

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

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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. Off-site microwaves are permitted, but do interfere slightly with telescope operation. **Ham Radio operation is permissible if certain interference precautions are made and if transmission is limited to specific frequency bands (See Gary Anderson for details).**

Housing:

When you come to Green Bank, you will be housed in either the residence hall or in an NRAO owned house off-site. The rent may vary, but should be approximately \$200 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.

Residence Hall:

The upper level of the residence hall consists of rooms. Each room has a bedroom (with two beds) and a bathroom. The lounge must be used for any cooking resources. There are also several apartments with living room, bedroom, bathroom and kitchen. Linens (towels and sheets) are provided and are changed once every week. There are extra blankets and pillows available, so there is no need to bring your own. All kitchen appliances are furnished, with the exception of a microwave and dishwasher. Dishes and utensils are also furnished. Laundry facilities are located in the basement of the residence hall. There are two washers and two dryers. Detergent is provided. There are televisions in the apartments and in the lounge. There is also a VCR in the lounge, as well as a small library.

Houses:

If you are assigned to live in one of the houses, you will have up to three roommates. Each person will have their own bedroom and there are two bathrooms to share. The houses have washer, dryer and dishwasher. Sufficient linens are provided for the entire summer, but you are responsible for washing them. Living in a house will obligate you to mow the lawn when needed. The houses are located in the neighborhood owned by NRAO, between a half mile and a mile from the main entrance to the observatory.

The past two years students have lived in the newly-renovated Hannah house, in the NRAO recreation area. The house has 5 bedrooms, 3 of which have two beds. Each bedroom has its own bathroom. The Hannah house is a nice, cozy place to live, with its main disadvantage being that it's about a half-hour walk to the lab.

Keys:

Keys for your housing are located in the lobby of the residence hall. At the end of your stay, return those keys to the drop box in the lobby.

Registration:

When you arrive you will find your keys and registration papers on a rack in the residence hall lobby.

Registration papers will accompany your keys. Please fill these out and return them to the cafeteria cashier.

Billing:

Your rent payments should be made at the beginning of each month. Make your checks out to NRAO and give them to the receptionist who will provide you with a receipt. If you cannot make your payment on time, you will receive an invoice for the amount you owe. Make sure that this amount is 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:

The NRAO cafeteria is open for three meals a day at a reasonable price. The schedule is as follows:

Weekdays: Breakfast: 7:30-9:30

Lunch: 12:00-1:00

Dinner: 17:00-18:30

Weekends: Breakfast: Saturday: Self-serve in the lounge

Sunday: 8:00-9:00

Lunch: Saturday: 12:00-1:00

Sunday: 12:00-1:30

If you wish to order something during the hours that the cafeteria is closed, for instance, for late night observing or an afternoon snack, let the cashier know what your order is and they will place it in the lounge refrigerator with your name on it. You may pay for it at the time that you place your order.

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.

In previous years, students were permitted to requisition a car for personal use if they did not bring one. Unfortunately, due to changing insurance requirements, this can no longer be done. The bottom line is, bring a car if you can. I elected to fly from my home in Iowa, and found myself sorely wishing I had taken the 2 or 3 days to drive here, especially my first week when I was the only one here.

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 personal business or 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 Becky Warner. Upon return of a vehicle, travel vouchers may be filled out to reimburse you for fuel expenses, provided that the vehicle was used for official business. These forms are available from the fiscal department. They must be authorized by the site director, and then returned to the fiscal department for processing. You may also be reimbursed for your travel expenses moving to and from Green Bank. You will be reimbursed **at the current IRS standard mileage rate**; you will not be reimbursed for lodging expenses. Lodging, meals, and miscellaneous expenses can be covered for official business only.

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 airports in Charlottesville, Lewisburg, Roanoke, Pittsburgh, and Washington, DC. All are within three or four hours. I would suggest flying into the Charlottesville, Virginia airport. Someone from the Charlottesville NRAO site will be able to pick you up at the airport and you will then be able to requisition a vehicle to transport you to Green Bank. **Contact Becky Warner for pickup arrangements.**

Bikes:

There are bikes located outside of the residence hall for you to use. Just be sure to return them when you are done. The bikes are supposed to be for use by tourists, so bring your own if you can.

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 for windows).

Mail:

Each employee is allotted a mail slot in the main office area. 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 1:30 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 the receptionist.

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 Jody Bolyard. 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. The REU coordinator, Toney Minter, will provide you with a selection of activities that you may be interested in. 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.

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

Tae kwon do: Dana Balsler

Yoga: Carla Beaudet

Soccer: Rich Lacasse

Softball: Jim Braatz

Volleyball: Greg Monk

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 Carla Beaudet.

The recreation area is located north of the main entrance to the observatory.

You will find that there is plenty to do to keep you occupied!

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 VCR. 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, Henry's and Trent's convenience stores provide you with day-to-day shopping and the essentials. Henry's is located just south of the observatory entrance and Trent's is located just north of the entrance. 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. Unfortunately, during the summer of 2001, the only telescopes that were operational were the 45 ft. and 85-3. The 140 ft. is in a hibernation stage

due to the lack of funding and the GBT is **in the final stages of** becoming fully operational.

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:

You will be expected to 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, Toney Minter 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). Also, students are usually inclined to play pranks either on their advisors or on the observatory itself. If you speak to the right people, they will tell you some of the past pranks. If you chose to do this, make sure that your prank cannot get you into serious trouble, as several past summer students have found themselves in peril of not being able to attend graduate school. **The most important rule to know is that the GBT is off-limits for pranks, and that is one of the few things people take very seriously out here.**

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 speculations.

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. They enjoy playing pranks on one another, so feel free to join in. 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 2001
Subject to change

Phillip Jewell.....Site Director
Richard Prestage.....Deputy Site Director/Computer Manager
Jody Bolyard.....Safety Officer
Toney Minter.....Summer Student Moderator/Computers
Mike Holstine.....Business Manager/Office Space
Becky Warner.....Housing/Transportation
Sherry Sizemore.....Receptionist/Billing Statements/Mail
Shirley Curry.....Hiring/Terminations/Expense Forms
Christine Plumely.....Telephones/Office Space
Toby Mann.....Fiscal Office/Payroll
Lisa Ervine.....Travel Expense Reimbursement
Charles Myers.....**Windows computer support**
Chris Clark.....Unix Computer Support
Wolfgang Baudler.....Unix Computer Support
Alesia Wayne.....Librarian
Jim Braatz.....Computers-AIPS++
John Hibbard.....Charlottesville Summer Coordinator**Bill Saxton*****Graphic Artist/Media Technician**

*Bill Saxton is one of the coolest people here in Green Bank. Be nice to him and make friends with him because you will find he has a big heart and is a great guy to hang out with!

If you have any questions, feel free to contact me as well:

mkwillia@valdosta.edu

or Regina Flores from the 2003 summer students

rf2030@columbia.edu