

## Upcoming Events



**Data Reduction Workshop** (<https://science.nrao.edu/facilities/evla/early-science/data-reduction-workshop>)

Sep 14 - 16, 2011 | Socorro, NM



**ALMA Software Development Workshop** (<https://science.nrao.edu/facilities/alma/naasc-workshops/almasoft2011>)

Oct 12 - 14, 2011 | Charlottesville, VA



**NRAO Town Hall at the 219th AAS** (<https://science.nrao.edu/science/aas/219/nrao-town-hall-at-the-219th-aas>)

Jan 10, 2012 | Austin, TX



**ALMA Special Session at the 219th AAS** (<https://science.nrao.edu/science/aas/219/alma-special-session-at-the-219th-aas>)

Jan 11, 2012 | Austin, TX



**Outflows, Winds and Jets Workshop** (<https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012>)

Mar 3 - 6, 2012 | Charlottesville, VA

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## NRAO Long-Range Plan

Fred K.Y. Lo, Director

The NRAO (5-year) Long Range Plan for Fiscal Years 2013 – 2017 captures the excellent status of the NRAO, as well as the strategic activities that are planned for the next several years, when the Expanded Very Large Array and the Atacama Large Millimeter/submillimeter Array will join the Green Bank Telescope and Very Long Baseline Array to form a complementary suite of forefront facilities in full science operations.

This Long Range Plan also describes how the NRAO facilities will enable the astronomy community to address a wide range of key science questions highlighted by the **New Worlds, New Horizons** ([http://sites.nationalacademies.org/bpa/BPA\\_049810](http://sites.nationalacademies.org/bpa/BPA_049810)) (NWNH) Decadal Survey report, as well as the longer-term development activities that will keep our research facilities at their best scientific performance and help realize the next-generation, medium-scale facilities recommended by the NWNH report, including the Hydrogen Epoch of Reionization Array, the North American Nanohertz Observatory for Gravitational Waves, and the Frequency Agile Solar Radiotelescope.

I invite you to read the NRAO Long Range Plan, which is available **on-line** (<https://science.nrao.edu/legacy/2013LRP/>) or as a **pdf file** (<https://science.nrao.edu/legacy/2013LRP.pdf>) download.

In the end, it is the science enabled by the NRAO that justifies its operations. Over the past decade, we have

worked hard to increase the Observatory's science impact. The most critical activities at the NRAO are funded via an Observatory-wide, science-driven prioritization process and a continual search for cost-effectiveness. As described in our Long Range Plan, our goal is to enable forefront research at radio wavelengths for the astronomy community in the US, and indeed the world.

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## EVLA Early Science: an ApJ Letters Special Issue

Chris Carilli

A special issue of the [Astrophysical Journal Letters \(http://iopscience.iop.org/2041-8205/739/1\)](http://iopscience.iop.org/2041-8205/739/1) – Volume 739, Number 1, 2011 September 20 – has just been published that is dedicated to Early Science results from the Expanded Very Large Array (EVLA). This special ApJ Letters issue includes 34 papers and demonstrates the broad range of forefront research being supported by the EVLA.

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## EVLA Update

Claire Chandler



Starting with the Expanded Very Large Array (EVLA) D-configuration in September 2011, all EVLA observers will have the ability to use 16 correlator sub-bands with up to 2 GHz instantaneous bandwidth, which will provide datasets a factor of eight larger than the current standard observations. Typical data rates will increase to about 15 GB per hour of observation for 1-second integrations, and most observations will result in data set sizes of typically several 10's of GB in size, and occasionally much larger.

While many NRAO users may have sufficiently fast Internet connections to continue to download individual data sets via the Internet, others may not. NRAO is therefore now offering a service for any user who would like their data to be shipped to them on a hard disk. Typically, we expect that users with more than 100 GB of data will want to have their data shipped on disk rather than retrieving it over the Internet, but we do not set a limit on the dataset size that users can try to retrieve themselves if they so wish.

The disk shipping service is not limited to EVLA data, but has some restrictions such as requiring the user to be registered at the [NRAO user portal \(https://my.nrao.edu/\)](https://my.nrao.edu/) and to use the [NRAO helpdesk \(https://help.nrao.edu/\)](https://help.nrao.edu/) with the same user name and password as for the portal for communications with the staff. Please see <https://science.nrao.edu/facilities/evla/data-shipment/> (<https://science.nrao.edu/facilities/evla/data-shipment/>) for further details of the NRAO disk shipment policy.

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## This Month @ the NAASC

### Additional ALMA Science Verification Data Available

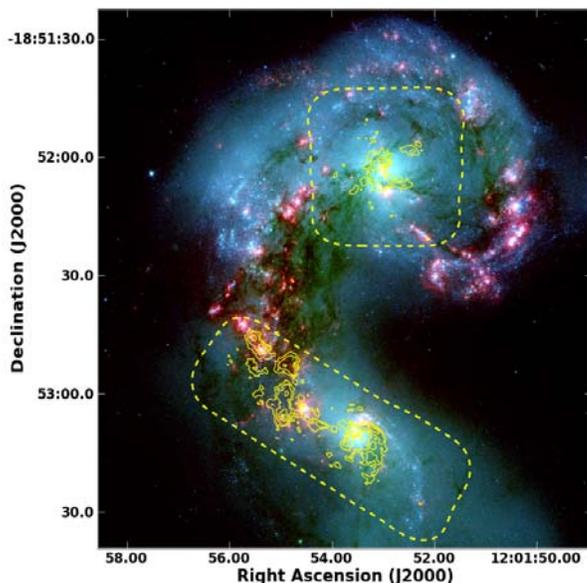
The second installment of ALMA Science Verification (SV) data is available from the [ALMA Science Portal \(https://almascience.nrao.edu/\)](https://almascience.nrao.edu/) via the "ALMA Data" link, or directly at <https://almascience.nrao.edu/alma-data/science-verification> (<https://almascience.nrao.edu/alma-data/science-verification>). These datasets consist of observations of the merging galaxy system known as the Antennae (NGC4038/9), and two observations of the proto-planetary disk TW Hya (supplementing previously released

data on this object). The Antennae dataset is the first mosaic data to be released by ALMA, and has an accompanying "[CASAguide \(http://casaguides.nrao.edu/index.php?title=AntennaeBand7\)](http://casaguides.nrao.edu/index.php?title=AntennaeBand7)" that explains all the calibration and imaging steps. The Common Astronomy Software Applications (CASA) package is used to calibrate and image ALMA data and is available at <http://casa.nrao.edu/> (<http://casa.nrao.edu/>).

The data products released here contain raw, uncalibrated data together with the necessary calibration tables to allow users to try their hand at a complete data reduction. Calibrated versions of the data are also provided, as are reference images in FITS format.

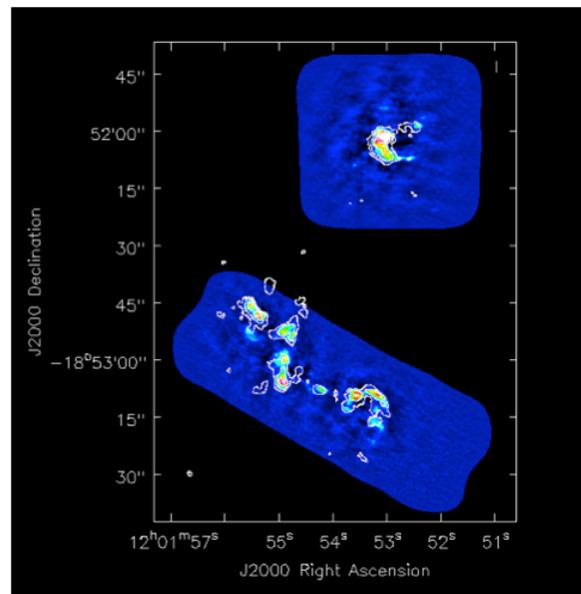
These SV datasets demonstrate the early capabilities of ALMA, before 16 antennas were available and while many of the subsystems were still being tested, so they should not be construed as representing the quality of the data that can be expected during Early Science. ALMA is still in the construction phase, and while the currently available datasets are impressive, the quality of data being collected using ALMA is continuously improving.

These products are the result of the dedicated work of a large number of staff at the Joint ALMA Observatory in Chile and the ALMA Regional Centers -- including the North American ALMA Science Center in Charlottesville -- who have participated in the commissioning activities, observations and data reduction that made this release possible.



[http://casaguides.nrao.edu/index.php?title=File:Antennae\\_foralmaCO3\\_2\\_withSV.png](http://casaguides.nrao.edu/index.php?title=File:Antennae_foralmaCO3_2_withSV.png)

Figure 1. The Antennae galaxies (NGC4038-39) comprise the closest ongoing merger of two spiral galaxies. The background image was taken by the Hubble Space Telescope and reveals the dust lanes and regions where super star clusters are formed. The yellow solid contours show the molecular gas as traced by CO(3-2) from ALMA Science Verification data. The yellow dashed lines show the area covered



[http://casaguides.nrao.edu/index.php?title=File:Alma\\_sma\\_compare.png](http://casaguides.nrao.edu/index.php?title=File:Alma_sma_compare.png)

Figure 2. The CO(3-2) total intensity map (moment 0) **comparison with Submillimeter Array** ([http://casaguides.nrao.edu/index.php?title=File:Alma\\_sma\\_compare.png](http://casaguides.nrao.edu/index.php?title=File:Alma_sma_compare.png)) (SMA) data. Color image is ALMA data, combining southern and northern mosaics. Contours show SMA data (Ueda, Iono, Petitpas et al., submitted to ApJ).

by the [ALMA Science Verification mosaic](http://casaguides.nrao.edu/index.php?title=File:Antennae_foralmaCO3_2_withSV.png)  
([http://casaguides.nrao.edu/index.php?title=File:Antennae\\_foralmaCO3\\_2\\_withSV.png](http://casaguides.nrao.edu/index.php?title=File:Antennae_foralmaCO3_2_withSV.png)).

Background image credit: NASA, ESA, STScI/AURA.

## ALMA Software Development Workshop

<https://science.nrao.edu/facilities/alma/naasc-workshops/almasoft2011>  
(<https://science.nrao.edu/facilities/alma/naasc-workshops/almasoft2011>)

NRAO will host a workshop 12-14 October 2011 in Charlottesville, Virginia to discuss software development plans for ALMA and closely related telescopes. The aim of the workshop is to generate a set of ideas for software applications that will enhance the science output from ALMA, and to stimulate the formation of consortia willing to submit these ideas to the ALMA Development Program for funding (including seed funding via NRAO and full funding via the ALMA Board) and/or the NSF directly. The workshop will concentrate on science data analysis of the large datasets that ALMA will produce. Topics will include line forest analysis, feature finding in large datacubes, matching data to simulations, visualization and compressive sensing.

To propose a presentation during the workshop, please contact Mark Lacy at [mlacy 'at' nrao.edu](mailto:mlacy@nrao.edu).

Due to the high demand for Charlottesville hotel accommodations in October, the deadline for guaranteed rooms and the special NRAO rate is 21 September. If you plan to attend the workshop, please make your [hotel reservations](https://science.nrao.edu/facilities/alma/naasc-workshops/almasoft2011/hotel) (<https://science.nrao.edu/facilities/alma/naasc-workshops/almasoft2011/hotel>) early.

## Outflows, Winds and Jets: from Young Stars to Supermassive Black Holes

<https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012>  
(<https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012>)



The NRAO North American ALMA Science Center (NAASC) will host its 6th annual science workshop – *Outflows, Winds and Jets: From Young Stars to Supermassive Black Holes* – in Charlottesville, Virginia, 3-6

March 2012. The venue is the Omni hotel, located conveniently near downtown Charlottesville. Pre-registration is open at the [conference web site \(https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012\)](https://science.nrao.edu/facilities/alma/naasc-workshops/jets2012). Pre-registration is not required, but will ensure that you receive timely information about the conference program and logistics. Registration will open 1 November 2011.

2012 will be a special year for radio wavelength science. In addition to the much anticipated operation of ALMA Early Science, other upgraded NRAO facilities – EVLA, GBT and VLBA – are joining forces to offer the astronomy community unprecedented access to superb imaging capabilities, the highest angular resolution and sensitivity, broad spectral coverage, and the highest precision. These telescopes together will transform the science of jets and outflows from young stars to supermassive black holes. This workshop is an exciting opportunity to bring together active researchers interested in outflow-bearing systems of different mass and size scales for a refreshing view of these spectacular phenomena.

Focus areas include:

- Deeply probing the driving engines
- Emission and absorption properties of outflows, winds, and jets
- Structures and chemistry of the outflow systems at varying scales
- Cross-talk among the participating communities, and
- Synergy programs with the featured facilities and other large telescopes.

The approach adopted by this workshop is interdisciplinary. Science arising across the mass and size scales will be naturally blended in. We hope to promote interactions among the various communities from young stars to active galactic nuclei, and to facilitate mutual exchanges and joint efforts at this special time.

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## ALMA Progress Toward Early Science

Al Wootten



[\(images/5\\_1.png\)](#)

Figure 1. Eighteen ALMA antennas prepare to scan the frigid winter sky on 13 August. Credit: NAOJ, ALMA (ESO/NAOJ/NRAO).

 [Zoom \(images/5\\_1.png\)](#)



[\(images/5\\_2.png\)](#)

Figure 2. ALMA includes an array within the array: the Atacama Compact Array (ACA) consists of a dozen 12m antennas that will gather data on shorter baselines than is possible with the larger 12m antennas. The first of the 7m antennas comprising the ACA arrived at the AOS during August. Credit: ALMA (ESO/NAOJ/NRAO).

[+ Zoom \(images/5\\_2.png\)](#)



[\(images/5\\_3.png\)](#)

Figure 3. The Front End Service Vehicle arrives at the ALMA gate from Taiwan. Credit: ALMA (ESO/NAOJ/NRAO).

[+ Zoom \(images/5\\_3.png\)](#)

August opened with sixteen ALMA antennas in place on the 16500 ft elevation Array Operations Site (AOS). Weather has been generally excellent, as expected during the altiplanic winter, during which temperatures never exceed freezing. The commissioning and science verification team focused attention on several areas, including a polarization campaign and further science verification projects. Among the ALMA antenna designs, there are four variants from three contractors, all meeting ALMA specifications. With the arrival of the first of the twelve 7m antennas, provided by the East Asian partner, all of the major antenna designs are

now present in the array and undergoing commissioning. A total of twenty antennas have been accepted and integrated; not all of these are present at the AOS at any given time owing to the schedule for upgrading antennas and their electronics.

Until now, servicing of receiver electronics has generally meant that an antenna, with its front end, has had to be transported from AOS to the lower elevation Operations Support Facility (OSF). With the recent arrival of the Front End Servicing Vehicle, a North American deliverable fitted for ALMA service in Taiwan, ALMA has the ability to change out receiver dewars directly at the antenna.

New components continue to arrive in Chile for integration at the OSF. The 21st North American antenna should arrive in port by Labor Day. Thirteen East Asian antennas have arrived at the OSF. There are elements of ten European antennas at the OSF. Thus, two thirds of the antennas will be at the ALMA site in Chile, either in the contractors' assembly camps, at the AOS or at the OSF, at publication of this article. During the month, the North American Front End Integration Center at NRAO delivered its ninth assembled Front End to Chile. ALMA has received 24 Front End assemblies, with half a dozen more expected to arrive at the OSF in September.

During August the process of reviewing ALMA proposals was carried out as reported in last month's eNews. **North American ALMA Science Center (NAASC (<https://science.nrao.edu/facilities/alma/intro-naasc>))** personnel were involved with the process at the Santiago Central Office, as Technical Assessors reviewing proposals and as Technical Secretaries for the science panel meetings. The Joint ALMA Observatory (JAO) in concert with the three ALMA Executives – NRAO, ESO and NAOJ – is currently finalizing the science-ranked list of projects to be scheduled during "Cycle 0" Early Science, the inaugural science observing period on ALMA. Shortly thereafter the NAASC will assign staff to assist successful North American proposers with reviewing their projects' Phase II materials for data acquisition, and ultimately with the observing products and data reduction. The PIs will be contacted by their 'friends' as this process continues.

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## **VLBA to Commence Daily Earth Orientation Measurements**

Walter Brisen, for the VLBA staff

Starting 1 October 2011, NRAO and the U.S. Naval Observatory (USNO) will begin a coordinated daily effort to measure the orientation of the Earth relative to the inertial quasar reference frame. These data are used to calibrate the Global Positioning System (GPS) and form essential measurements that allow relative astrometry to be performed with the NRAO Very Long Baseline Array (VLBA). The data collected during these observations will be electronically transferred to the USNO correlator for rapid processing.

These daily observations will be made with two VLBA antennas: Pie Town, NM and Mauna Kea, HI. Some VLBA science observations will be affected, especially long observations; users may see these two antennas drop out for a 2 hour period of time. We will do everything possible to minimize the impact on science observations. Active users will receive some additional information as the start date for this USNO program approaches.

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## **NRAO Director Search**



Associated Universities, Inc. (AUI) invites nominations and applications for the position of Director of the National Radio Astronomy Observatory.

The next NRAO Director will be responsible for leading and managing this large national enterprise in support of the entire astronomical community and helping sustain robust and effective scientific programs for the benefit of the nation, as well as for overseeing NRAO outreach activities that extend benefits of the science to the broader public. The Director will manage the transition of NRAO's major new facilities into routine operations over the next few years, as well as the continued development of NRAO itself as an observatory that meets the scientific community's, and the nation's, most advanced facility, technology, and operational needs in the next decade.

Please visit the [AUI web site \(http://www.aui.edu/pr.php?id=20081162\)](http://www.aui.edu/pr.php?id=20081162) for additional information.

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## Career Opportunities

### New Postings

**NAASC Postdoctoral Fellow:** (<https://careers.nrao.edu/applicants/Central?quickFind=50690>) The National Radio Astronomy Observatory in Charlottesville, VA is seeking a postdoctoral fellow to work with the NAASC scientific staff. The successful candidate should expect to spend 50% of their time on independent research, with the remaining time spent on developing ALMA expertise and assisting the NAASC scientific staff in the support of ALMA users.

**NRAO Postdoc:** (<https://careers.nrao.edu/applicants/Central?quickFind=50688>) The National Radio Astronomy Observatory in Socorro, New Mexico is accepting applications for three postdoctoral positions to participate in the scientific commissioning and technical development of the EVLA and VLBA. These positions (50% research, 50% support) provide the opportunity for hands-on training in areas of technical expertise and observatory operations.

**Jansky Fellow:** (<https://careers.nrao.edu/applicants/Central?quickFind=50689>) The National Radio Astronomy Observatory is recruiting for Jansky Fellows. The purpose of the Jansky Fellowship Program is to provide an opportunity for young scientists to establish themselves as independent researchers so that they may more effectively compete for permanent positions. Fellows formulate and carry out investigations either independently or in collaboration with others within the wide framework of interests of the Observatory.

**NRAO Postdoc:** (<https://careers.nrao.edu/applicants/Central?quickFind=50695>) The National Radio Astronomy Observatory in Green Bank, WV is seeking a postdoctoral fellow to join their scientific staff. The NRAO Postdoc will have 50% of their time available for independent research and the remaining time will be devoted to support of the GBT and GBT observers.

**Systems Administrator I:** (<https://careers.nrao.edu/applicants/Central?quickFind=50696>) The National Radio Astronomy Observatory in Charlottesville, VA is accepting applications for a Systems Administrator I. Under general supervision, the Database Systems Administrator will investigate reported issues and execute assigned implementation tasks for Oracle database and Linux server support.

**Scientific Programmer:** (<https://careers.nrao.edu/applicants/Central?quickFind=50664>) The National Radio Astronomy Observatory in Charlottesville, VA is seeking a Scientific Programmer who will research and develop software to visualize and analyze ALMA data. The developer must become familiar with Common Astronomy Software Applications (CASA) code and practices, work within the existing CASA framework to improve and develop C++ code using the Qt platform, and extend the DBUS interface to enable interactive use of existing analysis tools within the CASA system.

**ALMA Program Manager:** (<https://careers.nrao.edu/applicants/Central?quickFind=50665>) The Joint ALMA Observatory (JAO) located in Santiago, Chile is recruiting for a Program Manager to provide leadership and management to the Program Management Group. The Program Manager will be responsible for the day-to-day management of observation execution, tracking of the status of ALMA programs as well as data quality control and coordination of these activities with the three ALMA Regional Centers (ARCs) located in Europe, North America and East Asia.

**Project Scientist:** (<https://careers.nrao.edu/applicants/Central?quickFind=50650>) The National Radio Astronomy Observatory in Green Bank, WV is recruiting for a Project Scientist. The successful candidate will provide scientific guidance to the project manager and project team; lead the testing and commissioning of the receivers on the 20 Meter Telescope; lead the development of a time allocation framework that enables scientific and educational users; and advise UNC scientists and programmers who are developing the user interface and data reduction tools as well as supervise early science with the 20 Meter.

**Division Head:** (<https://careers.nrao.edu/applicants/Central?quickFind=50655>) The National Radio Astronomy Observatory in Green Bank, WV is seeking an enthusiastic and energetic person to head the Software Development Division. The Software Development Division head is responsible for managing the division as well as working with the other division heads in Green Bank to plan the future of the telescope and optimize its scientific use.

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## NRAO FY 2010 Annual Report

Mark Adams

The NRAO Annual Report for Fiscal Year 2010 summarizes the numerous science, development, operations, and construction activities that were conducted across the Observatory from 1 October 2009 through 30 September 2010. This Annual Report can be viewed [on-line \(https://science.nrao.edu/legacy/annualreport2010\)](https://science.nrao.edu/legacy/annualreport2010) and can be downloaded in [Adobe Acrobat pdf format \(https://science.nrao.edu/legacy/NRAO\\_FY2010\\_AnnualReport.pdf\)](https://science.nrao.edu/legacy/NRAO_FY2010_AnnualReport.pdf) (145 MB file).

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## NRAO Star Awards

Tim Bastian, Observatory Science Operations

NRAO Star Awards are made to staff members in recognition of exceptional contributions to the Observatory mission. So it is a great pleasure to announce that Star Awards were recently made to Dana Balsler, Mark Claussen, Joan Wrobel, and Jessica Utley in recognition of their outstanding contributions to the planning and implementation of the new NRAO proposal evaluation and time allocation process that was put in place

beginning with the January 2011 Call for Proposals. A great deal of work was required of each of these individuals to bring our new proposal and time allocation process to life. We are grateful for their dedication and extend our sincere congratulations to Dana, Mark, Joan, and "JJ" for their Star Awards!

## From the Archives

Ellen Bouton

[\(images/archives\\_1.png\)](#)



**About this month's photograph:** Charlottesville's Ivy Road Gang, headed by 2011 Jansky Lecturer Sandy Weinreb, gather for a late 1983 farewell lunch for retiring Art Shalloway. [Left to right] Walter Brown, Vince Summers, Ron Harris, Larry D'Addario, Warren Richardson, Marek Faber, Mike Balister, Kirk Crady, Harry Dill, Monroe Petty, Gene Runion, John Archer, Sandy Weinreb, John Granlund, Art Shalloway, Lucky Luckado, Marian Pospieszalski, Karen Thach, Garnett Taylor (behind Karen), Cathy Burgess, Ray Escoffier, Marshall

Crawford, Matt Dillon, Bill Porter.

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, [ebouton@nrao.edu](mailto:ebouton@nrao.edu) (<mailto:ebouton@nrao.edu>).

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