THE OBSERVER

NEWS FROM THE GREEN BANK OBSERVATORY
QUARTER 1, 2017

DIRECTOR'S NEWS

Welcome to the first issue of **The Observer**, the Green Bank Observatory's quarterly newsletter. As many of you are aware, after almost 60 years in the National Radio Astronomy Observatory, we have branched off to become a separate organization – the Green Bank Observatory. While the separation entails many changes for the facility and staff, we are endeavoring to keep the changes as smooth as possible for our user community. As a result, the proposal process for the GBT will remain synchronized with that of our sister organizations, the NRAO and the Long Baseline Observatory. Many of the other changes we are undergoing, such as the website transition, are described within this newsletter.

2016 was a busy year for the Green Bank Observatory. In addition to transitioning to a separate organization, we have two new high frequency instruments coming online this winter – MUSTANG2, a 70-105 GHz, 210 element bolometer array, and ARGUS, a 75-116 GHz, 16 element focal plane array. Both instruments have been through their initial science commissioning and are already taking early science data. Also in 2016 we began two exciting new contracts with the Breakthrough Foundation and with NANOGrav. Breakthrough Listen is the largest ever scientific research program aimed at finding evidence of civilizations beyond Earth. The scope and power of the search are on an unprecedented scale. The program includes a survey of the 1,000,000 closest stars to Earth. It scans the center of our galaxy and the entire galactic plane. Beyond the Milky Way, it listens for messages from the 100 closest galaxies to ours. NANOGrav monitors a set of pulsars that together form a Galactic scale gravitational-wave observatory. The data collected is also used to study supermassive black hole binaries in order to understand the morphology, kinematics, gas content, and feedback mechanisms of galaxies.

In the next few months we will be seeing quite a few improvements to the Green Bank Observatory. This winter will be our first excellent season for high frequency observing with ARGUS and MUSTANG2. Additionally, the first few pulsar observing modes with VEGAS, our FPGA/GPU signal processing system, will be released. And over the next few months we will be releasing a new reservations system for visitors coming to the site.

IN THIS ISSUE

Finally, I am excited to announce that this fall we will be having both a celebration of 60 years as a world class astronomical facility and a workshop looking toward the long term future of our facility and its instruments. Information on the workshop is given later in this newsletter, and information on the 60th anniversary celebration will be forthcoming.

Wishing all of you a fantastic 2017,

Karen O'Neil
Green Bank Observatory Director

UPCOMING EVENTS

OBSERVER TRAINING WORKSHOP (MAY 15-19)

The Green Bank Observatory's Observer training schools provide an introduction to general radio astronomical techniques as well as onsite training for GBT observers. These training schools will replace the single-dish summer schools which have held in the past, and will be scheduled two to three times each year. The next training school will be held May 15-19, 2017 in Green Bank, with the following school September 18-22, 2017.

We still encourage new observers to visit the Observatory, where their projects will receive priority scheduling and where local staff are on hand to assist in the observations. For further information, please see:
greenbankobservatory.org/observer-training/

TRANSFORMATIVE SCIENCE FOR THE NEXT DECADES WITH THE GREEN BANK OBSERVATORY

Big Questions, Large Programs, and New Instruments (October 16-20): With new instruments and excellent performance, the 100m Green Bank Telescope is only just reaching its full potential. On this 60th anniversary of the ground breaking for the Green Bank Observatory, we are holding a workshop looking toward the next 10, 20, and even 60 years of the Green Bank Observatory, and invite the community to attend and aid us in planning the future. For further information, please see:
greenbankobservatory.org/transformative-science

SKYNET JUNIOR SCHOLARS

The Skynet Junior Scholars program will host a 7-week guided, online professional development workshop from January 12th to February 23rd. The workshop will enable program participants to lead informal educational experiences for students in the SJS program. Skynet Junior Scholars (SJS) is designed to engage young explorers in the study of the universe using the same tools as professionals. The SJS web portal connects middle and high-school aged youth with activities, resources and guidance to become scholars of the sky. Workshop participants will receive educational kits and online access to optical and radio telescopes, data analysis tools, and professional astronomers. Upon completion, workshop participants must lead a group of students through the program by June to complete the leadership program. Find out more at:
greenbankobservatory.org/education/student_research/

PULSAR SEARCH COLLABORATORY

For all teachers, informal STEM educators who work with high school students, and students in grades 9-12. Join the Pulsar Search Collaboratory! Learn all about pulsars and how to analyze data taken by the Green Bank Telescope from renowned pulsar astronomers during our next online workshop! The workshop begins January 12 with a meeting just for teachers. Then, the six-week workshop begins for everybody the following week: January 19 at 7:30.

Learn more about the program and sign up here:
pulsarsearchcollaboratory.com/home/join-the-psc/

PROPOSAL NEWS

GREEN BANK TELESCOPE TIME ALLOCATION FOR SEMESTER 17B

The Green Bank Observatory (GBO) invites scientists to participate in the GBO's 2017B Semester Call for Proposals for the Green Bank Telescope (GBT). Proposals requesting the GBT as part of High Sensitivity Array (HSA), and Global 3mm VLBI Array (GMVA) should be submitted through the Long Baseline Observatory's call (available here).

The submission deadline for Semester 2017B proposals is Wednesday, 1 February 2017, at 17:00 EST (22:00 UTC).

The GBO wishes to remind proposers of continuing opportunities for joint observations with the Chandra X-ray Observatory, the Hubble Space Telescope, the Swift Gamma-Ray Burst Mission and the Fermi Gamma-ray Space Telescope.

The GBO strongly encourages proposers to carefully read through the News and Opportunities section of the proposal as there have been a number of changes made to instrument availability.

Proposal preparation and submission remain via the NRAO Proposal Submission Tool (PST) available at NRAO Interactive Services. Note that the PST use requires registration. Proposers who need assistance with proposal preparation or have questions regarding the Call or GBT capabilities should contact Observatory staff via the Helpdesk.

NEWS

A WIDE RANGE OF BLACK HOLE MASSES IN SPIRAL GALAXIES

Many spiral galaxies have circumnuclear accretion disks whose properties can be determined through observations of H2O megamasers. The Green Bank Telescope has been systematically discovering such accretion disks, and through participation in VLBI network observations, measuring the mass of the central black hole. Black hole masses derived this way can be extremely accurate, with uncertainties at the level of 5% to 10%, and follow from Keplerian rotation of the accretion disk at radii of 0.2-1 pc.

Green et al (2016) have used the results of this work for spiral galaxies to consider the connection, if any, between galaxy properties and the mass of the central black hole. They conclude that no galaxy property correlates tightly with the mass of the black hole as traced by megamaser disks in L* spiral galaxies.

They find that megamaser disk galaxies have a MBH-sigma* relationship that differs significantly from that established for the early-type galaxies. At a given sigma*, the disk galaxies have significantly smaller black hole masses, with a larger scatter, than the early-type galaxies.

The disk galaxy properties like total mass and central velocity dispersion also lie within a much narrower range than the black hole masses. It appears that the relationship between nuclear black hole mass and other properties of late-type galaxies remains to be understood.

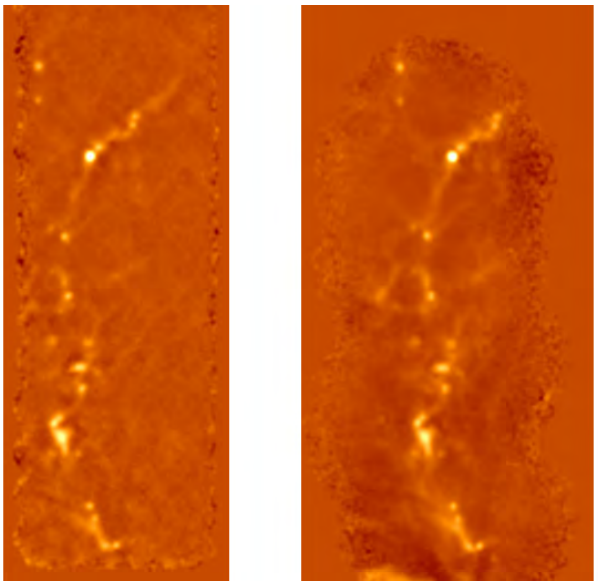
Greene, J.E. et al, 2016, ApJ, 826, L32

MUSTANG 2: AN EXTREMELY SENSITIVE, 100 GHZ BOLOMETER ARRAY

The performance of the newly completed MUSTANG-2 bolometer camera has been verified on the 100-meter Green Bank Telescope and astronomical observations have begun.

MUSTANG-2 sensitively maps broad-spectrum emission on the sky in the 70 to 105 GHz range using 210 individual bolometric detectors, each coupled to the sky with its own feed horn. It will be used for many different types of astronomical studies ranging from detailed imaging of galaxy clusters in the early universe to mapping areas of star formation in our own Galaxy. MUSTANG-2 is the successor to the GBT's pathfinder 3mm bolometer camera, MUSTANG, and represents a large step forward in sensitivity, fidelity, and robustness. To verify the performance of MUSTANG-2 the instrument team spent 40 minutes mapping a region of star formation in the Orion nebula that had previously been studied by MUSTANG (a press release on the original MUSTANG result can be found here). The new and old maps are very similar even though the old map required over 20 times more telescope time to acquire. Nearly 230 hours of highly-oversubscribed hours of GBT 3mm observing time have been allocated for MUSTANG-2 observing in the 2016/2017 season.

The receiver was developed by a collaboration consisting of the University of Pennsylvania, NRAO, NIST, the University of Michigan, the University of Kwazulu-Natal, and Cardiff University, with support from the NSF's ATI program.



Maps of the Orion "Integral Shaped Filament" region made with MUSTANG-1 (left; 14.9 hours integration time) and MUSTANG-2 (right; 40 minutes integration time). Images represent the sky brightness at a wavelength of 3mm.

SCIENCE FAIR

In December, the Green Bank Science Center hosted our 4th Annual Pocahontas County Science Fair. What a fun day for everyone! We had over 40 volunteers from GBO staff, the Forest Service and the local schools serve as judges and activity leaders. This year, 104 students entered 79 group and individual projects! Students not only competed for top project awards, but enjoyed a day of science and engineering activities. In the star lab, activity leaders challenged students to build a bridge that could hold weight with nothing more than index cards. In the classroom, students designed and built their own robot that could replicate similar scribbles made by our top-secret prototype scribblebot. In another collaborative activity, students moved a small ball from one can to another-using only strings! Being a judge this year was no easy task with so many creative and well-designed projects, however, the top prizes went to some very deserving students.

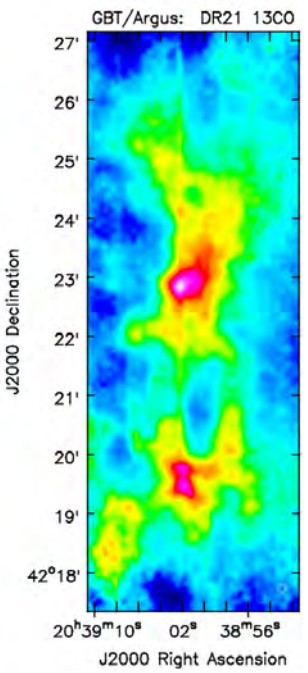
2016 Pocahontas County Science Fair participants

The top overall winners were: Willie O'Ganian from GBEMS in the elementary competition with "Give Primates a Hand!", Jaryd Friel from Marlinton Middle School in the middle school division with "Cleaning Coins", and Pocahontas County High School student Abram Leyzorek won in the high school division with "The effect of Microwaved Water on Feed Corn Growth".

16 ELEMENT FOCAL PLANE ARRAY, ARGUS

Argus is a new 16-element 75-116 GHz focal plane array instrument installed on the GBT. The instrument has successfully completed its initial phases of commissioning and is ready for shared-risk science observations with the GBT. The image is the result of an early test map taken using all 16 beams of Argus.

The image shows the integrated emission from the 13CO molecule associated with the star-formation region DR21. This 10'x3' map required about 40 minutes of telescope time and was taken in non-optimal weather conditions (zenith opacity of 0.42). The image is the result of the default data processing without any data editing. The beam size of the GBT is shown in white at the lower-right of the image for comparison.



Argus is a collaboration between Stanford University (PI Sarah Church), Caltech, JPL, University of Maryland, Universtiy of Miami, and the Green Bank Observatory. Information about the instrument can be found on the ARGUS web-page.

BOY SCOUT MERIT BADGE WEEKENDS

Our new Boy Scout Merit Badge Weekends received such a positive response, the event has become a monthly offering for 2017!

Often reserved months in advance, scout groups of all ages book their weekend here in Green Bank, earning their badges in astronomy or electronics. Scouts learn constellations in the star lab, use the 40-ft Telescope to perform a hands-on research experiment, investigate radio frequency interference and learn about motion of stars and planets. Each weekend, the science center hosts up to 60 or more scouts, often from several troops for the program.

Find out more at:
www.greenbankobservatory.org/scoutweekends

Scouts taking data in the 40-Ft. Control Room

WEBSITE TRANSITIONS

As many of you are likely aware, the Green Bank Observatory has a new website, greenbankobservatory.org

The new website will provide all information about the Observatory, from science news through educational events. However, transitioning to the new website will take time. As a result, you will find that much of the material relevant to scientists interested in taking scientific data with the Green Bank Telescope still resides at its former web address:

science.nrao.edu/facilities/gbt

As content is migrated, the links will be updated to reflect the new web addresses.

HISTORY

300-Foot Groundbreaking, April 27th, 1961.
From left: M. Howell, BS&I Erection Manager; John Hawkins, BS&I VP for sales; Jim Tilley, BS&I Executive VP; E.R. Faelten, Engineer; J.W. Findlay; Otto Struve, Director NRAO; Charlie Bush, BS&I Engineer.

JOHN FINDLAY'S GOLF STORY

John Findlay, NRAO's first head of engineering and electronic design, supervised the construction of the 300-foot telescope during 1961-62. He recounts the 300-foot construction project in a paper he gave at the 300-foot 25th birthday celebration in September 1987, which is reprinted in "But it was Fun", page 145.

The contractor that built the telescope was Bristol Steel and Iron, of Bristol, Virginia. Findlay made frequent trips to Bristol to review the project and disuss changes. The head of BS&I, Jim Tilley, made sure the meetings ended at 12:30 so they could play golf in the afternoon.

Findlay recalls a plan he made for the opening ceremony of the 300-foot telescope:

"Since we are telling stories, I told you that we had to play golf every day we went to Bristol when we were building [the 300 Foot]. And Jim Tilley was not a very good golfer and he had never made a hole-in-one ...

I took a nine-iron to the 300 Foot to see if I could hit a ball high enough to get it into the dish. If I had been able to do so I would have offered Jim the opportunity of making a hole-in-one. If this had worked then at the opening ceremony I would have allowed the golf ball to run down the dish and fall through the hole in the middle and with any luck break some small receptacle containing an alcoholic liquid and that would have completed the circuit. But I couldn't hit a ball into the dish! "

MEET THE STAFF

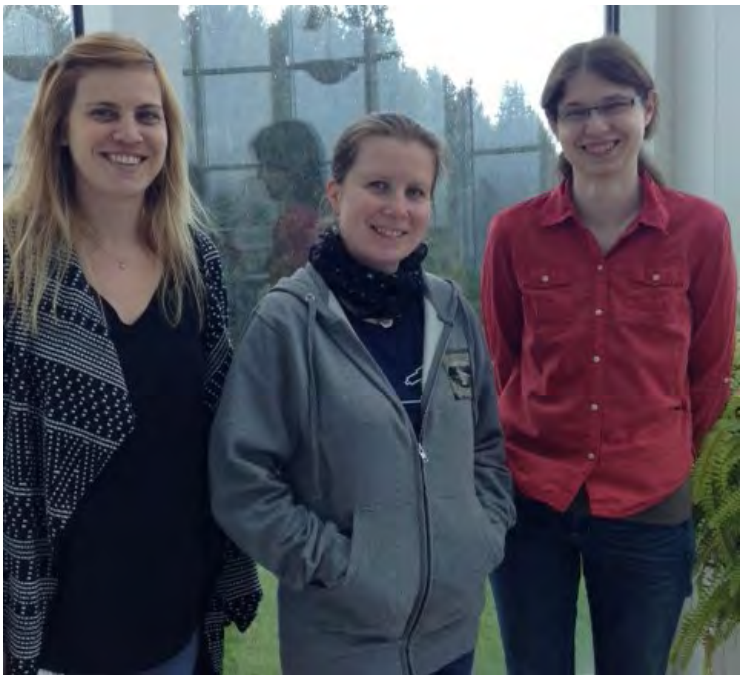
A FULL COMPLEMENT OF POST DOCS

The Green Bank Scientific division has employed a full complement of Post Docs. Our three Post Docs Nichol Cunningham, Jennifer Weston and Natalia Lewandowska are quickly settling into their roles as part of the Scientific team by coordinating colloquia, working with visiting student groups, supporting the GBT observers and doing their own research.

Nichol is from the United Kingdom and a scholar from Leeds University started at the GB site in September 2015. Nichol has already been a prominent addition to Rec Board by being the official party organizer for the Spring Party, organizing the Post Doc Symposium and coordinating volunteers for the Space Race Rumpus. Nichol's research is focused on star and galaxy formations.

Jennifer arrived in March after finishing her PhD at Columbia University. Jennifer too has joined the Rec Board and taught during the Research Student Boot Camp. Her research is focused on using radio observations of novae and symbiotic systems to examine the evolution of accreting dwarf galaxies among other things.

Natalia is our newest arrival just joining us in April. She came directly from defending her PhD in Germany at the University of Wurzburg. Natalia's research is focused on the study of giant radio pulses. Natalia just returned from a conference at the VLA and will be settling into her new role in Green Bank.



From Left: Nichol Cunningham, Natalia Lewandowska and Jennifer Weston

CAREER OPPORTUNITIES

EDUCATION SPECIALIST

The Education Specialist assists the Green Bank Senior Education Officer in designing, funding, and implementing formal and informal education program, and leads, develops, and actively participates in the K-12 education, public outreach, and visitor center programs at the Green Bank Observatory

View posting online: go.nrao.edu/gbo-ed-specialist

SUMMER STUDENT OPPORTUNITIES

Since its inception in 1959, the Green Bank Observatory Summer Student Research Assistantship program has engaged over 1,000 young people in scientific research, and many of our summer students have gone on to distinguished careers in astronomy, physics, and other sciences. The list of former NRAO summer students includes women and men who represent a wide range of careers, research interests, geographic locations, and backgrounds.

Required application materials include the following:

Completed on-line application form

Copies of transcripts (unofficial) from all colleges or universities you attended. You will be prompted at the end of the application process to attach a single PDF file containing your transcripts.

Letters of recommendation, submitted using our online form, from three people who can evaluate your ability, experience, and potential.

View posting online: go.nrao.edu/gbo-summer-research

ENGAGE

The Green Bank Observatory now has membership and other donation opportunities. On the new "Engage" page (greenbankobservatory.org/engage) guests can make a donation, volunteer, or become a member of the Green Bank Observatory.

CONTACTS

Green Bank Observatory
155 Observatory Rd
P.O. Box 2
Green Bank, WV 24944 (USA)
(304) 456-2011

GENERAL CONTACTS

Reservations, Field Trips, Tours, Events, and General Information
Reception; (304) 456-2011;
reservations@gbobservatory.org

Newsletter Information, submissions
pvosteen@nrao.edu

Public RFI Questions:
nrqz@gb.nrao.edu

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