

Welcome to the NRAO Town Hall



Tony Beasley
NRAO



Atacama Large Millimeter/submillimeter Array
Karl G. Jansky Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array



NRAO Town Hall Agenda

- **NRAO Overview**
 - Tony Beasley, NRAO
- **Star Formation**
 - Rachel Akeson, Research Scientist, NASA Exoplanet Science Institute, IPAC
- **The High-z Universe**
 - Dominik Riechers, Assistant Professor of Astronomy, Cornell University
- **Audience Q&A**



NRAO Overview

- Research Facilities
- Semester 2013B Call for Proposals
- NSF Portfolio Review Impacts
- Community Support

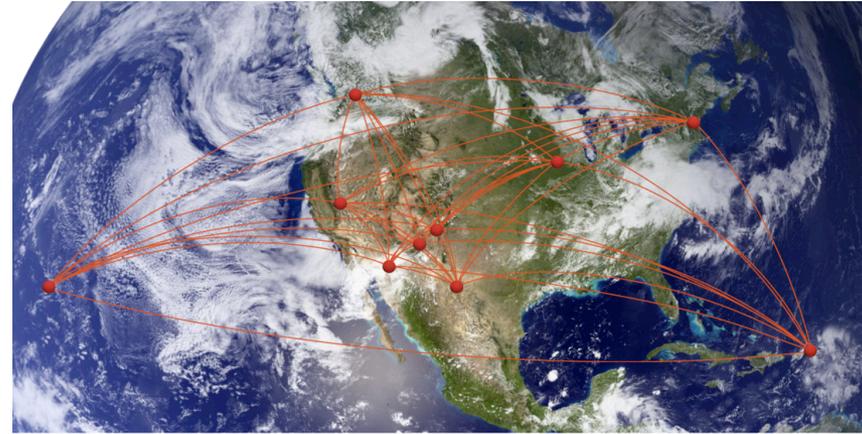


Research Facilities

Very Large Array



Very Long Baseline Array



Green Bank Telescope



Atacama Large Millimeter/submm Array



Atacama Large Millimeter/submm Array

- ALMA Early Science underway since Sep 2011
- Cycle 0 Early Science observing completed Dec 2012
- Cycle 1 Early Science observing begins Jan 2013 and extends for 10 months



ALMA Cycle I Early Science

- Total time for Cycle I Early Science observations ~ 800 hours
- 196 highest-priority Cycle I projects selected
- Antennas
 - 32 x 12m antennas for main array
 - 9 x 7m antennas for Atacama Compact Array (ACA, only with use of main array)
 - 2 x 12m antennas for Total Power Array (spectral line data only)
- Configurations
 - Main array: 6 configurations, max baselines 160m - 1 km, 15m min baseline
 - ACA: 1 config, baselines 8.9 - 32.1m
- Mixed correlator modes, i.e., low and high resolution
- 150 pointing mosaics
- Target of Opportunity observing/ Director's Discretionary Time observing
- Time critical observations, with scheduling sharpness of ~3 weeks
- Combination of main array, Atacama Compact Array, and total power data



Atacama Large Millimeter/submm Array

- Recent *First Year of ALMA Science* conference demonstrated ALMA's broad & significant science impact to almost every field of modern astrophysics
- 193 attendees from around the world
- <http://www.almasc.org/2012/>



ALMA

The First Year of
ALMA Science

Puerto Varas, Chile
December 12-15, 2012

Exciting results from ALMA Early Science observations, from the Solar System to the high-redshift Universe, with an outlook to the future

RadioNet

Scientific Organizing Committee

Leonardo Testi (ESO, Chair)
Paolo Andreani (ESO)
Luisa Ball (JAO)
Alberto Scaife (University of Maryland)
Crystal Brogan (NRAO)
Françoise Combes (Observatoire de Paris)
Robi Inson (Royal Observatory of Edinburgh)
Kelsey Johnson (University of Virginia)
Carol Lonsdale (NRAO)
Gautier Mathys (JAO)
Munetake Momose (Osaka University)
Neil Nagar (Universidad de Concepción)
Laini-Mie Nymen (JAO)
Toshihiko Otahi (Daito Prefecture University)
Alican Paik (JAO)
Masso Ballo (JAO)
Keri Tabernata (NAOJ)
Ewine van Dishoeck (Leiden Observatory)
Al Wootten (NRAO)
Martin Zwaan (ESO)

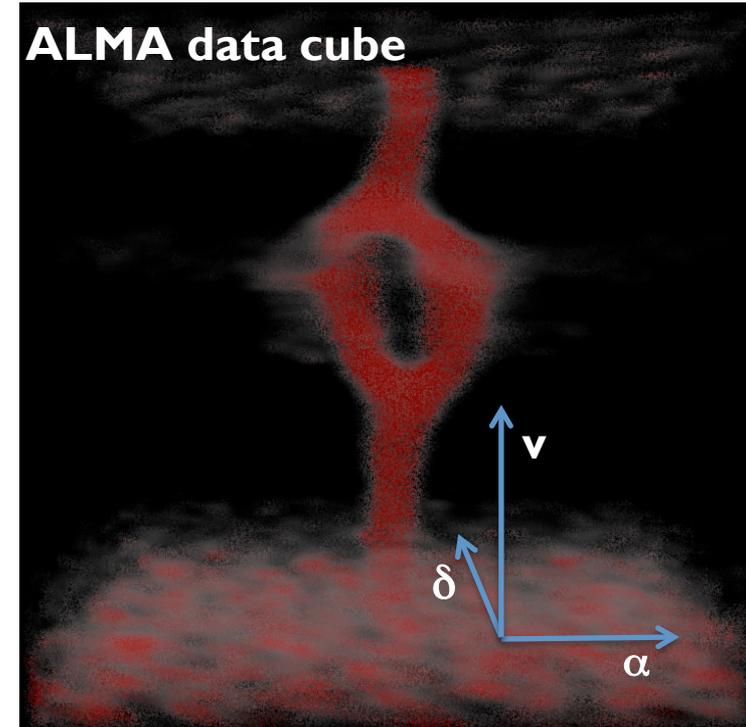
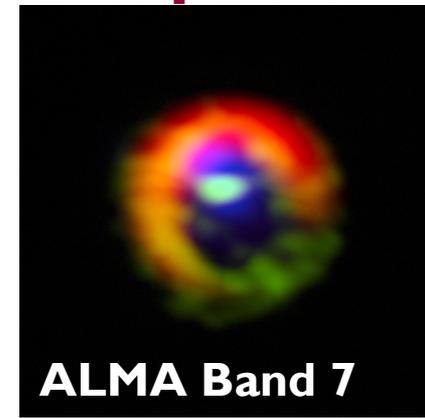
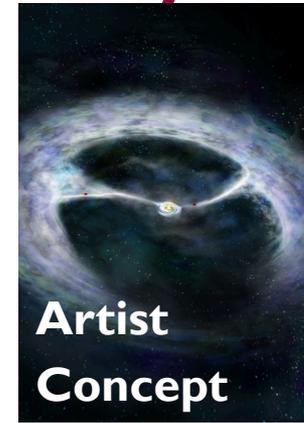
Atacama Large Millimeter/submillimeter Array

ESO
NAOJ
NRAO



Gas Flows through a Protoplanetary Disk Gap

- HD142527: IR data shows 10 AU inner disk, 140 AU gap, disrupted outer disk 140+ AU
 - Disruption attributed to unseen planetary mass body(s) at ~ 90 AU
- ALMA sensitivity and spatial resolution enabled images of dense gas in gap-crossing filaments, along with diffuse CO gas within gap.
 - Observation explains how the observed high accretion rate may be maintained
 - Dynamical models suggested outer disk gas could be channeled by putative protoplanets through gap-crossing bridges feeding the inner disk: these observations support these models



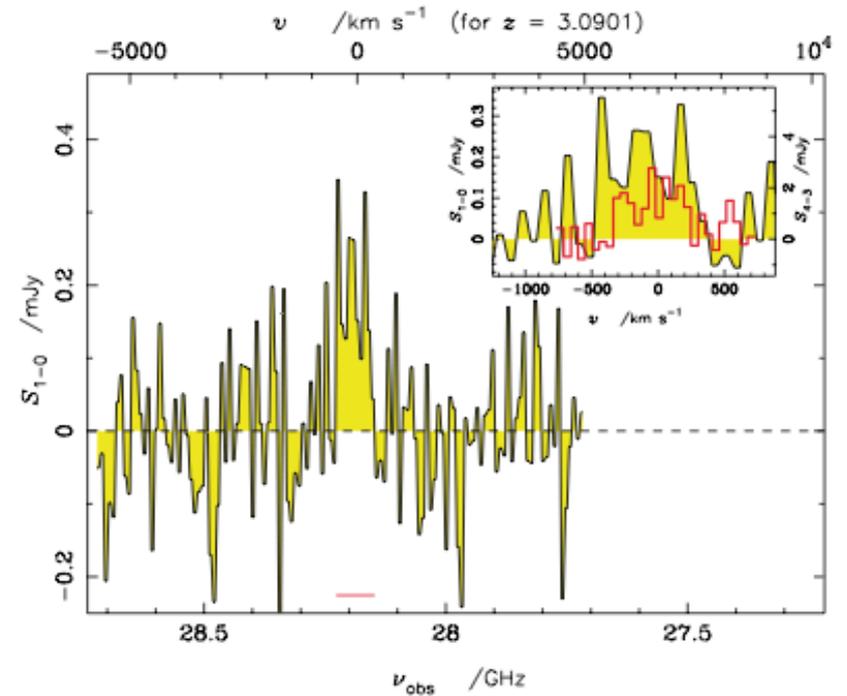
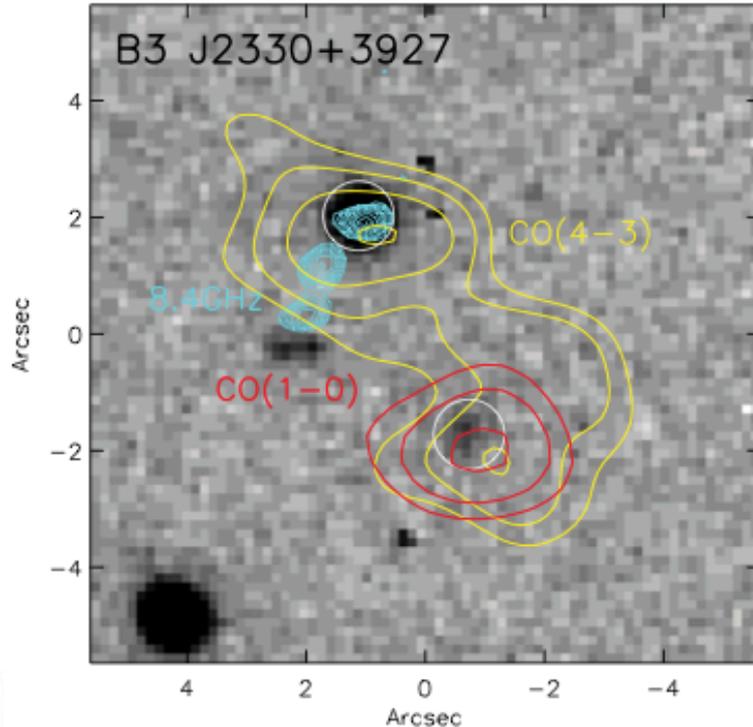
Very Large Array

- Expanded Very Array construction project completed on schedule, on budget, and delivering per its scientific specs
- Enabling new science: full science operations initiated Jan 2013
- Very Large Array is a new instrument: 10 – 100X more capable



Molecular Gas in Forming Massive Galaxies

- Ivison et al imaged CO emission from two $z=3$ radio galaxies using VLA & PdBI
- Results indicate extreme, dense starbursts in complex, merging gas rich galaxies
- Show evidence for AGN feedback on the molecular gas through enhanced turbulence and high CO excitation



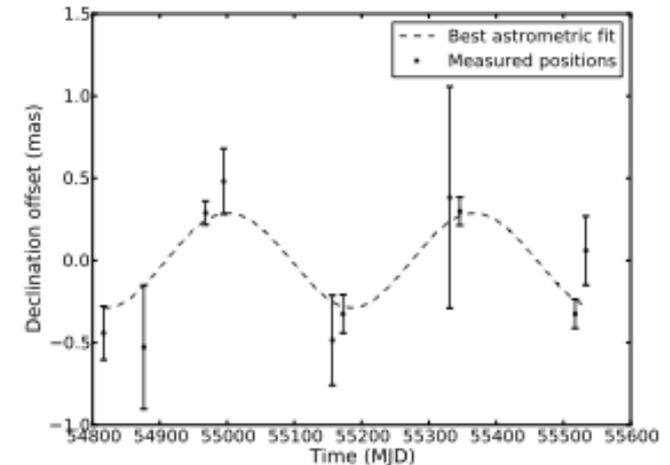
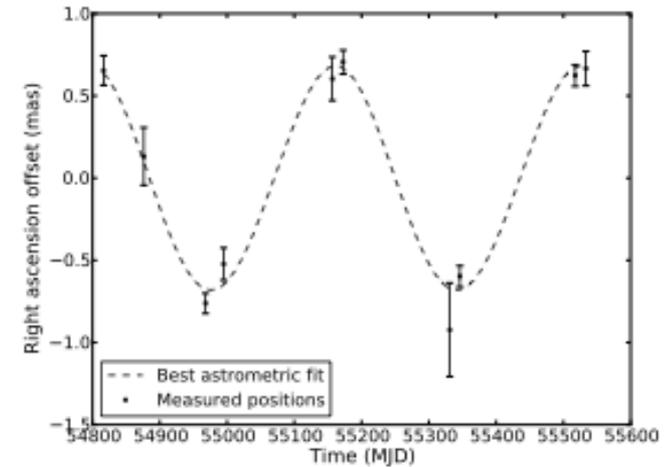
Very Long Baseline Array

- Ten 25m diameter radio telescopes on interferometric baselines to 8,600 km
- Highest resolution imaging telescope: sub-milliarcsecond resolution
- Highest precision astrometric telescope: $10 \mu\text{-arcsec}$
- Key Science Project emphasis
- Sensitivity Enhancement Project well underway
- Partner support of VLBA operations



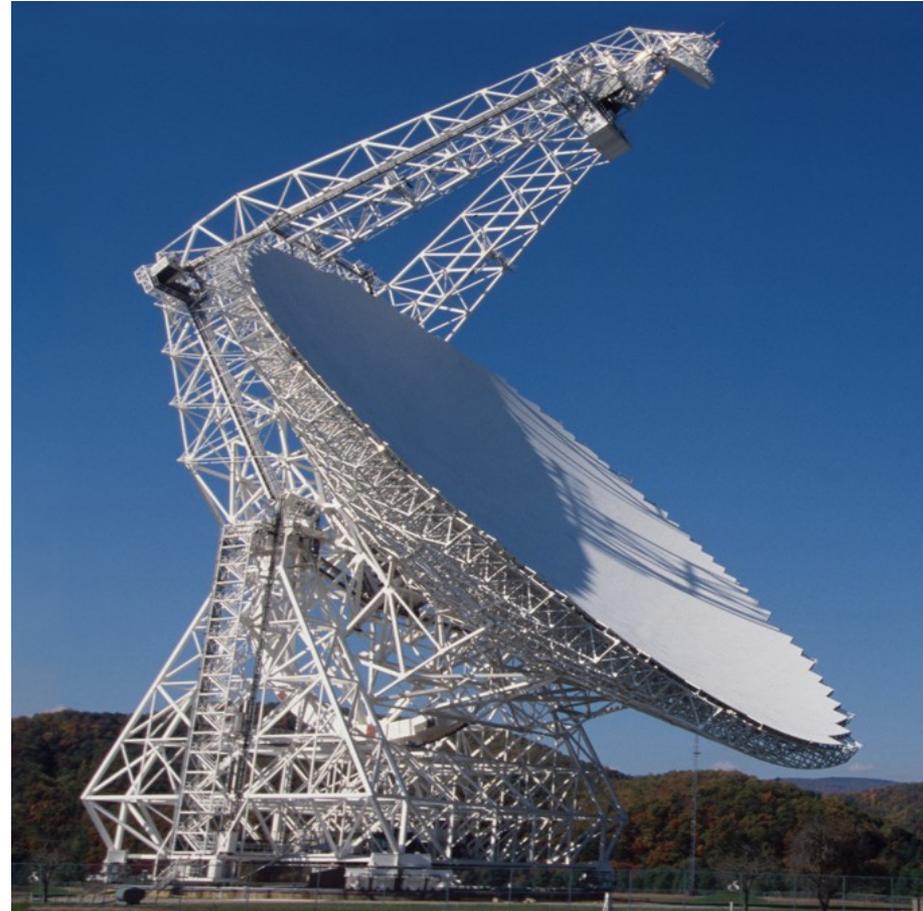
Transitional pulsar characteristics accurately measured with the VLBA

- Deller et al: a direct parallactic distance to transitional ms pulsar J1023+0038
- In crucial, short-lived evolutionary phase of mass transfer that leads to high neutron star spin-up to a ms pulsar
- Parallax (0.731 ± 0.022 mas), proper motion (17.98 ± 0.05 mas/yr), & previous optical obs yield
 - 1368 pc distance
 - neutron star mass of $1.71M_{\odot}$
 - 3D space velocity of 126 km/s.



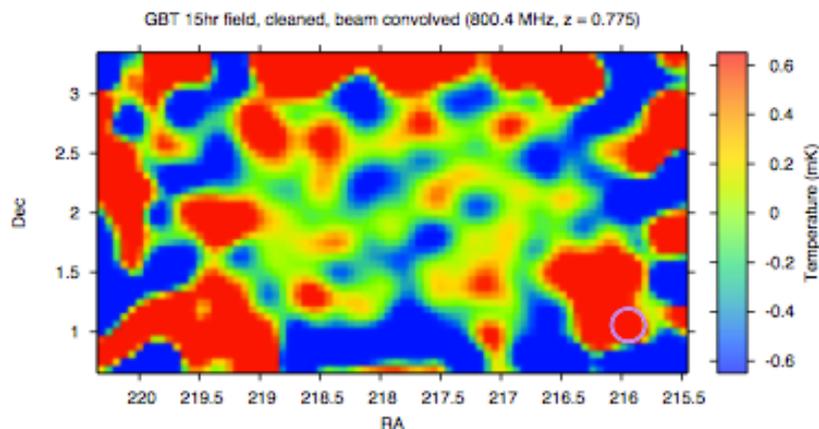
Green Bank Telescope

- Largest fully-steerable radio telescope
- Sensitivity & frequency coverage enable a wide-range of science
- State-of-the-art detector suite for spectroscopy, pulsar observations, continuum, Very Long Baseline Interferometry
- Focal Plane Array development program increasing observing efficiency

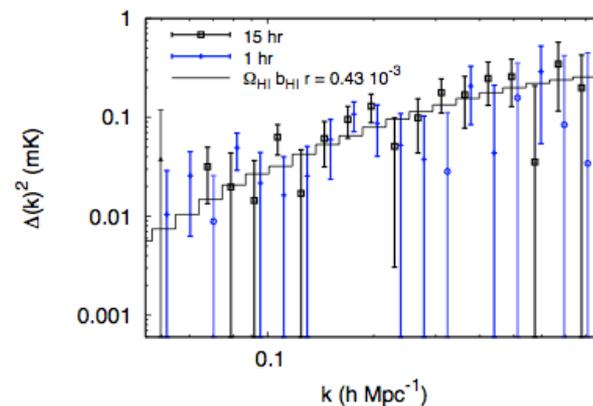


HI intensity mapping with the GBT

- Masui et al (2012) present HI intensity mapping over 41 deg. sq. in the WiggleZ Dark Energy Survey area at $0.6 < z < 1$
- Measures integrated HI surface brightness: 1000s of galaxies & large cosmic volumes
- Cross-correlation with smoothed optical spectroscopic data shows a clear correlation, indicating HI signal on deg-scales
- HI intensity consistent with optical quasar absorption line measurements for the evolution of the cosmic HI mass density



Continuum-subtracted
total intensity



Cross power spectrum with
optical redshift survey

Semester 2013B Call for Proposals

- **NRAO Call for Proposals for Semester 2013B published Thursday, 3 January 2013**
- Observing proposals due Friday, 1st February 2013, 5 p.m. EST
 - Very Large Array
 - Very Long Baseline Array – High Sensitivity Array – global Very Long Baseline Interferometry
 - Green Bank Telescope
 - *Applies to requests for time from 1 August 2013 – 31 January 2014*
 - ***<https://science.nrao.edu/enews/6.1>***



Observatory Challenges

- NRAO budget evolving rapidly – transition from two construction projects to Operations... difficult staff, responsibility transitions
- US science – NSF – NSF/AST – facing considerable uncertainty, downward pressure. Planning processes underway (e.g. Portfolio Review).
- Science community: new instruments, new user science requirements and expectations, new modes of research rapidly driving our business.
 - *Data volumes, science-ready data, VAO, service & dynamic observing,*
- Response
 - Internal: updating Observatory structure, function
 - Funding: working closely with NSF, seeking partnerships, opportunities
 - SciCom: interact with users, committees/WGs. Send us email.
- **Commitment to the mission and our community remains strong.**



NSF Portfolio Review Impacts

- **NSF-AST Portfolio Review Committee recommended divestiture of GBT and VLBA by FY 2017**
- If implemented by NSF-AST, these recommendations will have major impacts on the US astronomy community
 - Critical & irreplaceable scientific capabilities would be surrendered
 - Community's ability to train young scientists & engineers would be greatly reduced
 - Research programs that address high priority science themes would be prematurely terminated; radio wavelength access for US faculty & students would be significantly reduced. Over-subscription rates would increase at remaining facilities.
 - US leadership in radio astronomy would be diminished
- Core issue is: AST funding @ NSF. Signal: 3.5%. Error: 0.7%
- Need: advocacy, outreach, participation. Issue: US Science funding. Issue: facilities vs. grants at NSF. Issue: Coordinate, speak, act.



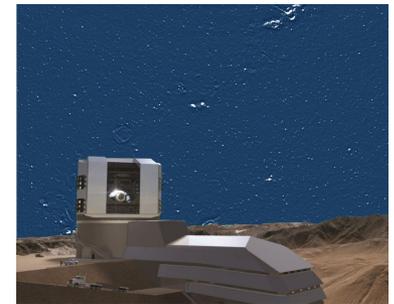
Community Support

- **NRAO CASA Tutorial**
 - Wednesday, 9 January 2013: 2:00-3:30 pm, Room 103B
 - software processing overview for novice VLA and ALMA users
- **ALMA Data Reduction Tutorial**
 - 28 February – 1 March 2013: NRAO-Charlottesville, VA
 - overview of ALMA data reduction for Cycle 0 & I proposers
- **3rd VLA Data Reduction Workshop**
 - 8-12 April 2013: NRAO-Socorro, NM
 - Assist observers with the challenges posed by the vastly increased flexibility and complexity of the VLA



Community Support

- **Transformational Science with ALMA: From Dust to Rocks to Planets**
 - 8 - 12 April 2013: Kona, Hawaii
 - Explore protostellar disk evolution from formation to dissipation
- **Radio Astronomy in the LSST Era**
 - 6 - 8 May 2013: NRAO - Charlottesville, VA
 - Explore the landscape of radio wavelength observations in LSST era
- **NAIC-NRAO Single Dish Summer School**
 - 10-17 July 2013
 - Arecibo Observatory, Puerto Rico
 - Provide knowledge & practical experience in single-dish radio astronomy



Community Support

- Jansky Postdoctoral Fellowships
- Student Programs
 - 25-30 undergrad/grad students each summer
- Undergrad/Grad internship & Co-op programs
 - Support science & engineering research programs
- Student Observing Support
 - Financial support of up to \$35K/investigator/year
- Grote Reber Doctoral Fellowship Program
 - Resident dissertation research with NRAO staff
- Visitor Program





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