in the warehouse.

Each alternate has been tested by actually operating the telescope for an extended period from the alternate. The tests verified that we can operate our telescopes normally in case a primary control room is unavailable for several days while being disinfected.

We certainly hope that these alternate control rooms will not be needed, but this precaution ensures that we will be able to continue observing without interruption in case of this eventuality.

NRAO – GBO Summer Student Experiences

Jim Braatz & Lyndele von Schill

NRAO, working with our partners at the Green Bank Observatory (GBO), is ramping up to deliver a rich and unique research and professional development experience for our incoming class of summer students. The summer program will be conducted remotely, as both the students and many mentors will work from their homes. The program will kick off this year with a remote "Radio Astronomy Bootcamp" during which the students will:

- participate in a lecture series on radio astronomy basics;
- learn about the telescopes operated by NRAO and GBO and enjoy remote tours;

- learn about the history of the observatories and radio astronomy;
- participate in panel discussions on career development; and
- conduct remote observations, and give group presentations on their projects.

NAC student Jasmin Washington in Green Bank

After the bootcamp, the focal point of each student's experience will be their research project conducted under the supervision of an NRAO or GBO staff mentor.

The NRAO – GBO program this year will host 38 students, undergrad and graduate. The summer program includes students participating in the Research Experience for Undergraduates (REU) program, the National Astronomy Consortium (NAC) program, and other internships.

The NAC will coordinate weekly virtual meetings and activities for a cohort of 14 students mentored by NAC partners at NRAO, Princeton University, Space Telescope Science Institute, University of Wisconsin-Madison, and Michigan State University.

We are looking forward to working with this newest cohort of next-generation astronomers and engineers.

From the Archives

Ellen Bouton

About this month's photo: Zoom is no substitute, especially for gatherings with food! At this potluck lunch in Charlottesville, Virginia in January 2013, people shared favorite dishes (and recipes) from their family traditions. The photo does not, and Zoom could not, do justice to the event. The gathering was billed as "A Taste of Diversity," but could now be called "A [Virtual] Taste of What We Are Missing."

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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