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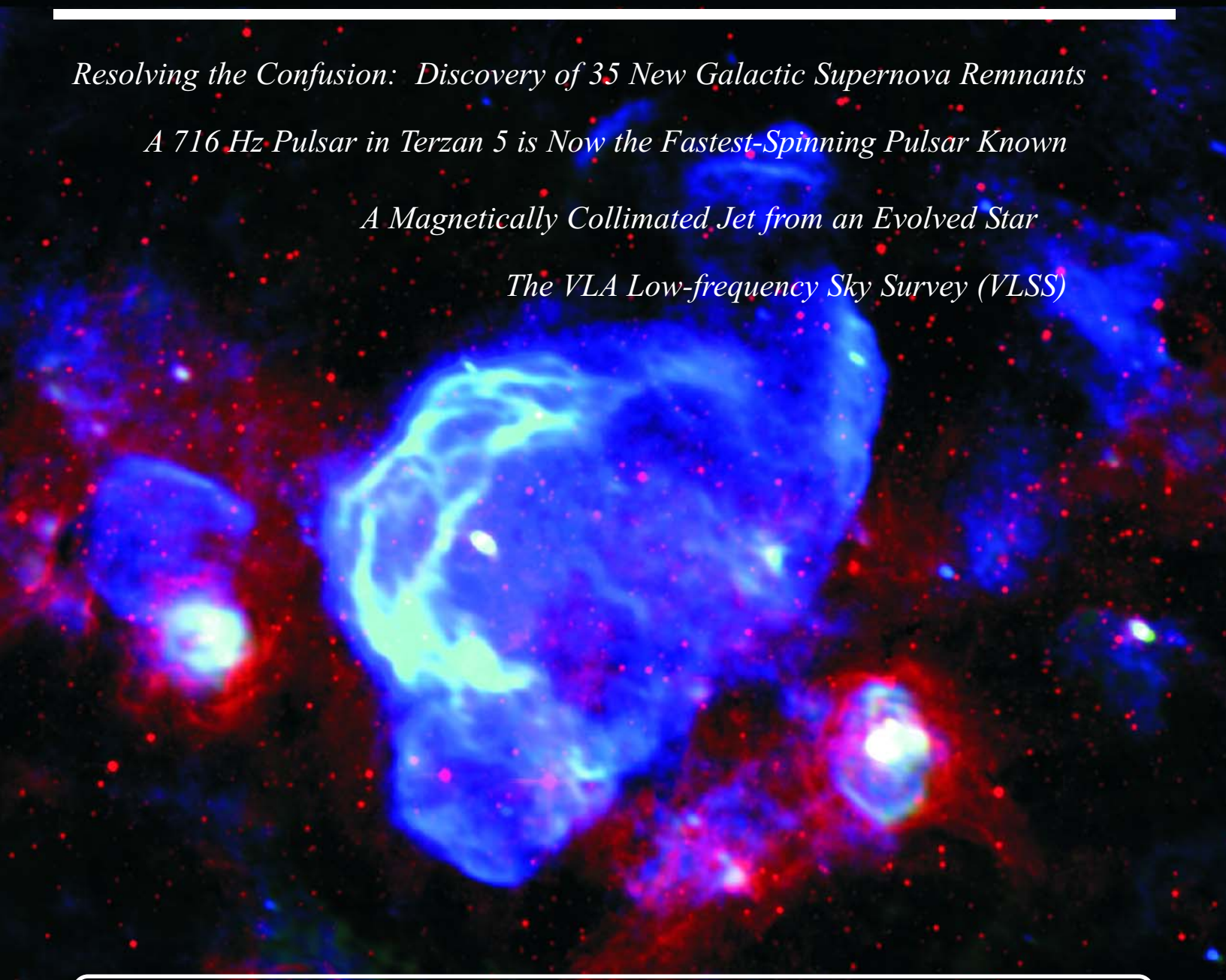

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Cover: A composite image of the Galactic plane near W28: blue (VLA 90 cm), green (SGPS + VLA 20 cm), red (MSX 8 μm). Image courtesy of Crystal L. Brogan, et al. See their article on page 4 of this issue.

The NRAO Graphics Department will be happy to assist you in the production of images for your article as well as for your research papers. Contact Patricia Smiley (*psmiley@nrao.edu*) with your request.

If you have an interesting new research result obtained using NRAO telescopes that could be featured in the NRAO *Newsletter*, please contact Jim Condon at *jcondon@nrao.edu*. We particularly encourage Ph.D. students to describe their thesis work.

Editor: Mark T. Adams (*mtadams@nrao.edu*); Science Editor: Jim Condon (*jcondon@nrao.edu*);
Assistant Editor: Sheila Marks; Layout and Design: Patricia Smiley

Fred K. Y. Lo, Director

On May 10, the National Science Board (NSB) reaffirmed the Atacama Large Millimeter Array (ALMA) Project by approving additional funding to complete the project. This NSB approval is recognition of the transformational nature of the science ALMA will enable. This action provides the National Science Foundation (NSF) Director with spending authority for the revised budget and scope of the project, a very important step towards acquiring the funds from the Administration and the U.S. Congress to complete ALMA.

The cost increase is due to a number of factors, such as the complexity of an international project, a significant increase in commodity prices, and a booming economy in Chile. Starting last October, the ALMA project underwent a series of reviews of its budget and schedule, as well as its management, by expert panels organized by the ALMA Board and by the NSF. All the reviews found the technical readiness of the project to be extremely high. These reviews recognized the high quality of the people involved with the project and the significant efforts made by the project to control and manage its budget and schedule. These were key factors in obtaining the NSB approval, as was the effort the ALMA Board has made to ensure its ability to act in a timely way, while holding the project accountable.

Starting more than a year ago, the ALMA project went through a thorough review of the scope, budget, and schedule by the ALMA team (the re-baseline process), under the lead of ALMA Project Manager Tony Beasley of the Joint ALMA Office. The ALMA project was then reviewed by an international expert panel, headed by Steve Beckwith of the Space Telescope Science Institute, appointed by the ALMA Board. Subsequent to the successful review of the entire ALMA project, the NSF commissioned another panel, headed by Don Hartill of Cornell, to review the cost and management of the North American part of ALMA to ensure the re-baselined project can be successfully completed under the proposed budget. The North American ALMA Project Manager Adrian Russell, the entire ALMA team, and the supporting NRAO scientific, technical, and administrative staff deserve our sincere thanks for their excellent work on the budget re-baselining and their outstanding performance through the multiple project reviews.

This NSB approval also could not have been accomplished without the strong and unwavering support of the astronomical community in North America, and indeed the world. The NRAO and its international partners, the European Southern Observatory and the National Astronomical Observatory of Japan, are dedicated to building and operating an ALMA that will fulfill its scientific promise and open extraordinary new frontiers.

Elsewhere in this issue of the NRAO Newsletter you will read about the excellent progress being made on ALMA construction in Chile, and the continuing progress on ALMA technology development and testing at the NRAO Technology Center in Charlottesville, at the Antenna Test Facility in New Mexico, and elsewhere. Excitement about ALMA science continues to build, and we hope that many of you will attend one of the up-coming meetings that will focus on ALMA science such *Science with ALMA: A New Era for Astrophysics*, which will convene in Madrid, Spain from November 13 –16, 2006.

Two major and productive reviews of the Observatory's progress on its other major construction project, the Expanded Very Large Array (EVLA), took place in Socorro at the Array Operations Center in May. The EVLA Advisory Committee met on May 8 – 9, and the NSF Mid-Project Update took place on May 11 – 12. These meetings thoroughly reviewed the status and future of the EVLA Project. The presentations by the EVLA project staff were clear and effective, and the team did an excellent job during what was a rather grueling week. The NRAO is particularly grateful for the time and careful effort invested by each member of these review committees.

The EVLA Advisory Committee found the project to be making strong and continuous progress towards its goals. They were impressed, for example, by the Project team's efficient implementation of pre-commissioning tests. The committee was concerned, however, that the profile of the EVLA in the astronomical community is inordinately low. The committee's good suggestions for improving the EVLA Project's visibility in the broader community included involving astronomers as early as possible and inaugurating a postdoctoral program in New Mexico that would support EVLA commissioning activities and effectively train the next generation of EVLA users. The committee also urged the NRAO to aggressively engage the user community in test observations in support of EVLA commissioning as soon as possible.

The NRAO is continually seeking new and innovative ways to provide the astronomical community access to our facilities and enable the broadest range of scientific research. On May 17, the NRAO hosted a Legacy Projects Workshop (*http://www.aoc.nrao.edu/events/legacy/*) at the Array Operations Center in Socorro, New Mexico. Legacy and Key projects have been implemented to great effect at other observatories, and this workshop was an important venue for seeking the community's advice regarding how such large projects might be implemented at the NRAO. Legacy and Key projects should produce results of high scientific impact or data of long-term value to the entire astronomical community. They may require large amounts of time on one or more telescopes, collaborations of many astronomers from several institutions, new instrumentation and software, and new modes of observing. This mid-May workshop at the NRAO brought together interested astronomers to identify the leading scientific and technical opportunities for such large projects and refine NRAO's policies for implementing them. The workshop was a great success, and included invited speakers, a panel discussion, and both oral and poster sessions enabling every participant to present ideas related to legacy programs involving NRAO facilities. The call for proposals for the upcoming October 2 deadline will include the solicitation of Legacy and Key projects.

The annual NRAO Users Committee meeting took place at Socorro, May 18 – 19. Chaired by Michele Thornley (Bucknell University), this meeting included vigorous discussion about ALMA, EVLA, GBT, VLBA, e2e, CDL technology, user support programs, software development, the WWW, EPO, and other key items. The committee made a number of excellent recommendations that will be carefully considered and discussed by the senior management team and the scientific staff. We were particularly gratified that the committee was impressed by NRAO's responsiveness to the committee and the Observatory's commitment to its users, and encouraged the devotion of an increased fraction of telescope time to Legacy and Key projects.

As every summer begins, the Observatory enjoys meeting a new group of summer students. Seven students have recently arrived in Charlottesville, for example, to spend the months of June through August doing research in collaboration with NRAO scientific staff on topics as diverse as star formation, exotic pulsars, nearby active galaxies, instrumentation, and ALMA simulations. We are always delighted to greet the new summer students. Supporting the development of the next generation of astronomers is a responsibility that the NRAO takes very seriously.

In mid-August, at the International Astronomical Union General Assembly in Prague, the NRAO will staff an exhibit that describes the VLA / EVLA, GBT, and VLBA. We are also collaborating with our international partners on an ALMA exhibit. As always, we will be very interested to discuss with you how the NRAO can best serve your scientific research.

Fred K. Y. Lo

NRAO Large Proposal Call for October 2, 2006 Proposal Deadline

To facilitate science projects that require significant amounts of telescope time, NRAO encourages the submission of Large Proposals. Large Proposals may be addressed to Legacy projects that are of interest and value to the community generally or to Key projects addressing major scientific problems and issues. Large Proposals can also be aimed at long-term time domain problems.

Depending on proposal pressure and quality, it is NRAO's intention to grant more Large Proposal time than in past cycles, with as much as 25 percent to 50 percent of the total telescope time granted to Large Proposals over the next year and in the future.

Prospective proposers are reminded that the next Large Proposal deadline for the NRAO telescopes will be on October 2, 2006. At this deadline, we are adding the GBT to the Large Proposal call in addition to the VLA and VLBA.

Large Proposals are those proposals requesting 200 or more hours of observing time. Proposals requiring more than one NRAO telescope to accomplish their scientific objectives will also be considered as Large Proposals if the total time requested is 200 or more hours. Large Proposals should be submitted by the same process as normal proposals for the individual telescopes (e-mail to *propsoc@nrao.edu* for the VLBA; the on-line NRAO proposal tool for the GBT and VLA).

This summer we will be reviewing our Large Proposal process and policy, reviewing issues such as page limits, proprietary period, required data products, funding, etc. The existing VLA/VLBA policy is at: *http://www.nrao.edu/administration/directors_office/large-prop.shtml*. Any changes to the policy will be posted by August 1, 2006 to the NRAO web site.

Note that the general capabilities of the three operational telescopes are described in their observational status summaries.

GBT: *http://wwwlocal.gb.nrao.edu/gbtprops/man/GBTpg/GBTpg_tf.html*

VLBA: *http://www.vlba.nrao.edu/astro/obstatus/current/obssum.html*

VLA: *http://www.vla.nrao.edu/astro/guides/vlas/current/*

VLA: At this deadline, we will accept VLA Large Proposals only if they request predominantly A and B configuration observations. To facilitate more observing time for Large Proposals and to phase the configuration cycle properly for EVLA testing, we expect to spend more time than normal in the next A and B configurations, perhaps as much as eight months per configuration rather than the traditional four months per configuration. The exact time spent in each VLA configuration will depend strongly on the quality and pressure of the large proposals. Further information about the status of the VLA during the transition to EVLA, and about its capabilities to carry out large proposals, may be found at *http://www.aoc.nrao.edu/evla/archive/transition/impact.html.*

GBT: In addition to the normal operation of the antenna, we are planning a three month shut-down during the summer 2007 to refurbish the azimuth track. The telescope will be available for some periods during this time, but with reduced capabilities (e.g. no azimuth motion). Again, full details will be provided with the August announcement.

We anticipate that there will be another call for Large Proposals next year to include the GBT, the VLBA, and the more compact VLA configurations. The proposal deadline will likely shift to June 2007, so that the proposal review results will be available before the proposal submission deadline of the Astronomy & Astrophysics Research Grants program of the AST Division at the National Science Foundation.

Fred K. Y. Lo

SCIENCE

Resolving the Confusion: Discovery of 35 New Galactic Supernova Remnants

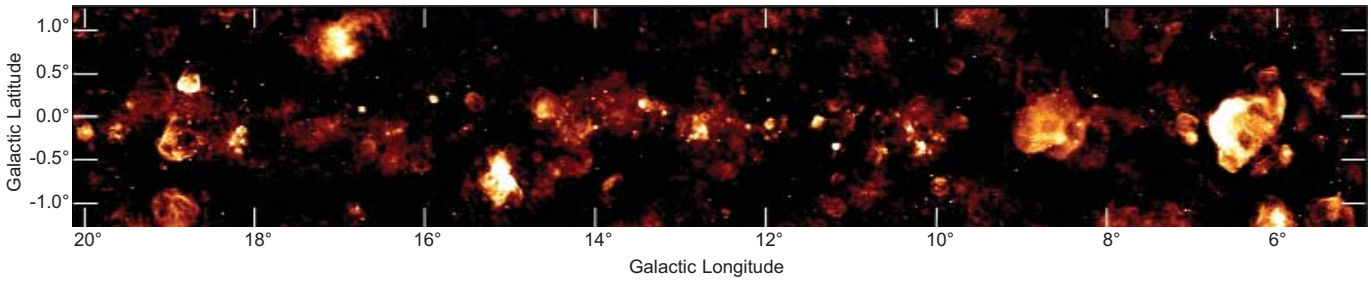

Figure 1. VLA 90 cm wavelength mosaic image of the survey region with 42" resolution. The mosaic is comprised of fourteen 2.5-degree FWHM images, one per pointing.

Though supernova explosions have a profound effect on the morphology, kinematics, and ionization balance of galaxies, our census of supernova remnants (SNRs) even in our own Galaxy is incomplete. Based on statistical studies of predicted supernova (SN) rates, there should be many more SNRs in our Galaxy (about 1000; Li et al. 1991, Tammann 1994) than are currently known (about 230; Green 2004). This deficit is likely the result of selection effects acting against the discovery of old, faint, large remnants, as well as young, small remnants in previous low-resolution and/or poor-sensitivity Galactic radio surveys (c.f. Green 1991). The missing remnants are likely concentrated toward the inner Galaxy where the diffuse synchrotron emission and thermal HII regions near the Galactic plane cause the most confusion. Thus, more-sensitive, high-resolution surveys of the inner Galaxy at low radio frequencies are the key to determining whether the "missing" remnants exist or if our understanding of SN rates is significantly flawed.

We recently imaged the Galactic plane at 90 cm wavelength from l=+4.5 to +22 degrees and $|b| < 1.25$ degrees using the VLA in the B, C, and D configurations. The mosaiced image with a resolution of 42" is shown in Figure 1 (Brogan et al. 2006). This image provides an unprecedented view of the radio continuum emission of this region on a wide range of spatial scales and is by far the highest dynamic range large-scale radio image of this part of the Galactic plane yet created.

However, complementary images at other frequencies are required to identify SNRs by their non-thermal emission. For this purpose we have created a 20 cm wavelength mosaic of the survey region using both Southern Galactic Plane Survey (SGPS) data obtained with the Australia Telescope Compact Array (McClure-Griffiths et al. 2005) and archival VLA D-configuration data (Helfand et al. 2005). The resulting 20 cm image has a resolution of 70" × 37" but is not sensitive to smooth structures larger than about 18'. For this reason, data from the 4.3'-resolution single-dish Bonn 11 cm wavelength survey were also utilized (Reich et al. 1990). Midcourse Space Experiment (MSX) 8 μm wavelength infrared data (Price et al. 2001) with 20" resolution were also used to distinguish between thermal and non-thermal emission (non-thermal emission is anti-correlated with bright infrared emission).

In total we have identified 35 new SNR candidates that meet the following criteria: (1) the source must be resolved in our 42" resolution, 90 cm wavelength image and show a shell-like morphology; (2) the radio continuum spectral index α ($S_\nu \propto \nu^\alpha$) computed from the integrated flux densities must be negative, indicative of non-thermal emission; and (3) the source morphology must be distinct from bright mid-infrared 8 μm emission. Figure 2 shows three-color images of two regions surrounding the two largest previously known remnants in the survey region, W28 and W30, and demonstrates our detection technique. We have divided the

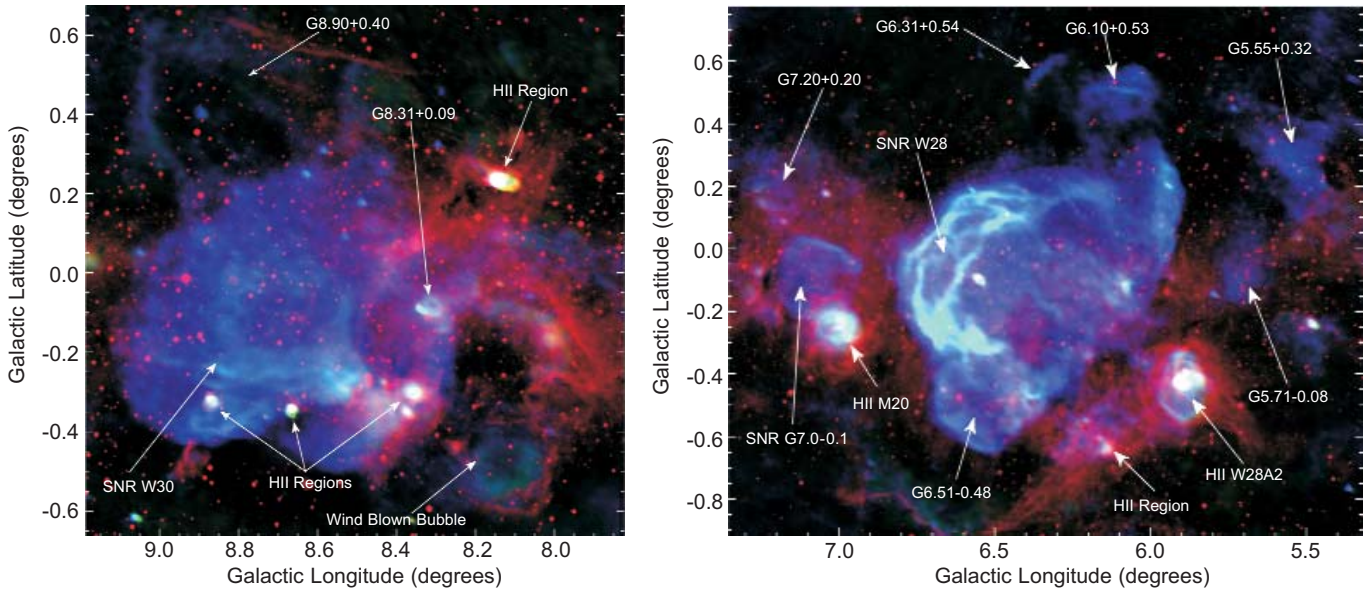

Figure 2. Three-color images with blue=VLA 90 cm, red=MSX 8 μm, and green=SGPS+VLA 20 cm of the (left image) W30 and W28 regions (right image). New SNRs are indicated by their Galactic coordinates (2 in [a] and 6 in [b]); previously known SNRs, HII regions, and a wind-blown bubble are also labeled. Non-thermal sources in these images appear primarily blue in color, HII regions are white, and flat-spectrum sources like wind-blown bubbles are green.

35 candidates into three categories based on the accuracy of the integrated flux measurements (affected mostly by confusion and source size): (I) the source is almost certainly an SNR; (II) the source is very likely an SNR but the flux measurements could be refined; and (III) the source morphology is non-typical or the source is very large and follow-up is essential. There are 15 class-I, 16 class-II, and 4 class-III candidates.

Generally, the newly discovered SNRs are smaller and fainter than those previously known in this region. The median diameter of the new SNRs is 8' compared to approximately 15' for the 19 previously known remnants. The SNR candidates have 1 GHz surface brightnesses in the range $\Sigma_{(1\ GHz)}=(1\text{-}15)\times 10^{-21}$ W m^{-2} Hz^{-1} sr^{-1}, indicating that this survey is at least ten times deeper than the Bonn 11 cm SNR survey. This 90 cm survey of only 42.5 deg^2 has increased the number of identified remnants within the survey boundaries by nearly a factor of 3 (from 19 to 54) and produced a 15 percent increase in the total number of known Galactic SNRs. Estimates of the level of completeness of SNR surveys in other parts of the plane suggest that a similar 90 cm survey of the inner $|l| < 50$ degrees would approximately double the number of known remnants. Overall, given that this technique remains insensitive to very small (< 2'), very large (> 50'), and Crab-like remnants (without distinct radio shells), these results suggest that the "missing SNRs" problem can be attributed to selection effects and not our understanding of SN rates. Future instruments like the EVLA, LWA, ATA, and SKA will allow even deeper low frequency, high dynamic range surveys that will likely discover the remaining shortfall of Galactic SNRs.

Crystal L. Brogan (NRAO), Joseph Gelfand (CfA)
Bryan M. Gaensler (CfA), Namir E. Kassim (NRL)
T. Joseph Lazio (NRL)

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A 716-Hz Pulsar in Terzan 5 is Now the Fastest-Spinning Pulsar Known

The Green Bank Telescope has proved to be a spectacularly good instrument for uncovering the faint pulsars thought to be hiding (Fruchter & Goss 2000) in the massive globular cluster Terzan 5. So far, 30 pulsars have been discovered in Terzan 5 (Figure 1) using the GBT and Spigot backend, bringing the total population in the cluster to 33 (Ransom et al. 2005a, b). Terzan 5 contains a quarter of the total population of globular-cluster pulsars and has the highest observed density of pulsars of any direction on the sky. One of the most recent and exciting pulsar discoveries in Terzan 5 is PSR J1748-2446ad (hereafter Ter5ad), which is now the fastest-spinning pulsar known (Hessels et al. 2006). Ter5ad finally breaks the 24-year-old record held by the 642 Hz pulsar B1937+21, which remarkably was also the first millisecond pulsar found (Backer et al. 1982).

Ter5ad is spinning once every 1.396 ms or, equivalently, 716 times a second. On a western musical scale, this frequency lies between F and F sharp an octave and a half above middle C! We have used Ter5ad's rotation rate to constrain its radius, by assuming the extreme case where gravitational and centrifugal forces are equal and also incorporating effects due to general relativity (Lattimer & Prakash 2004). Assuming a pulsar mass of 2 solar masses, the (non-rotating) radius is constrained to be less than 16 km. If the true mass of the pulsar is lower, then the radius constraint will also be smaller. For such a radius, the transverse velocity at the surface of the pulsar is an amazing 24 percent of the speed of light.

The maximum spin rate a millisecond pulsar can achieve is an unresolved question. Based on the population of low-mass X-ray binaries (the most likely progenitors of the millisecond pulsars) and previous radio surveys (although these have strong observational biases against detecting the fastest-spinning pulsars) it appears there is some physical mechanism limiting millisecond pulsars from spinning close to their breakup spin rate (more than 1000 Hz). Ter5ad is a very useful input for models that invoke spin-frequency-dependent gravitational radiation as a mechanism for limiting millisecond pulsar spins.

Ter5ad is also part of a highly atypical binary system. It is in a circular, 26 hour orbit with a 0.14 solar mass (minimum) companion. The pulsar is eclipsed for roughly 40 percent of its orbit at an observing frequency of 2 GHz. The physical size of the eclipse region is ≈5–6 solar radii, larger than the semi-major axis of the projected orbit. This suggests that the companion is a bloated main-sequence or post-main-sequence star. This is a very rare companion type for millisecond pulsars, which normally have helium white-dwarf companions. In this way, Ter5ad seems very similar to another Terzan 5 pulsar, Ter5P, as well as PSR J1740–5340 (D'Amico et al. 2001) in NGC 6397, both of which have similar orbital and eclipse properties, and whose companions are possibly filling their Roche lobes. Further evidence that the companion is bloated comes from our recently derived timing solution, which requires many high-order orbital period derivatives to accurately model the orbit. This suggests that there are strong tidal effects at work in the system.

Our timing solution also reveals that both Ter5ad and Ter5P are positionally coincident with hard X-ray sources seen in a 40 ks Chandra observation of the cluster. Further work is required to study the spectral properties of the sources, but in analogy with

PSR J1740–5340, these X-rays are likely from companion gas shocked by the pulsar's wind (Grindlay et al. 2001). Optical/IR studies of these companion stars will be interesting as they may elucidate the nature of the companions and could better constrain the pulsar masses. However, approved and upcoming VLT (using IR adaptive-optics) and HST observations will be very challenging as Terzan 5 is distant (≈8–11 kpc) and highly absorbed, and the pulsars reside close to the crowded center of the cluster (see Figure 1).

Terzan 5 contains five of the ten fastest-spinning pulsars known and may be harboring other even faster-spinning pulsars still awaiting discovery. It is possible that such systems have been missed thus far because they have very long eclipse durations and/or are in very compact binary systems. We are continuing to search for pulsars in Terzan 5 and other clusters visible with the GBT.

Scott Ransom (NRAO)

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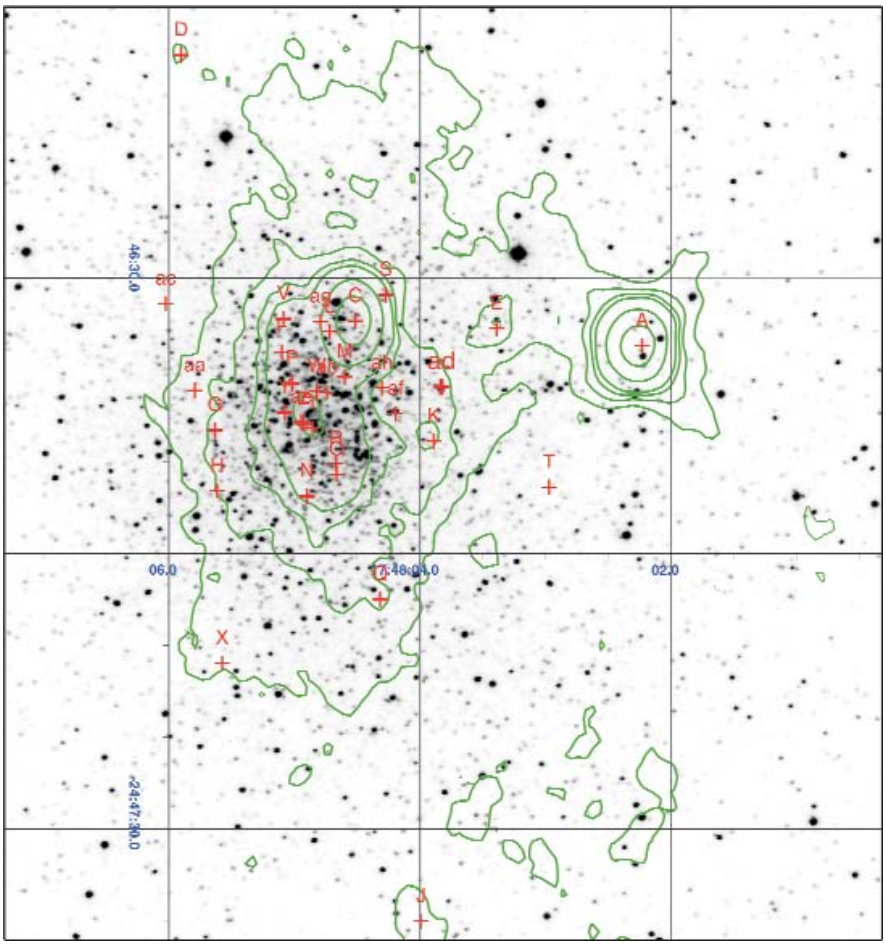

Figure 1. Timing positions (in red) for 32 of the 33 known pulsars in the globular cluster Terzan 5 as determined from 1.5 years of GBT+Spigot observations. The greyscale is an I-Band image of the globular cluster taken by S. Ortolani with ESO's NTT. The dark green contours are naturally weighted 20 cm contours from the VLA observations of the cluster described by Fruchter & Goss (2000).

A Magnetically Collimated Jet from an Evolved Star

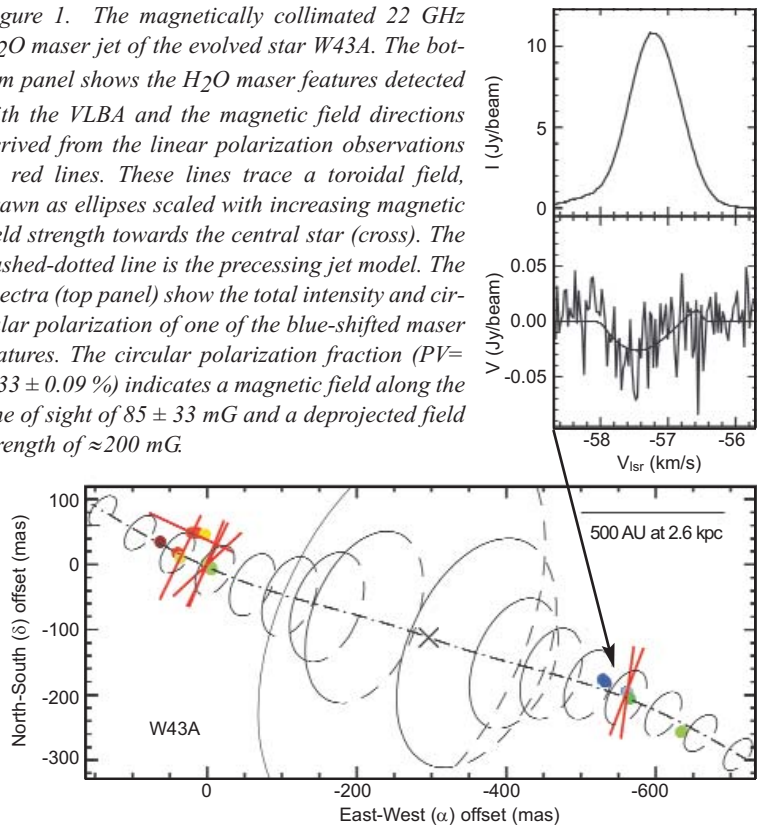

Figure 1. The magnetically collimated 22 GHz H_2O maser jet of the evolved star W43A. The bottom panel shows the H_2O maser features detected with the VLBA and the magnetic field directions derived from the linear polarization observations as red lines. These lines trace a toroidal field, drawn as ellipses scaled with increasing magnetic field strength towards the central star (cross). The dashed-dotted line is the precessing jet model. The spectra (top panel) show the total intensity and circular polarization of one of the blue-shifted maser features. The circular polarization fraction ($PV = 0.33 \pm 0.09$ %) indicates a magnetic field along the line of sight of 85 ± 33 mG and a deprojected field strength of ≈200 mG.

Many planetary nebulae (PNe) have asymmetric shapes even though their progenitor stars are generally spherical. The cause of their spectacular shapes is still a matter of debate. Most young planetary nebulae are bipolar, and observations indicate that the energy contained in their outflows is often orders of magnitude larger than can be provided by radiation pressure (Bujarrabal et al. 2001). The source of this energy might be magnetic fields, binary or disk interactions, or a combination of these.

Theoretical models for the magnetic launching of bipolar jets have been fully accepted in the case of the outflows of young stellar objects, and they also can reproduce the structures seen in PNe (e.g. Garcia-Segura et al. 2005). However, the origin of the magnetic fields in evolved stars is unclear. While an internal stellar dynamo is able to produce sufficiently strong magnetic fields (Blackman et al. 2001), it needs a continuous external source of angular momentum, which might be provided by interaction with a nearby binary companion or a heavy planet (Frank & Blackman 2004).

Until recently there was no direct proof of the existence of sufficiently strong magnetic fields around evolved stars. The interpretation of magnetic field strengths determined from SiO (silicon monoxide) masers close to the star (within ≈2 stellar radii) was uncertain, and extrapolating the small magnetic fields measured in the OH (hydroxyl) masers much farther out (up to several thousand astronomical units (AU)) equally so. However, our recent observations of H_2O (water) maser polarization confirmed that strong large-scale magnetic fields do indeed occur in the envelopes of asymptotic giant branch (AGB) stars (Vlemmings et al. 2005), the progenitors of PNe.

W43A is one of a small number of "water fountain" sources, AGB stars that have only very recently started their transformation into a likely bipolar (proto-)PNe. VLBA observations of the H_2O masers of W43A revealed that, instead of being in an envelope a few hundred AU from the star, the masers occur at the tips of a precessing bipolar jet (Imai et al. 2002). This jet has been estimated to be approximately 55 years old and has an outflow velocity of ≈145 km s^{-1}.

To investigate the origin of the jet of W43A, we observed its 22 GHz H_2O maser emission using the VLBA (Very Long Baseline Array) with high spectral resolution (Vlemmings et al. 2006). We determined both the linear and circular polarizations of the masers at the blue- and red-shifted tips of the precessing jet and, for one of the maser features, managed to determine the Zeeman splitting caused by the magnetic field in the jet. From the theoretical models for H_2O maser polarization, we determined both the direction and strength of the magnetic field. We found that the magnetic field

has a toroidal shape as shown in the Figure, and we determined the magnetic field strength in the maser region to be approximately 200 mG. As the masers exist in high-density material at ≈1000 AU that has been swept up by the jet, the magnetic field lines are compressed and the magnetic field strength enhanced, the magnetic field around the jet having a strength of only 1–3 mG. As the field was found to be toroidal, we can determine the magnetic field strength at the base of the jet on the surface of the star. The strength of a toroidal magnetic field is inversely proportional to the distance to the star, so the stellar magnetic field is of the order of 2–20 G. This is fully consistent with the earlier measurements of fields around evolved stars and with the field in the torus of the PN K 3-35 (Miranda et al. 2001).

Although the origin of the magnetic field in W43A is still unclear, we can conclude from its shape and strength that the magnetic field is collimating the jet. This makes these observations the first direct detection of a magnetically collimated jet in any astronomical object. Additionally, it supports the theory that magnetic fields are the main shaping agents of asymmetric PNe.

Wouter Vlemmings, Phil Diamond (Jodrell Bank), Hiroshi Imai (University of Tokyo)

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The VLA Low-frequency Sky Survey (VLSS)

We are pleased to report the second public data release for the VLA Low-frequency Sky Survey (VLSS), an ongoing effort to map the 3π sr of sky above declination δ = -30 degrees at a frequency of 74 MHz (λ = 4 m). With the addition of new data obtained in spring 2005 during the B and BnA configurations, as well as improved reprocessing of the previously existing data, the survey is now more than 90 percent complete.

The 74 MHz system on the VLA offers an unprecedented combination of sensitivity and resolution at this low frequency. The VLSS has 80 arcsec resolution and a 5σ detection limit of 0.5 Jy beam^{-1} on average; in areas near the Galactic plane and very bright sources the noise levels are higher. The observational challenges at this wavelength include radio frequency interference (RFI), ionospheric phase distortions, and a large field of view filled with sources. These challenges have been surmounted by a variety of new algorithms. The principle data products from the survey are a set of publicly available images and a catalog of approximately 105 sources.

The scientific goals of the survey are multiple. Samples of sources with steep spectral indices at low frequencies can be used to detect pulsars, high-redshift radio galaxies, and cluster haloes and relics. Using these low-frequency data it is also possible to study absorption effects in supernova remnants, normal galaxies, and HII regions in the Galactic plane. Another main goal of this survey is to make a low frequency counterpart to the NVSS, which will be available for public use by all astronomers. Finally we are creating a low-frequency sky model that can be used to plan and calibrate more sensitive 74 MHz VLA experiments, as well as provide an initial calibration grid for planned radio telescopes such as the SKA and LOFAR.

Two initial sets of pilot observations, covering roughly 10 percent of the total sky area, were carried out in 2001 and 2002 to refine the survey observing methods and reduction software. In the fall of 2003 a substantial fraction of the remaining observations were completed, and our first official data release, in summer 2004, covered roughly half of the sky. During spring 2005 we observed most of the remaining fields in B-configuration and half of the remaining BnA-configuration (low-declination) fields. In addition to reducing the new data, we reprocessed the existing data to take advantage of an improved ionospheric correction algorithm. All of the data were then combined to create a second data release in May 2006 (see Figure 1).

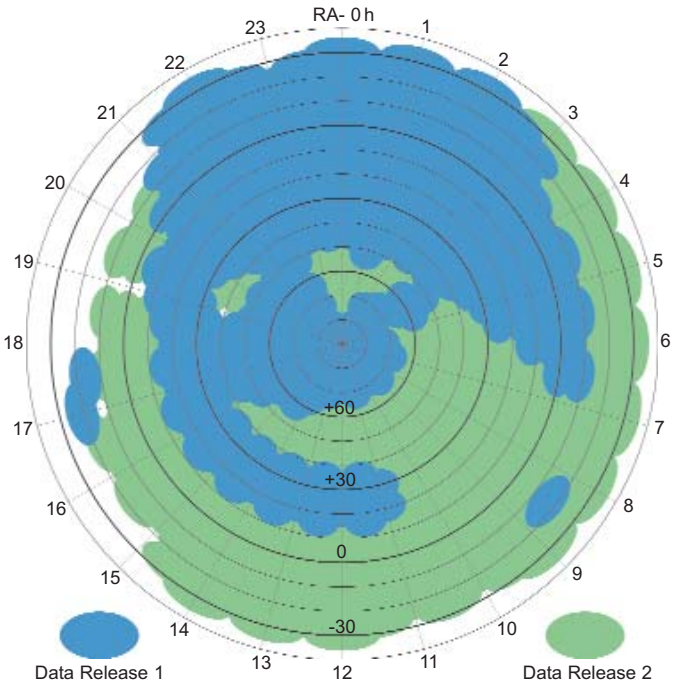


Figure 1. A map showing the current sky coverage of the VLSS. The blue areas were included in the previous release, and the green areas are new. All areas have been re-reduced, however, at this time. Most of the remaining area to cover will be observed in the June 2006 BnA configuration.

In the current release, the VLSS positions of bright point sources are typically within 3 arcsec of the NVSS positions. There are now about 67,000 sources covering more than 95 percent of the sky above declination δ = -10 deg and two-thirds of the sky between δ = -10 deg and δ = -30 deg. They are available as a searchable source catalog and postage stamp images on our website (*http://lwa.nrl.navy.mil/VLSS/*), which is also linked from the NRAO homepage. Figure 2 shows a sample of bright, extended objects seen by the survey.

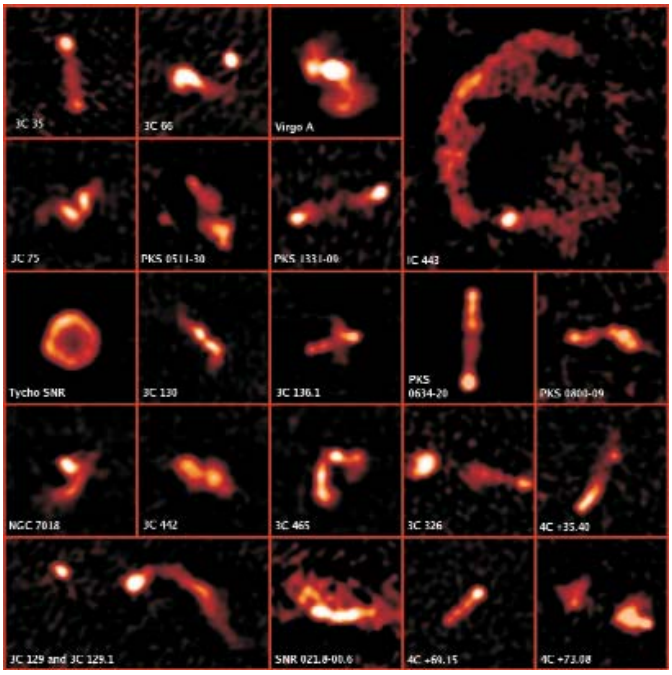


Figure 2. A collage of bright, extended sources found in the VLSS.

Observations for the remaining unobserved fields are planned for the 2006 BnA and B configurations. In addition, a small fraction of fields for which the available images do not meet survey standards will be reobserved.

Wendy Lane and Aaron Cohen (NRL)
Rick Perley, Bill Cotton, and Jim Condon (NRAO)
Namir Kassim and Joseph Lazio (NRL),
Bill Erickson (UMD)

Atacama Large Millimeter Array

ALMA Construction

Figure 1. The Array Operations Site (AOS) Technical Building (TB) exterior, which will house array electronics such as the ALMA Correlator, has been completed. It is one of the highest-altitude (16,570 feet), highest-technology buildings in the world.

Figure 2. The AOS TB as seen from the future center of the array. As construction progresses, this area will contain the antenna pads for the compact configuration of ALMA.

From Chile to Socorro and Charlottesville ALMA has progressed handily in many aspects over the past quarter.

In Chile, the outer shell of the Technical Building (TB) at the Array Operations Site (AOS) on the Chajnantor plain has been completed, and on June 1 a contract was signed with ConPax in Santiago to finish the interior during the current austral winter through summer period. By the end of next March we should be able to see the completed AOS TB sitting at 5000m (16,570 ft) on the Chajnantor plateau, arguably the highest building in Chile and among the highest anywhere.

Elsewhere on the Chajnantor plain, planning for the network of roads and fiber interconnecting the AOS TB and the antenna pads is underway. A few dozen kilometers down the road connecting the high site to the rest of the world, the construction of the Operations Support Facility (OSF) will soon commence. Located at a more pleasant 9600 foot altitude, this large facility will house the rest of the array electronics including the local archive, as well as the people who work to make ALMA produce transformational science around the clock. Here, facilities exist for the temporary housing of ALMA and contractor personnel. Construction of the on-site antenna erection facilities continues in preparation for the arrival of the first production antennas on the site in less than a year.

In Santiago at the Joint ALMA Office, several new hires have joined the ALMA team. Christian Saldias has begun work as the new IT Manager. He will soon be joined by a Human Resources manager. Additionally, in preparation for the operation of the Joint ALMA Observatory, advertisements have been placed for key personnel including the Head of Science Operations, the Head of Administration, and the Head of Technical Services. During the past few months the European Project Scientist, Tom Wilson, has acted as JAO Project Scientist; in June the Japanese Project Scientist, Ryohei Kawabe assumed that post. Al Wootten, the North American Project Scientist, will relieve him in September. Shortly afterward, a permanent JAO Project Scientist should assume the role. As the number of people increase, the details of the permanent headquarters for the Joint ALMA Observatory are being defined. This headquarters will be located in the Vitacura section of Santiago, near ESO's facility.

Figure 3. In this photo from the 5000m altitude Cerro Negro by C. Ocampo, the road which will carry the antennas to the AOS TB can be seen in the foreground. The AOS TB itself is in the distance, to the right of Cerro Chascon (rightmost distant peak).

In North America, the assembly and integration of the ALMA Prototype System is entering its final laboratory phases before moving to the prototype antennas at the Antenna Test Facility (ATF) near the VLA on the Plains of San Augustin. In the lab, recent successful tests of the whole system included the demonstration of the first millimeter wave cross-correlation, at 86 GHz. The holography system that will be used in Chile to test the first production antennas will be assembled, integrated, and verified at the ATF in September and October before being shipped to Chile for installation at the OSF. Work on the VertexRSI production antenna proceeds, with initial shipments to Chile expected around the turn of the year. In March, Computing conducted an end to end (scheduling block to archive) test of the optical pointing commissioning observing mode, the first time the entire end-to-end software system worked together on real hardware (antenna evaluation used a small subset of the computing subsystems). In May, Computing conducted its fourth incremental Critical Design Review (internal to Computing this time), including the first reviews of the ACA software subsystem and the Observatory Operations Support software, which have recently ended their first design phase.

At the NRAO Technology Center in Charlottesville, work continues on several fronts. Over the past few months, the Front End Integration Center, one of two facilities in which the receiver and associated electronics will be integrated, has taken shape. A preproduction 1.3 mm (ALMA Band 6) receiver has been proven on the sky at the University of Arizona Submillimeter Telescope on Mt. Graham. The first of the 3 mm (ALMA Band 3) receivers will soon be shipped from the Herzberg Institute for Astrophysics in Victoria, Canada for integration as the first front end package is readied for deployment at the ATF in less than a year. The second quadrant of the correlator is taking shape next to the first quadrant, which has been assembled and running for several months now.

Several astronomical meetings during the period highlighted ALMA instrumentation and science. About one hundred young astronomers and astrochemists met at Fulgso, Denmark near the University of Aarhus for a meeting on *Complex Molecules in Space: Present Status and Prospects with ALMA*, organized by David Field. The synergy of ALMA's transformational science with NASA's *Great Observatories* program was discussed by Chris Carilli, the new Head of the North American ALMA Science Center, at a workshop in Pasadena. Al Wootten represented ALMA at a workshop on the Red Rectangle held at the University of Virginia. Several aspects of ALMA instrumentation were presented at the SPIE meeting on Astronomical Telescopes and Instrumentation held in Orlando. There were special ALMA sessions at the joint American Astronomical Society/Astronomical Society of Canada meeting in Calgary during June. During the upcoming months, there will be several venues at the IAU meeting in Prague looking forward to ALMA science. During October there will be a meeting on Water Vapor Radiometry in Bavaria. An international meeting on *Science with ALMA: A New Era for Astrophysics* will be held November 13 – 16, 2006 in Madrid, Spain.

By July, ALMA integration will have moved to the ALMA Test Facility near the VLA, leading within a few months afterward to the first interferometry using ALMA hardware. At about the same time, the first production antennas will begin to arrive at the ALMA site in Chile. The months just ahead begin the period of ALMA field assembly integration and verification

leading into commissioning and the early days of delivery of ALMA's transformational science.

Al Wootten

North American ALMA Science Center (NAASC)

This has been a busy quarter at the NAASC. NAASC and other NRAO staff were involved in a test of the ALMA pipeline system in early April. A preliminary version of the NA ALMA operations plan was reviewed internally at NRAO on April 11 by representatives from Green Bank Operations, New Mexico Operations, the End-to-End project, the EVLA, Fiscal, HR, the Director's Office, and NRC. The plan was well received, and the committee's recommendations are being implemented. The plan was then presented to the NRAO Visitors Committee (April 18), the NSF (April 24), and the Users Committee (May 18). In May, the JAO Director, Massimo Tarenghi, visited Charlottesville to work on the ALMA Operations Plan. Trips are planned to Chile and ESO in the coming months to continue this work. Finally, the NAASC sponsored a special session at the June meeting of the American Astronomical Society (see accompanying article). More information on the NAASC is available at *www.cv.nrao.edu/naasc/*.

The ALMA Regional Center (ARC) is a subset of the NAASC, with the responsibility of providing the core scientific support of the ALMA observatory. There are three ARCs planned: one each in North America, Europe, and Japan. John Hibbard continues in his role as the manager of the North American ARC. Paola Andreani, formerly of SISSA, has relocated to ESO in Garching to head the European ARC; and Kawabe Ryohei of NAOJ heads the East Asian ARC. This quarter the ARC managers are revising the global ALMA Operations Plan, in collaboration with the Joint ALMA Observatory (JAO) director, Massimo Tarenghi, and other JAO staff in Chile.

There have been on-going discussions between NRC-HIA and NRAO to discuss the greater North American operations of ALMA. Face-to-face meetings were held in Charlottesville in April and again at the June meeting of the AAS in Calgary, Alberta. Bi-monthly telecons and an August face-to-face meeting are planned to continue this productive partnership.

The goal of this summer's activities is to have a complete global and North American ALMA operations plan that capitalizes on the long-standing expertise in interferometric operations at NRAO and best incorporates the Canadian contribution to operations, as well as promotes community involvement in ALMA operations.

J. E. Hibbard and C. L. Carilli

ALMA North American Science Advisory Committee (ANASAC)

The ALMA North American Science Advisory Committee (ANASAC) is composed of representatives of the wider North American astronomical community to provide scientific advice to the NRAO Director on the operation of the NAASC. The ANASAC met via telecon on April 28, 2006. A number of topics were discussed, including the results of the recent ALMA reviews, the current ASAC charges, and a possible grants program to support work demonstrating the ALMA's unique scientific capabilities. The next ANASAC telecon is scheduled for June 30, when future NAASC workshops and the NAASC proposal to NSF will be discussed.

Subsequent to the meeting, Jonathan Williams of Hawaii was appointed as the new ANASAC Chair. Jonathan has been enlisted to organize ANASAC input into key U.S. community issues, such as a potential grants-with-observing-time program, as well as to perform a general review of the North American ALMA operations plan. A listing of the current ANASAC membership and dates of scheduled meetings are given at *www.cv.nrao.edu/naasc/admin.shtml*. The community is encouraged to contact their ANASAC representatives with any ideas or questions on NA ALMA operations or the Science Center.

Chris Carilli

ALMA Special Session at Calgary AAS Meeting

Members of the NAASC, including our Canadian colleagues, organized a special session at the June meeting of the American Astronomical Society (AAS) entitled *Imaging Star Formation in the Cosmos with ALMA*. The June 5 afternoon session was filled to capacity, with nearly 200 AAS and Canadian Astronomical Society (CASCA) members in attendance to hear presentations on *Using ALMA to Disentangle the Physics of Star Formation in Our Galaxy* by Douglas Johnstone (NRC-HIA, U. Victoria), *Imaging Star-Forming Gas in Nearby Galaxies with ALMA* by Jean Turner (UCLA), and *ALMA and Distant Galaxies* by Andrew Blain (Caltech).

The special session included an accompanying poster session (#51) *Imaging Star Formation in the Cosmos with ALMA II*, with nine posters and one in session #56 on the 3mm cartridge. These posters also traveled to the JAO in Santiago the following week. Invited session 30.01 featured Christine Wilson speaking on *Luminous Infrared Galaxies with the Submillimeter Array: Probing the Extremes of Star Formation*.

Presentors (l-r): Jean Turner, Andrew Blain, and Douglas Johnstone

Powerpoint and pdf versions of the talks from the special session and several of the posters are collected at *http://www.cv.nrao.edu/naasc/TownMeetings/*.

J. E. Hibbard and C. L. Brogan

Expanded Very Large Array

The EVLA Project has made substantial construction progress over the past several months. EVLA antennas 13, 14, 16, and 18 are now functioning with four complete IFs. These antennas are being used by the scientific and technical staff to evaluate the performance of the EVLA hardware and software. Additionally, the antennas have been returned to operations, moved out to the array, and are being used in some scientific observations. The receivers currently installed on these antennas include L, C, X, K, and Q-Bands. The installation of electronics on antenna 24 is nearly complete, and test observations with the two IFs of the antenna are already being made. Antenna 26 had its azimuth bearing replaced in April, and its mechanical overhaul is nearly complete. The installation of electronics on antenna 26 will begin in late June.

The status of the project was reviewed by the EVLA Advisory Committee on May 8 – 9. This meeting was followed by an NSF Mid-Project Review on May 11 – 12.

The prototype L-Band receiver, with its newly designed octave bandwidth orthomode transducer (OMT), was evaluated in the electronics laboratory. The OMT design is very important because a scaled version of it will be used at S and C-Bands. The RF performance of the OMT is excellent, but its noise performance needs improvement. We expect the improvements to be completed in August of this year. A Critical Design Review of EVLA front ends was held in April.

The central reference generators in the EVLA local oscillator (LO) system are now in full production. The

design for the new motherboard of the LO transmitter is underway and will be completed soon. The problems we experienced with the frequency synthesizers (e.g. periodic glitches in visibility amplitude and jumps in phase with a change in frequency) were traced to external timing signals and the firmware in a direct digital synthesizer. We now believe these problems are resolved. The new analog boards that are used in many modules have been completed, and production quantities of the boards are being ordered.

The assembly of the shielded room for the EVLA WIDAR correlator is complete, and the outfitting of the room with HVAC, electrical, and fire suppression systems is well underway. Prototype correlator chips were delivered to the Herzberg Institute of Astrophysics in Penticton, British Columbia, Canada in mid June. The chips will reside on baseline boards, and prototypes of these boards are scheduled for delivery in late June. A plan was developed for on-the-sky (OTS) testing of the prototype WIDAR correlator, including definition of the software needed to support OTS testing. The actual OTS testing will begin during the third quarter 2007.

In the development of EVLA monitor and control software, two major and one minor release of the User Interface software occurred during the first quarter 2006. The Array Operator screen now includes the ability to add or remove antennas during an observation. Software was also written to implement reference pointing on the EVLA antennas.

Our first foray into a major component of the EVLA data management software system is the Proposal Submission Tool for the VLA and GBT. This prototype will be modified to support the EVLA, and the ability to support a number of telescopes is naturally built into the tool. In closely related work, the Proposal Handling Tool will have its initial version released in mid 2006. Work on the User Database and its interface into the rest of the system also continues. This is a significant part of the "glue" that holds the system together. Work on a preliminary version of the Observation Preparation Tool has begun, and a plan has been developed to incorporate VLA support into the tool by the end of 2006. Work on the Scheduling Tool is concentrated on a prototype that is being used to schedule the VLA during moves between configurations. The knowledge gained from these experiments on the prototype is being incorporated into the model development for the overall architecture.

The current VLA archive access tool is a successful prototype for the eventual EVLA archive access tool. Post-processing effort has focused on algorithm development and user interface tests. We are currently investigating whether EVLA and ALMA can use a common Science Data Model, an important issue both for post-processing and for other elements of the EVLA software system.

Mark McKinnon

VLA Antenna, photographer: Gene Shiau

Green Bank

The Green Bank Telescope

The GBT has now switched to the summer maintenance schedule of four ten-hour maintenance days per week. The main activities will consist of structural inspections and painting, although we will, of course, take the opportunity to perform as much other maintenance work as possible that requires the antenna at access (e.g. routine maintenance of the active surface). As well as the normal summer activities, this year we will be performing a number of tasks in preparation for next year's azimuth track refurbishment, described in more detail in the following articles.

Telescope operations remain extremely efficient, with setup times now averaging under fifteen minutes per session and minimal time lost due to faults. Remote observing for approved observers, making use of VNC (Virtual Network Connection), is proving extremely popular. We continue to urge observers to come to Green Bank, however, to interact with our scientific staff and get a much better appreciation of the operation of the telescope.

Since October 2005, observers have used the Astronomer's integrated desktop (Astrid) to create and submit scheduling blocks, monitor their progress on the telescope, and provide a real time, quick look data display. Since its introduction, Astrid has received very positive evaluations from GBT observers. Astrid has increased observing efficiency by reducing setup time and decreasing user errors. Using Astrid, the astronomer launches one application and has access to all of the software, documentation, and feedback facilities that are required to conduct an interactive observing session. These systems together provide a common look and feel for GBT software applications, enable offline observation preparation, and facilitate dynamic scheduling and remote observing. Astrid and its application components are predominantly written in Python.

In the future, additional application components or "plugins" will also be adapted into Astrid as new observing capabilities dictate (for example pulsar observing has recently been integrated into Astrid). Improved tools to access the Observation Management Database are being reviewed. We have also considered further expanding offline validation capabilities and creating templates for scheduling blocks that employ common observing strategies.

Version 2.0 of GBTIDL was released on May 17, 2006. GBTIDL is an interactive data reduction and analysis package designed for processing spectral line data taken with the GBT. The main enhancement in version 2.0 is the ability to flag data. Flagging is a reversible process used to identify individual channels, entire scans, or subsets of scans (e.g. integrations) that should be excluded from later operations such as averaging, calculating statistics, and model fitting. Flagging works both in online mode (while taking live data) and offline mode.

To download GBTIDL, access online documentation, contribute to the package, report bugs, and request enhancements, visit the GBTIDL web site at *http://gbtidl.sourceforge.net*. The release notes for version 2.0 are available at this site and give a complete description of the recent enhancements and bug fixes. Running GBTIDL requires an IDL license. GBT observers who do not have access to IDL otherwise are invited to use GBTIDL on a dedicated machine at NRAO. Contact your observing support person for details.

In instrumentation news, the lab spectrometer is now up and running, and has been in use since mid-May to investigate the Ka-Band and Q-Band receiver spectral baselines. In the case of the Ka-Band receiver, the CCB (continuum backend) is also being used as a diagnostic tool. As of this writing it is too early to come to any conclusions, but we do see similar behavior in the lab as is seen on the GBT with the operational spectrometer. So, it is clear that our earlier conclusion, that the spectral baseline problems are divorced from the telescope optics and the fiber IF system, was correct. We have already made some configuration changes in the Ka-Band receiver to attempt to pinpoint the cause(s) and will shortly begin a similar effort with the

Q-Band receiver, which was removed from the telescope in early June.

Progress remains on track for the Zpectrometer, the ultra-wideband spectrometer being built by Andy Harris at the University of Maryland in collaboration with NRAO. The Zpectrometer covers the full 14 GHz bandwidth of the Ka-Band (26-40 GHz) receiver with a set of analog lag correlation spectrometers in a multi-channel correlation radiometer architecture. The Zpectrometer's bandwidth and stability, combined with the GBT's collecting area, will enable sensitive and efficient spectral searches for molecules in high redshift galaxies. The instrument is optimized for observations of low-excitation spectral lines from the carbon monoxide (CO) molecule at redshifts of $1.88 < z < 3.43$ and $4.76 < z < 7.87$. This range of redshifts is of intense current interest because it may correspond to the era when most of the stars in the Universe formed and galaxies assembled. Current plans have the Zpectrometer arriving in fall 2006 for testing, and we anticipate opening the Zpectrometer for general observing in the winter 2007/2008 season.

We intend to hold an important workshop entitled, *Future Instrumentation for the Green Bank Telescope,* in Green Bank on September 7, 8 and 9, 2006. The purpose of the workshop is to revisit GBT development priorities in light of recent scientific, technical, and software/data-handling advances, and to plan a second generation of GBT instrumentation which would include wide-field imaging arrays. If you are interested in attending, please contact Jay Lockman (*jlockman@nrao.edu*) for further details.

Richard Prestage

Green Bank Telescope Azimuth Track Remediation

Green Bank has now moved into the execution phase of the azimuth track remediation project. Everything above the concrete foundation will be replaced: base plates, wear plates, and fasteners. Contracts have been placed with suppliers for all of the components needed to replace the GBT track. The suppliers are:

- Base Plates – Continental Field Systems, Savannah, Georgia
- Wear Plates – Gadsden Tool Company, Gadsden, Alabama
- Fasteners – FEMCO Machine Company, Punxsutawney, Pennsylvania
- Field Demolition and Construction – General Dynamics/Vertex RSI, Richardson, Texas

Track measurements and site preparations will begin this summer. Components will begin arriving in the fall, and all components are scheduled to be on site by April 1, 2007. Mobilization of field forces will occur in April, and demolition and construction will begin the week of April 30, 2007 and last approximately 90 days. The telescope pointing must then be re-characterized to support astronomical operations, which will occur in August 2007.

The next fifteen months will be busy ones for the Green Bank staff. They will be conducting factory inspections and measurements, as well as providing field support, fabrication of transition pieces, minor modifications of the wheel and truck system, and oversight of the measuring and alignment processes in addition to the astronomical characterization activity.

Bob Anderson

2007 Summer Shutdown – Special Call for Proposals

Normal operation of the GBT will be suspended for approximately four months, starting in May 2007, to allow for the azimuth track remediation work. For most of this time, the telescope will be parked at a fixed azimuth, and for certain periods no operation will be possible. However at other times it will be possible to use the GBT with reduced capabilities (e.g. as a transit telescope). We are still finalizing the detailed plans for the shutdown period. Once these are complete, we will announce a specific call for proposals for the shutdown period, to be submitted for the October 2006 proposal deadline. Full details will be posted to the Green Bank website and distributed via the "gbt-news" email exploder.

Richard Prestage

New GBT Scientific Management Positions

Ron Maddalena

Karen O'Neil

To improve our ability to continually enhance the scientific operation of the GBT and the effectiveness of our development program, I have created two new scientific management positions, the Head of GBT Science Operations, and the Head of GBT Program Development. I am very pleased that we have been able to fill both of these positions with excellent candidates from the existing Green Bank scientific staff.

The Head of Science Operations will be responsible for leading the day-to- day operation of the GBT from a scientific perspective. This position has been filled by Ron Maddalena. The Head of GBT Program Development will oversee the execution of continued upgrades to the GBT, including taking responsibility for the Green Bank six-week cycle planning process. This position has been filled by Karen O'Neil.

Together, Karen and Ron will execute many of the duties which were previously the responsibility of the Deputy Assistant Director. They are two extremely competent individuals who bring many skills to the table. They will be working closely in collaboration with me, Jay Lockman (GBT Principal Scientist), and all of the Green Bank Division Heads to ensure that our scientific, technical, and administrative staff are deployed to provide maximum benefit.

Richard Prestage

GBT Student Support Program: Announcements of Awards

Four awards were made in May 2006 as part of the GBT Student Support Program. The program is designed to support GBT research by graduate or undergraduate students at U.S. universities or colleges, thereby strengthening the proactive role of the Observatory in training new generations of telescope users.

The May 2006 awards were in conjunction with approved observing proposals submitted at the February 2006 deadline. Awards were made to the following students:

- A. Basu-Zych (Columbia University) in the amount of $10,000 for the proposal entitled: *HI Observations of Local Analogs of Lyman Alpha Break Galaxies*.
- E. Chambers (Boston University) in the amount of $18,000 for the proposal entitled: *Pre-stellar Evolution in Infrared Dark Cloud Cores.*
- J. Hewitt (Northwestern University) in the amount of $9,000 for the proposal entitled: *A Continued Search for Supernova Remnants.*
- S. Ragan (University of Michigan) in the amount of $34,200 for the proposal entitled: *Ammonia in Massive Pre-stellar Cores.*

New applications to the program may be submitted along with new GBT observing proposals at any proposal deadline. For full details on this program and a cumulative record of past rewards, select the GBT Student Program from the GBT Astronomers page at the Green Bank home page or access the program description directly at *http://wiki.gb.nrao.edu/bin/view/Observing/GbtStudentSupportStatus.*

R. C. Bignell (NRAO), K. E. Johnson (Univ. Virgnia),
D. J. Nice (Princeton Univ.),
F. J. Lockman (NRAO), R. Prestage (NRAO)

Socorro

VLA Configuration Schedule

Configuration	Starting Date	Ending Date	Proposal Deadline
BnA	26 May 2006	12 Jun 2006	1 Feb 2006
B	16 Jun 2006	18 Sep 2006	1 Feb 2006
CnB	29 Sep 2006	16 Oct 2006	1 Jun 2006
C	20 Oct 2006	16 Jan 2007	1 Jun 2006
DnC	26 Jan 2007	12 Feb 2007	2 Oct 2006
D	16 Feb 2007	14 May 2007	2 Oct 2006
A	01 Jun 2007	*	1 Feb 2007

Note: For the next configuration cycle there is, at present, considerable uncertainty about the duration of each configuration as well as about the ordering of the configurations. This is because of the possibility of increased observing time for large proposals (see article elsewhere in this Newsletter) and because of requirements of EVLA commissioning. The community will be informed of future configuration schedules in upcoming editions of the NRAO Newsletter as well as by email and on the web.*

VLA Proposals

The new NRAO Proposal Tool, which is accessed through portal *http://e2e.nrao.edu/userdb,* is now the only method available for submitting VLA Proposals. The maximum antenna separations for the four VLA configurations are A-36 km, B-11 km, C-3 km, and D-1 km. The BnA, CnB, and DnC configurations are the hybrid configurations with the long north arm, which produce a circular beam for sources south of about -15 degree declination and for sources north of about 80 degree declination. Some types of VLA observations are significantly more difficult in daytime than at night. These include observations at 90 cm (solar and other interference; disturbed ionosphere, especially at dawn), deep 20 cm observations (solar interference), line observations at 18 and 21 cm (solar interference), polarization measurements at L-Band (uncertainty in ionospheric rotation measure), and observations at 2 cm and shorter wavelengths in B and A configurations (trophospheric phase variations, especially in summer). In 2007, the D configuration daytime will involve RAs between 21^h and 03^h. Current and past VLA schedules may be found at *http://www.vla.nrao.edu/astro/prop/schedules/old/*.

EVLA construction will continue to impact VLA observers; please see the web page at *http://www.aoc.nrao.edu/evla/archive/transition/impact.html*.

VLBA Proposals

Please use the most recent proposal coversheet, which can be retrieved at *http://www.nrao.edu/administration/directors_office/vlba-gvlbi.shtml*. Proposals in Adobe Postscript format may be sent to *propsoc@nrao.edu*. Please ensure that the Postscript files request U.S. standard letter paper. Proposals may also be sent by paper mail, as described at the web address given above. Fax submissions will not be accepted. VLA/VLBA referee reports are distributed to proposers by email only, so please provide current email addresses for all proposal authors.

Time will be allocated for the VLBA on intervals approximately corresponding to the VLA configurations, from those proposals in hand at the corresponding VLA proposal deadline. VLBA proposals requesting antennas beyond the ten-element VLBA must justify, quantitatively, the benefits of the additional antennas. Any proposal requesting a non-VLBA antenna is

ineligible for dynamic scheduling, and fixed date scheduling of the VLBA currently amounts to only about one third of observing time. Adverse weather increases the scheduling prospects for dynamics requesting frequencies below about 10 GHz. See *http://www.vlba.nrao.edu/astro/schedules/* for a list of dynamic programs which are currently in the queue or were recently observed. VLBA proposals requesting the GBT, the VLA, and/or Arecibo need to be sent only to the NRAO. Note also the possibility to propose for the High Sensitivity Array (see *http://www.nrao.edu/HSA*). Any proposal requesting NRAO antennas and antennas from two or more institutions affiliated with the European VLBI Network (EVN) is a Global proposal, and must reach **both** the EVN scheduler and the NRAO on or before the proposal deadline. VLBA proposals requesting only one EVN antenna, or requesting unaffiliated antennas, are handled on a bilateral basis; the proposal should be sent both to the NRAO and to the operating institution of the other antenna requested. Coordination of observations with non-NRAO antennas, other than members of the EVN and the DSN, is the responsibility of the proposer.

J. M. Wrobel and B. G. Clark
schedsoc@nrao.edu

VLBI Global Network Call for Proposals

Proposals for VLBI Global Network observing are handled by the NRAO. There are three Global Network sessions per year, with up to three weeks allowed per session. Plans for Global Network sessions are posted at *http://www.obs.u-bordeaux1.fr/vlbi/EVN/call.html*.

Any proposal requesting NRAO antennas and antennas from two or more institutions affiliated with the European VLBI Network (EVN) is a Global proposal, and must reach **both** the EVN scheduler and the NRAO on or before the proposal deadline. Fax submissions of Global proposals will not be accepted. A few EVN-only observations may be processed by the Socorro correlator if they require features of the EVN correlator at JIVE which are not yet implemented. Other proposals (not in EVN sessions) that request the use of the Socorro correlator must be sent to NRAO, even if they do not request the use of NRAO antennas. Similarly, proposals that request the use of the EVN correlator at JIVE must be sent to the EVN, even if they do not request the use of any EVN antennas. All requests for use of the Bonn correlator must be sent to the MPIfR.

Please use the most recent proposal coversheet, which can be retrieved at *http://www.nrao.edu/administration/directors_office/vlba-gvlbi.shtml*. Proposals may be submitted electronically in Adobe Postscript format. For Global proposals, those to the EVN alone, or those requiring the Bonn correlator, send proposals to *proposevn@hp.mpifr-bonn.mpg.de*. For Global proposals that include requests for NRAO resources, send proposals to *propsoc@nrao.edu*.

Please ensure that the Postscript files sent to the latter address request U.S. standard letter paper. Proposals may also be sent by paper mail, as described at the web address given. Only black-and-white reproductions of proposal figures will be forwarded to VLA/VLBA referees. VLA/VLBA referee reports are distributed to proposers by email only, so please provide current email addresses for all proposal authors.

J. M. Wrobel and B. G. Clark
schedsoc@nrao.edu

VLA Dynamic Scheduling Opportunities

During recent trimesters, we have experimented with dynamically scheduling the VLA during the reconfiguration periods. We evolved from an experimental to an operational phase in trimester 2006-T2 by dynamically scheduling in the reconfiguration periods as well as during gaps in the schedules for the BnA and B configurations. Previously, such gaps were scheduled as filler subject to preemption for rapid response science.

These dynamic scheduling opportunities will continue indefinitely. Eligible proposers are invited to submit observe files for these dynamic opportunities. On the day of observation, observe files will be picked to fill the time from among those submitted. Information

about the available time will be regularly updated. Should you wish to take advantage of these opportunities, please consult *http://www.aoc.nrao.edu/~schedsoc/dynvla.shtml* for information about eligible proposers, as well as about preparing and submitting observe files at *http://www.aoc.nrao.edu/~schedsoc/dynin.html* for information about available LSTs.

J. M. Wrobel and B. G. Clark
schedsoc@nrao.edu

EVLA Impact Forecast and the Return of EVLA Antennas to the VLA

During the entire EVLA project NRAO is committed to keeping the VLA observing and producing forefront science. It is expected that there will be some periods when the amount of observing time is reduced, and the average number of antennas available may be less than for the nominal VLA. Also, as EVLA antennas return to observing after their EVLA outfitting, and during the time that the VLA correlator is still in use (the so-called transition period), the use of the VLA with these EVLA antennas may be somewhat different than observers have experienced. It is thus important that users of and proposers for the VLA are kept apprised of the current situation of the impact of EVLA work as it affects the VLA. We have a couple of ways of doing this. We have an email list of VLA observers, and items of interest about the EVLA impact (as well as other articles of note) are sent to this list, typically about a month in advance of NRAO proposal deadlines. If you would like to be added to this list, please contact Lori Appel (*lappel@nrao.edu*, 505-835-7300). In addition, there are two web sites (which we have advertised in previous *Newsletter* articles) which discuss both the EVLA impact forecast on VLA observers (*http://www.aoc.nrao.edu/evla/archive/transition/impact.html*) and the use of returned EVLA antennas to the VLA (*http://www.vla.nrao.edu/astro/guides/evlareturn*). The impact forecast page is updated at about the same time as the email message mentioned above, while the use of returned EVLA antennas page is updated more often, as we ourselves learn about the best observing methods for the EVLA antennas, about twice per month. If you are an observer using the VLA, or a possible proposer to use the VLA, these two web pages have important information for the use of the VLA during this transition period.

Mark Claussen

Amplitude Calibrator Models for the VLA

It is well known that the main amplitude calibrators for the VLA are resolved at most frequencies and configurations. Where they are not heavily resolved (e.g., 20 cm in the D-configuration), there are confusing sources in the field of view. The best way to directly determine the amplitude calibration of the VLA antennas is to use detailed models of the source structure of these calibrators. See as an example Figure 1, which shows an image and the uv plot of 3C48 at X-,Band.

In the June 30, 2004 edition of the AIPS Letter, we announced the availability of VLA flux calibrator models for the three highest frequency bands observed with the VLA in AIPS. Here we announce the availability of flux calibrator models for all bands from 1.3 to 20 cm for 3C48 and 3C286, all bands from 1.3 to 6 cm for 3C138, in addition to the models for 0.7, 1.3, and 2.0 cm for 3C147. Additional models for 3C138 and 3C147 at the lower frequencies will become available over the next year. To see what models are available in AIPS, type CALDIR, at the AIPS prompt; to load a model use the task CALRD. The models are also available for download from *http://www.aoc.nrao.edu/~cchandle/cal/cal.html* (0.7, 1.3, and 2.0 cm) and *http://www.aoc.nrao.edu/~amiodusz/vlacal.html* (3.6, 6, and 20 cm).

Now that most VLA primary flux calibrators have models, using models should be the default when amplitude calibrating the VLA. See the AIPS Cookbook for details. As mentioned above, the VLA primary flux calibrators are resolved at most frequencies

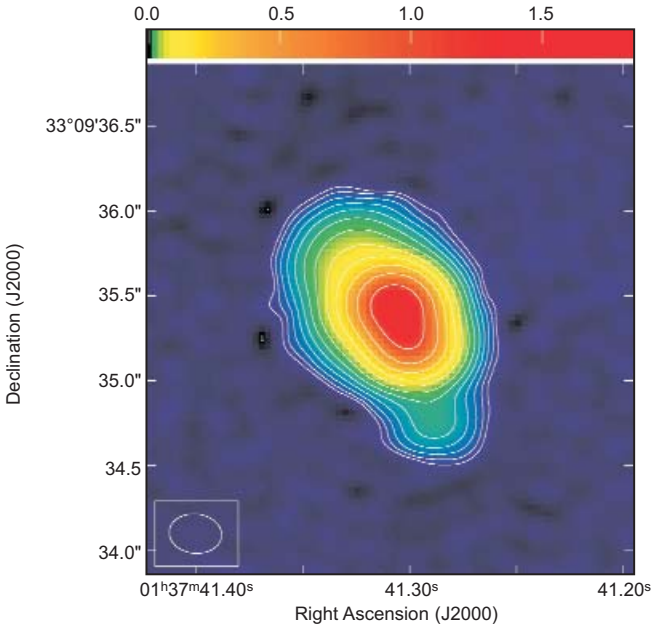


Figure 1. An image of the VLA primary flux calibrator 3C48 at X-Band that includes all VLA configurations.

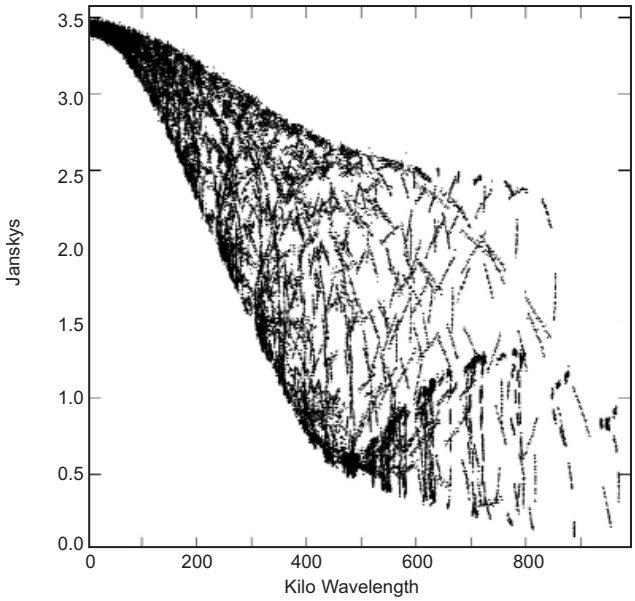


Figure 2. Plot of the amplitude vs. uv distance for the data used to make the image on the left. As can be seen, 3C48 is severely resolved and the available source models should be used when calibrating the data.

and configurations. Even in the configurations and frequencies where they are not resolved there can be many confusing sources, so in *all situations* a model will make the flux calibration more accurate. Using the models means that the user will no longer have to limit the uv range or antennas when running CALIB, which in turn will make automated data reduction easier. For example, the AIPS procedure VLARUN automatically uses the models if they exist.

Amy Mioduszewski

Education and Public Outreach

NRAO at the 208th AAS Meeting

More than 600 astronomers gathered in Calgary, Alberta, for the American Astronomical Society's 208th meeting in early June. The attendees enjoyed the crisp air in the foothills of the Canadian Rockies, a beautiful city's vibrant downtown, and a host of scientific presentations, including exciting news about current and future research with NRAO telescopes.

On Monday afternoon, ALMA took center stage at a special session on *Imaging Star Formation in the Cosmos with ALMA*. Chaired by NRAO's John Hibbard, this session featured three talks that clearly showed the excitement that ALMA's unprecedented capabilities engender among those seeking to understand the processes of star formation. Doug Johnstone, of the NRC-Herzberg Institute of Astrophysics and the University of Victoria, spoke about the need for ALMA to pursue detailed studies of star formation in the Milky Way. He was followed by Jean Turner, of UCLA, who outlined how ALMA will advance our understanding of star-forming gas in nearby galaxies.

Scott Ransom talking to scientists after his invited presentation at the AAS.

NRAO exhibits at the Calgary meeting.

Andrew Blain of Caltech presented the final talk, explaining how ALMA promises a rich scientific yield in the study of distant galaxies.

That oral session was followed by a poster session on the same topic on Wednesday and Thursday. Nine posters in this session detailed not only ALMA's importance to understanding star formation processes, but also how NRAO is preparing to make ALMA a productive and efficient scientific tool for the entire astronomical community.

Thursday, the final day of the meeting, was opened with a well-attended talk by NRAO's Scott Ransom, on *Pulsations, Exotic Objects, and Partner Swapping (oh, my!): A New Globular Cluster Pulsar Renaissance.* Ransom delighted his audience with a recounting of the discoveries he and his colleagues have made using the GBT to find new millisecond pulsars in the globular cluster Terzan 5. They not only broke the record for the number of pulsars in a globular (33), but also found the fastest-spinning millisecond pulsar ever, at 716 Hz. He explained the implications of this work for understanding neutron-star equations of state, General Relativity, and the dynamics of globular clusters.

Throughout the meeting, attendees visited the NRAO booth in the exhibit area to pick up literature about the Observatory, get a new NRAO luggage tag, and to talk about using our observing facilities to advance their own scientific goals. NRAO scientists and Education and Public Outreach personnel were on hand to answer questions at the booth.

Dave Finley

NRAO Hosts Virginia Piedmont Technology Council 2006 Tech Tour

On March 30, 2006, the NRAO Technology Center (NTC) in Charlottesville hosted an enthusiastic group of 12 high school students for a special tour of this unique facility and its technology. Sponsored by the Virginia Piedmont Technical Council and the Piedmont Virginia Community College, the 2006 Tech Tour introduced area high school students to the dynamic high technology world that exists in and around Charlottesville, and the challenging and diverse career possibilities offered by technology. Students spent an entire day traveling to selected companies and research facilities where they were treated to a wide range of hands-on demonstrations. Through Tech Tour, high

school students experienced technology in many unique and specialized applications. Tech Tour also provided valuable opportunities for young people to meet and talk with local engineers, scientists, and technicians who are advancing real-world technology in modern laboratory environments. During this year's Tech Tour at the NTC, Richard Bradley, John Effland, and Gerry Petencin led the visiting students in lively discussions and demonstrations of radio astronomy instrumentation and signal processing, receiver design and testing for the Atacama Large Millimeter Array, low noise amplifiers, and electro-chemistry.

Mark Adams

John Effland with high school students during the 2006 NRAO Technology Center tour.

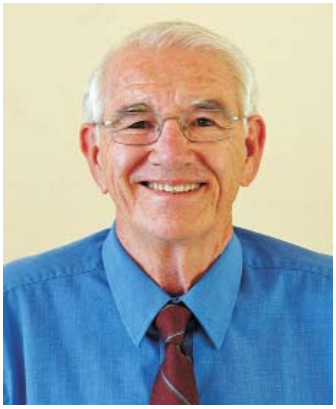
In General

Frank J. Low Selected for the 2006 Jansky Lectureship

Associated Universities, Inc., and the National Radio Astronomy Observatory are pleased to announce that the 41st annual Karl G. Jansky Lectureship has been awarded to Professor Frank J. Low, a pioneer in the development of millimeter and infrared astronomy.

While he was at the NRAO (1962 – 1965), Low undertook a series of important millimeter wavelength experiments. Conducted in Green Bank, West Virginia, this work exploited his innovative low temperature bolometer detector which was mounted on a relatively small dish. The success of this early research resulted in Low's proposal to continue with a larger instrument at a drier site and eventually led to the NRAO millimeter wavelength 36 Foot Telescope at Kitt Peak, Arizona.

Low's pioneering work in infrared astronomy began with the development of his sensitive broadband detector that enabled astronomers to observe throughout the infrared spectrum, a breakthrough achievement. Low also developed the first airborne telescope that operated open-port at 50,000 feet. With these novel tools he proved that the two giant planets, Jupiter and Saturn, generate and emit internal energy. In addition, Low was a primary organizer of the joint American-British-Dutch Infrared Astronomy Satellite (IRAS), the first satellite to observe the universe in the infrared.



Frank J. Low

Low's astronomical research career has been wide-ranging. His work has included significant contributions to the physics of the Solar System, stars, star formation, the Galactic Center, other galaxies, and quasars. The Kleinmann-Low Nebula, for example, is an unusually active star-forming region in Orion. Discovered in 1967 by Low and his collaborator Douglas Kleinmann, observation of this nebula and its environs at infrared and other wavelengths has led to key advances in our understanding of massive star formation.

Low joined the University of Arizona Lunar and Planetary Laboratory in 1965. He became a Steward Observatory Research Professor in 1971, a Regents' Research Professor in 1988, and Regents' Professor Emeritus in 1996. In addition to his election to the National Academy of Sciences in 1974, Low has received numerous prestigious awards, including the Helen B. Warner Prize of the American Astronomical Society, the NASA Medal for Exceptional Scientific Achievement, the Rumford Prize of the American Academy of Arts and Sciences, and the Joseph Weber Award for Astronomical Instrumentation (American Astronomical Society). Professor Low was most recently awarded the Astronomical Society of the Pacific's 2006 Catherine Wolfe Bruce Gold Medal for lifetime achievement. He is also president and founder of Infrared Laboratories, Inc.

Professor Low's 2006 Jansky Lecture is entitled, *How the Spitzer Space Telescope was Designed, Tested, and Built*, and will be presented on October 18 in Charlottesville, Virginia and on October 20, in Green Bank, West Virginia. The final presentation of the Lecture is being planned for early November in Socorro, New Mexico.

The Karl G. Jansky Lectureship is an honor established by the trustees of Associated Universities, Inc., to recognize outstanding contributions to the advancement of astronomy. First awarded in 1966, it is named in honor of Karl G. Jansky who, in 1932, first detected radio waves from a cosmic source. Further information can be found at *http://www.nrao.edu/jansky/janskyprize.shtml*.

Fred K. Y. Lo

Head of North American ALMA Science Center Announced

We are delighted to announce that Chris Carilli has been appointed as the Head of the ALMA Science Center (NAASC) effective May 1, 2006.

Chris will initially take up the role from Socorro before relocating to Charlottesville later this year. Chris is no stranger to ALMA being a member of both the ASAC and ANASAC. This is a very formative time for the North American ALMA Science Center and we look forward to Chris' involvement and leadership.

Chris Carilli

While Chris is moving from Socorro and his long affiliation with the VLA and VLBA, his move illustrates the important principle of One Observatory by rotating our staff to where he or she is needed the most.

In addition, the One Observatory goal is not for the NA ALMA Science Center to function in isolation. There will be very close collaboration and coordination and active exchanges of personnel and ideas with the Science Centers NRAO is planning to establish for EVLA/VLBA and the GBT.

It is important to note that Science Centers do not refer to buildings. They refer to the necessary activities provided and organized by NRAO to the astronomy community to make sure all the NRAO telescopes are optimally used for science.

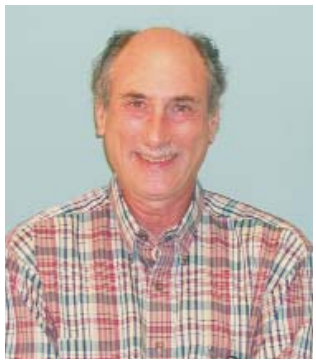
K. Y. Lo and A. P. Russell

NRAO e2e Project Team Appointed

I am pleased to announce the appointment of Nicole Radziwill as the new Assistant Director for the End-to-End (e2e) Operations Project and Ed Fomalont as the End-to-End Project Scientist and Deputy to Nicole, effective April 3, 2006.

Nicole Radziwill

The e2e Operations Project is a critical, strategic initiative of the



Ed Fomalont

Observatory to make each of our facilities easier to use for all astronomers, starting from proposal submission and ending with the access to reference images that are archived and part of the Virtual Observatory. Broadening access to NRAO facilities by the overall astronomical community is essential to optimizing the science return from the substantial investments in NRAO facilities. To achieve this important goal, the Assistant Director for e2e Operations Project will work closely with all the sites and projects within NRAO to provide the critically needed Observatory-wide coordination and leadership in this area.

As the name indicates, the e2e Operations Project will develop operational modes in addition to specific software tools. The project will span all the NRAO facilities, the GBT, (E)VLA, and VLBA, and will work closely with the Joint ALMA Observatory to optimize cooperation and commonality of approach. In the end, users of NRAO facilities will be presented with a complement of easy-to-use radio astronomical facilities that can address a broad range of scientific enquiries.

Nicole assumes these new duties following an extremely successful tenure as Head of the Software Development Division for the Green Bank Telescope. Under Nicole's leadership, the GBT group has successfully deployed new versions of the monitor and control system, a new user interface and scheduling block builder (which embodies important elements of an e2e system), online data displays, and a new data analysis system. Prior to joining NRAO, Nicole had many years of experience in the commercial world as a program manager for software development.

Ed is recognized as one of the world's most experienced users and data reduction experts for the VLA and VLBA. He has worked closely with those facilities since their inception. Recently, Ed has also been a primary tester for the ALMA post-processing software group and is involved with the ALMA correlator and calibration teams. Ed's breadth of scientific knowledge and experience will be invaluable in guiding e2e operations development.

Fred K. Y. Lo

2006 Recipient of an Indian National Science Academy Medal for Young Scientists

Poonam Chandra

Poonam Chandra, a Jansky Postdoctoral Fellow resident at the University of Virginia, is the 2006 recipient of an Indian National Science Academy Medal for Young Scientists. The award is given annually to scientists under the age of 35 who show the highest promise, creativity, and excellence. She received the medal and a cash prize for her work on supernovae and soft gamma-ray repeaters using data taken with the Giant Meter-wave Radio Telescope (GMRT) and the Very Large Array (VLA).

Dale Frail

2006 Grote Reber Gold Medal to be Awarded to Bernard Mills

The 2006 Grote Reber Gold Medal will be awarded to Professor B. Y. Mills, one of the early pioneers of radio astronomy. Mills is being honored for his innovative contributions to the development of radio telescopes and for his pioneering investigations of the radio sky which led to the first estimates of the radio galaxy luminosity function and helped to define their spatial distribution. The medal will be presented at a ceremony

on August 17, during the IAU General Assembly in Prague.

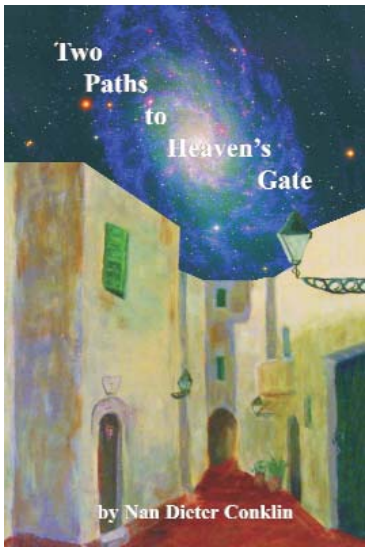
Prof. B. Y. Mills

The Reber Medal was established by the Trustees of the Grote Reber Foundation to honor the achievements of Grote Reber and is administered by the Queen Victoria Museum in Launceston, Tasmania in cooperation with NRAO, the University of Tasmania, and the CSIRO Australia Telescope National Facility. Nominations for the 2007 Medal may be sent to Martin George, Queen Victoria Museum, Wellington Street, Launceston, Tasmania 7250, Australia or by e-mail to *martin@qvmag.tas.gov.au* to be received no later than November 15, 2006.

Ken Kellermann

Two Paths to Heaven's Gate

NRAO and the NRAO Archives are pleased to announce the publication of *Two Paths to Heaven's Gate*, a memoir by Nan Dieter Conklin. Dr. Conklin was a prominent figure in what was 50 years ago an entirely new science, radio astronomy. She was the first American woman whose Ph.D. dissertation used radio astronomy data and, in 1952, the first American woman to formally publish original research in the field. Over the course of her impressive career at Harvard and Berkeley, she pioneered studies of neutral hydrogen in nearby galaxies that are members of the local group and of the structure of the interstellar medium in the Milky Way and other galaxies. She also played a key role in early discoveries and investigations of interstellar masers. In her candid memoir, Dr. Conklin discusses the evolution of her scientific work and her interactions with the other senior scientists of her day, writing with continuing fascination of discoveries both accidental and painstakingly accomplished. The book is also clear view of her personal life, from the considerable adversities she experienced – the demands of single parenthood in the days before childcare, the multiple sclerosis with which she was diagnosed in 1960, just two years after receiving her doctorate – to a celebration of her immensely happy third marriage to Garret Conklin and subsequent exuberant adventures in lifestyle and travel. Dr. Conklin tells of her personal and professional life with a clarity that is accessible to both scientists and non-scientists.



Two Paths to Heaven's Gate

Copies are $10 each prepaid, with an additional per copy shipping and handling charge of $3 for U.S., $14 for Canada/Mexico, and $20 to other non-U.S. addresses. Checks payable to NRAO should be sent to: NRAO Archives, 520 Edgemont Rd., Charlottesville VA 22903, USA. Please include a full shipping address, or a print copy of the order form found at *http://www.nrao.edu/archives/Conklin/bookorder.pdf*

Ellen N. Bouton

2006 NRAO/AUI Radio Astronomy Image Contest

(reprinted from January issue)

The NRAO is calling for submissions to the second annual Radio Astronomy Image Contest, which is sponsored by Associated Universities, Inc. (AUI), the NRAO's parent organization. We hope to involve the community in a significant way and provide a means to showcase the community's work through its publication in the Image Gallery, a calendar, and a series of

posters. We welcome images that display multi- wavelength information and contain data obtained with any telescope, however we request that they contain and showcase radio emission observed with an NRAO telescope.

The prizes are sponsored by Associated Universities, Inc. (AUI) which will award a first prize, a second prize and up to ten honorable mentions consisting of: First Prize $1,000; Second Prize $500; Honorable Mentions $100 each. The prizes will be awarded by a panel of scientists appointed by the NRAO that will include one scientist who is not a member of the Observatory's staff. The panel membership will be made public when the contest results are announced. The deadline for submission is September 1, 2006. The winners will receive email notification and will be announced on the NRAO website by October 15, 2006.

Details of the contest as well as a submission tool can be found on the NRAO website at: *http://www.nrao.edu/ image-contest.html* while the most relevant details can also be found in the flier enclosed with this *Newsletter*.

The contest will add significantly to the online NRAO Image Gallery (*http://www.nrao.edu/imagegallery/php/level1.php*). The Gallery contains radioastronomical images organized by object classes and can be browsed using a comprehensive Search Tool with links to the NASA Extragalactic Database (NED), the SIMBAD database, and also to the corresponding scientific and popular papers. The Image Gallery includes a web-based submission tool (*http://www.nrao.edu/image-gallery/ php/ext_sub.shtml*) which can be used to upload images using a web browser.

Juan Uson

Further Information

To obtain more information on the NRAO, visit the NRAO home page at: *http://www.nrao.edu*

To Contact any NRAO Site

Headquarters
Director's, Human Resources, Business Offices
Atacama Large Millimeter Array
North American ALMA Science Center
Charlottesville, Virginia
(434) 296-0211

Green Bank Site
Green Bank Telescope
Green Bank, West Virginia
(304) 456-2011

Array Operations Center
Very Large Array
Very Long Baseline Array
Socorro, New Mexico
(505) 835-7000

Tucson Site
ALMA Tucson
Electronics Division
Tucson, Arizona
(520) 882-8250

NRAO Results

For more information on recent scientific research with NRAO telescopes:

NRAO Press Releases: *http://www.nrao.edu/pr*
NRAO Preprints: *http://www.nrao.edu/library/listings/nrao_current.shtml*
Current VLA Observation Highlights: *http://www.vla.nrao.edu/genpub/current_obs/*

NRAO Products

VLA NVSS Survey (VLA D-array 20 cm continuum): *http://www.cv.nrao.edu/nvss/*
VLA FIRST Survey (VLA B-array 20 cm continuum): *http://www.cv.nrao.edu/first/*
Galactic Plane "A" Survey: *http://www.gb.nrao.edu/~glangsto/GPA/*
The NRAO Data Archive System can be accessed and queried via the web: *http://e2e.nrao.edu/archive/*
Green Bank Solar Radio Burst Spectrometer (SRBS): *http://www.nrao.edu/astrores/gbsrbs/*

Observing Information

VLA: *http://www.vla.nrao.edu/astro*
VLBA: *http://www.aoc.nrao.edu/vlba/html/vlbahome/observer.html*
GBT: *http://www.gb.nrao.edu/astronomers.shtml*
Information on proposal templates, instructions, and deadlines can be found at:
http://www.nrao.edu/administration/directors_office/

Publicizing NRAO Results

If you have a new research result obtained using an NRAO telescope that might be of interest to a wider audience, please write a 2-3 sentence description of the result and email it to one or more of the persons listed below. Your information could result in a press release, an article in this Newsletter, and/or inclusion of your image in the NRAO Image Gallery.

Press release contact: Dave Finley, Public Information Officer (*dfinley@nrao.edu*)
Newsletter contact: Mark Adams, Editor (*mtadams@nrao.edu*)
Image Gallery contact: Patricia Smiley, Information Services Coordinator (*psmiley@nrao.edu*)

NRAO Page Charge Policy

It is NRAO policy to pay a portion of the page charges for articles reporting original observations made with NRAO instruments or utilizing NRAO archival data. For more information and for details of the policy requirements, please see: *http://www.nrao.edu/library/page_charges.shtml*.

The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.

NATIONAL RADIO ASTRONOMY OBSERVATORY
520 EDGEMONT ROAD
CHARLOTTESVILLE, VA 22903-2475

DATED MATERIAL - DO NOT DELAY