

*Everything You Need to Know:  
A Guide for REU Students  
At Green Bank Observatory*

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*Updated in 2010 by NRAO staff*

As REU students of the National Radio Astronomy Observatory in Green Bank, West Virginia for the summer of 2001, Paul Robinson, Tucker Friesmuth, Michael Wallace and myself have had a blast. Our summer was filled with exciting activities and interesting people.

This guide is designed to help you prepare for your summer as an REU student. I have tried to include everything that you might need to make your life at Green Bank more comfortable and more enjoyable.

#### For Starters:

Being selected to work at the Green Bank Observatory is a great honor. You will have the opportunity to work with some of the telescopes and with great scientists here. If you have never participated in an REU program, do not let yourself be overwhelmed. The program is designed to attract future astronomers, computer programmers, physicists, and mathematicians to the field of radio astronomy. Whatever field you will be working in will be a great start to your career.

#### Prepare Yourself:

Green Bank is a very small town in Pocahontas County, West Virginia. The entire county has a population of nine thousand. If you are accustomed to big city life, you may be shocked to find that such a small community will be your home for the better part of the summer. There is no Wal-Mart or full service grocery store, so prepare to be taken back in time. There is plenty to do to keep you occupied, but you have to be willing to participate. You will find that, due to being in the center of a 13,000 square mile National Radio Quiet Zone, you will be without radio, television, cellular phone, and microwave for the most part. We will show you what there is to do with your time to make your stay worthwhile.

#### Quiet Zone:

The eastern part of West Virginia is encompassed in a thirteen thousand square mile quiet zone that restricts the transmitting of radio waves in order to reduce signals that can be picked up by the highly sensitive radio telescopes at the observatory. All nearby radio, television, and cellular towers must transmit in a direction away from the center of the radio quiet zone. You are not allowed to use wireless equipment or unshielded microwaves on site. Off-site microwaves are permitted, but these do interfere slightly with telescope operation.

### Housing:

When you come to Green Bank, you will be housed in an NRAO owned house on-site. The rent may vary, but should be approximately \$280 per month, including all utilities and excluding only long distance telephone calls. The use of personal phone cards is expected, but if you must make a long distance call without a phone card, you must report the outgoing destination and the duration of the call. Paying for these calls is your responsibility and is based on the honor system.

The primary housing facility for the summer students is the Hannah House. The house has 5 bedrooms. Each bedroom has two beds and its own bathroom. You may need to share your bedroom with another summer student. It is about a half-hour walk from the lab. The NRAO houses have a washer, dryer, and dishwasher. Sufficient linens are provided for the entire summer, but you are responsible for washing them.

### Keys:

Keys for your housing are located in the Jansky Lab. At the end of your stay, return your keys to Jessica Taylor or put them in the drop box in the lobby.

### Arrival:

Before coming you will receive a key-card in the mail along with other materials. The key-card will let you into the Jansky Lab to pick up your housing keys if you arrive on the weekend or after hours. Contact the Green Bank REU coordinator 24/7 at [dfrayer@nrao.edu](mailto:dfrayer@nrao.edu), 304-456-2223 (work), or 304-456-4655 (home) for assistance. On your first day of work, see Shirley Curry to fill out the required paperwork.

### Billing:

You will receive an invoice each month for housing. Make your checks out to NRAO and give them to Sherry Sizemore who will provide you with a receipt. Make sure all of your rent invoices are paid before you leave.

### Lounge:

The lounge is located on the upper level of the residence hall. It houses a small library, a conference table, a television and VCR complete with cable and VHS tapes, and a kitchenette. The books and movies are there for your enjoyment but be sure they are returned to their proper place. Snack foods

and light breakfast foods are provided in the kitchenette along with alcoholic beverages. Payment is once again based on the honor system.

Meals (starting 2011):

The NRAO cafeteria is open for breakfast and lunch weekdays as follows:

Weekdays: Breakfast: 7:30-9:30  
Lunch: 12:00-13:00

Meals on the weekends and dinners are available at the Starlight Cafe which is open 11:00-19:00 seven days a week during the summer months. Many summer students cook their own meals and local dining places include Station#2 in Durbin, Ryders, Boyer's Restaurant, Henrys, Dunmore, and Cass. Farther away is Snowshow, Marlinton, Elkins, and Lewisburg which have several dining choices.

Weather:

The weather in Green Bank is typical of a mountain area. The temperature, on average, stays in the 60's to 70's range. For a few weeks, the temperatures may reach the 80's. Expect to have chilly nights and lots of rain. Sleet storms have been known to occur in every month of the year, so be prepared for all types of weather.

What to Bring:

As far as clothing goes, I would suggest bringing pants, shorts, long and short sleeve shirts, a bathing suit, some old clothes for caving and hiking and some sturdy boots, in addition to normal everyday clothing. There is no need to bring linens or pillows, with the exception of a beach towel. Bring a good jacket and an umbrella. Bring all necessary toiletries. You may want to bring a few movies and books as well. You may want to bring a CD and or DVD player and your favorite collection of CDs/DVDs. If you play a musical instrument, bring it! You will have opportunities to play with local musicians. Most importantly, bring a good sense of humor and enthusiasm for your work!

Dress Code:

The dress code for work here is very casual. Most people wear jeans and t-shirts everyday. You are welcome to wear whatever you like, given that it is tasteful.

#### Cars:

You will probably find that bringing your own car is advantageous to you. Undoubtedly, you will want to take trips on the weekend to Elkins, Durbin, Marlinton, Harrisonburg, Clarksburg, or Snowshoe Mountain. It will be necessary for you to travel to one of these cities for long-term groceries and supplies or the occasional meal dining out.

If you need to travel for NRAO business purposes, you may requisition an NSF (National Science Foundation) vehicle. These vehicles may only carry employees of NRAO. If you need a vehicle for official business where a non-employee will accompany you, you may requisition an AUI vehicle (Associated Universities, Inc.). All requisitions should be placed with Sherry Sizemore. Vehicles are not to be used for personal use. While on site, only diesel vehicles can be used beyond the gates. If you need to ride to one of the telescope sites and prefer not to walk or use a bicycle, you may requisition a diesel vehicle.

#### If You Fly:

When traveling to and from Green Bank, a car is the most efficient way to travel. If, however, you live far enough away that flying is your first choice, there are several nearby airports. There are several airports within 4 hours of Green Bank, including Charlottesville (CHO), Lewisburg (LWB), and Washington Dulles (IAD). These are within two to four hours from the observatory. NRAO can send a driver to pick you up from CHO, IAD, or LWB airports. Contact Jessica Taylor to arrange pick-up from one of these airports, if needed.

#### Bikes:

There are few observatory bikes located outside of the residence hall for you to use; return them when you are done. Most of the observatory bikes are in poor condition, so bring your own if you can. Several of the observatory staff have weekly road and mountain biking rides. If you are interested in joining the observatory group rides contact David Frayer.

#### Employment:

When you report for your first day of work, you will need to see Shirley Curry. She will have an employment packet ready for you to fill out before you can start work.

#### Email:

You will be given a temporary email account which will be your <first initial><the first seven letters of your last name>@nrao.edu. You will have Internet access to use any other email accounts that you may have, but all official NRAO emails will be sent to your NRAO address. See a system administrator to obtain your account (Wolfgang Baudler or Chris Clark for unix/linux and Charlie Myers or Steve Tritapoe for windows).

#### Mail:

Employee mail boxes are located in the main office area. Summer students may need to share a mail box slot. Mail is delivered to your box between 2:00 and 3:00 each afternoon. If you have outgoing mail, place it in the outgoing box before 1:00pm each afternoon. If you receive a package too large to fit in your box, a notice of its location will be placed in your box. Stamps are available near the mailboxes. Purchases are based on the honor system, so be sure to pay for your stamps. Any questions about mail should be directed to Sherry Sizemore.

#### Workstations:

Each student will be assigned his or her own workstation with desk and computer. You will have a user name that is the same as your NRAO email and a password that is known only to you. If there is not a workstation set up for you when you arrive, speak with Chris Clark. In the meantime, there are public workstations that you can use.

#### Pay Checks:

Stipend checks are available from Shirley Curry every two weeks while you are here, starting with the day of your arrival.

#### Sick Days:

As a temporary employee, you are allotted sick days. You do not have to make them up as long as you work for the entire ten-week period that you are required to stay. If you elect to stay for the twelve-week period, you may choose to make up sick days.

#### Safety:

The safety officer is Johnny Samples. He will conduct a safety meeting upon your arrival to instruct you on the hazards of working in different areas of the observatory.

### Staff:

You will find that everyone on the staff at Green Bank is very nice and willing to help you with anything that you need. Do not hesitate to ask someone if there is anything that you are unsure of. There is a listing of the staff members that you will come in contact with on a daily basis provided in the appendices. Most of the advisors and some of the other staff members will undoubtedly invite you to have dinner with them. You will be welcome in anyone's home at any time. The people of Green Bank are very neighborly, so be sure to make friends!

### Activities:

There are lots of things to do in Green Bank and the surrounding areas. Some of them include:

- biking along the many trails on site
- swimming in the recreational area pool
- mini golf at the recreation area
- volleyball at the recreation area
- tennis at the recreation area
- basketball at the recreation area
- ping pong in the basement of the residence hall
- billiards in the basement of the residence hall
- hiking among the hills (several hiking trips are usually planned)
- concerts/symphonies in Elkins or Marlinton
- plays in surrounding communities
- Blue Grass Festival in Elkins
- Road Kill Cook-off in Marlinton
- Caving trips to nearby caves

There is a weight and workout room in the basement of the residence hall complete with treadmills, stationary bikes, rowing machines, free-weights and heavy lifting equipment. The basement of the residence hall also includes two pool tables, ping pong table, air hockey table, and a foosball table.

There are also several community/company events that include aerobics, yoga, soccer, and volleyball. If you are interested in any of these activities, speak with the following people:

Aerobic: Amy Shelton

Yoga: Carla Beaudet

Soccer: Ray Creager

Volleyball: Jessica Taylor  
Cycling: David Frayer

The annual company picnic is held during the summer and you are invited to bring a guest and participate in the activities.

If, at any time, there is a movie that you would like to have shown in the auditorium, speak with Sue Shears.

The recreation area is located north of the main entrance to the observatory near the Hannah House. You will find that there is plenty to do to keep you occupied (including pool, basketball court, tennis court, miniature golf course)!

#### Entertainment:

If you are assigned to live in one of the houses, you may want to coordinate with your roommates to bring a television and DVD player. Microwave ovens are not permitted unless you take all necessary steps to prevent them from interfering with the telescope (see the residence hall kitchen microwave for an example). Several of the staff members have elaborate movie collections and they will be happy to let you borrow them. If you prefer to go to the cinema, the closest is in Elkins, one hour away. You will probably make several trips to the Charlottesville site, which is the headquarters for NRAO. The students there will host you for the weekend if you chose to stay in town for a few days. NRAO will pay housing expenses.

#### Shopping:

For quick shopping, Dollar General, Henry's and Trent's convenience stores provide you with day-to-day shopping and the essentials. The Dollar General and Henry's are located just south of the observatory entrance and Trent's is located just north of the entrance in Arbovale. If you need to do serious grocery shopping, you may need to take a trip to Elkins, where there are several full service grocery stores and a Wal-Mart. Elkins is approximately fifty miles north of the observatory. There is also a movie theatre in Elkins, along with several restaurants. Trent's carries a good selection of basic foods, but if you are looking for anything unusual, or fresh vegetables, you will need to go to Elkins to find it.

#### Assignments:



You will be assigned to work with one advisor and may have another student working with you. The assignments may be anything from data reduction to commissioning data for the GBT (Green Bank Telescope) or laser metrology. For instance, Paul Robinson was assigned to write a stray radiation program for the reduction of data on an HI galactic plane survey. Melissa Williams was responsible for the reduction of that same data, including baselining, averaging, and producing a final map. Michael Wallace worked in the laser metrology lab and Tucker Freismuth was reducing data for a galactic plane survey as well. Students are usually permitted to actually take data on at least one of the telescopes.

As the atmosphere here is somewhat laid back, do not be alarmed if your advisor tends to be gone for most of the summer. If you happen to be working for someone who stays away, my only advice is try not to get frustrated.

Formalities:

Traditionally, the summer students host a dinner in honor of your advisors at the end of the summer. This is usually done as a cookout for the entire group. When you get ready to plan this, the REU coordinator will be able to help you.

You will be expected to write a summary of your work, either as a short work or as a full-length paper. Your advisor will tell you which. You will be required to present a symposium at the end of the summer in which you give a short review of your work for the summer and any findings you may have. You may also decide to write a short piece for the Journal of the Pocahontas County Astronomical Society (JOPCAS).

A Short Summary of Our Projects:

I worked with Jay Lockman on a study of the hydrogen envelope of the galaxy at a distance from the galactic plane where it begins to be affected by the interstellar environment. I participated in the reduction of an HI galactic plane survey using UniPops and AIPS++. Had the GBT been operational before I left, I would have been able to complete several follow-up observations of the 21 cm line of hydrogen.

Paul Robinson worked with Jay Lockman and myself on the reduction of the HI survey data. He was responsible for writing a program to subtract stray

radiation from the raw data. This step is important because the data cannot be reduced until the stray correction is applied.

Tucker Friesmuth worked with Glen Langston on the reduction of data from his galactic plane survey.

Michael Wallace worked with Dave Parker in testing the laser metrology system that is responsible for accurate positioning of the dish of the GBT. He built a computer interface to the HP-5528A Laser Measurement System to perform automated distance measurements accurately to a tenth of a micron. He also participated in recalibrating parts of the laser range finder and monuments. In addition to laser work, he helped to produce plots of data concerning the motion and relative strain in the azimuth track on the GBT. He produced plots of the vertical and horizontal run-out data for the GBT's elevation gear. These two sets of data were used to check if both the azimuth track and elevation gear met design specifications.

#### Impressions:

I personally had a wonderful time at Green Bank. I made a few friends and learned a great deal about my chosen profession. The location here in the mountains was superb for relaxation and comfort. My summer was essentially stress-free and fun. I have the impression that Green Bank is the best NRAO location in which to work because the weather is nice, the people are friendly and your work may include actual observations. Each advisor takes a different approach to working with their summer students, so be sure to ask as many questions as you need to decide if this is the right choice for you. It is not uncommon for summer students to decide that radio astronomy is not right for them, but it is also not uncommon for summer students to go on to a great career in radio astronomy, especially with NRAO. The best advice I can give you on how to get the most out of your summer here is to ask questions.

#### Advice and Fair Warning:

I was told that this guide was too serious for the average person here in Green Bank, but now that you know most of the details, let me give you fair warning. Most of the people here are, to say the least, fun. Aside from enthusiasm for your work, the most important thing you need to bring with you is your sense of humor (and I hope it's a good one!). There will be groups of teachers visiting for a week or two at a time. Be sure to make friends with them, because they are fun people, too.

**A note from the 2003 Summer Students:**

**On behalf of all the summer students of 2003, I would like to share with you a little about our experience here in Green Bank. 2003 was the second year in many years that the Hannah House was used for student housing. We lived together, ate together, came to work together and shared everything. As a result we have all become very close and have made friendships that will last a lifetime. Coming from New York City myself, I never thought I would like Green Bank, but it has become like a second home and I am very sorry to go. The staff here at NRAO will become your colleagues, your friends and your mentors. I know I personally will treasure my new-founded friendships forever. Just know that a summer in Green Bank is more than just a summer job—it is about becoming part of a great, extended family and the sooner you figure that out the better your summer will be! Good luck from all of us!**

**-The 2003 Summer Students: Aaron Geller, Andy Cowan, Justin Atchison, Kate Rubin, Regina Flores, and Shannon Wells**

Major Contacts as of 2011

Subject to change

Karen O'Neil.....Site Director  
Johnny Samples.....Safety Officer  
David Frayer.....Summer Student Coordinator  
Mike Holstine.....Business Manager/Office Space  
Jessica Taylor.....Housing/Transportation/Rent Invoices  
Sherry Sizemore..... Mail/Vehicles/Rent Receipts  
Shirley Curry.....Hiring/Terminations/Expense Forms  
Christine Plumley.....Telephones/Office Space  
Lisa Irvine.....Fiscal Office/Payroll  
Sarah Gibson.....Travel Expense Reimbursement  
Steve Tritapoe/Charles Myers.....Windows computer support  
Chris Clark/Wolfgang Baudler.....Unix Computer Support