



National Radio  
Astronomy  
Observatory



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## West Virginia's Space Place



National Radio  
Astronomy  
Observatory  
[www.nrao.edu](http://www.nrao.edu)

# Field Trip Planning Guide



[www.visitgbt.org](http://www.visitgbt.org)

Check out the Green Bank Science Center  
on Facebook for updated events & specials!





# Discover Science!



Experience science and engineering in action when you and your students visit the National Radio Astronomy Observatory (NRAO). Astronomers from around the world harness the awesome power of the Robert C. Byrd Green Bank Telescope (GBT) to answer mankind's biggest cosmic questions. More than just a tour, a field trip to the NRAO might just inspire your students to join the next generation of scientists and engineers.

Rich in educational programs and activities, with inexpensive on-site lodging and dining, the Green Bank Science Center can assist you in building a visit lasting a few hours to a few days.

**What's a  
Black Hole?  
How can you  
see it?**

**How old is  
the Universe?  
How big is it?**

**Where did  
we come  
from?**

**What happens  
when a Star dies?  
What is a Pulsar  
and where does it  
come from?**



# NRAO Field Trip Activities



## Standards Grades 4 - 8: Physical Science, Earth Science & Physics, 21st Century Skills

### KEY STANDARDS MET



**Nature of Science**



**Content Standards**



**Application of Science Standards**



**Standards for 21st Century Learning**

Our field trip activities are mapped to State and National Science Standards! As you plan a field trip for your students, use this information to assist in choosing the activities that suit your classroom goals best.

Plan to spend a minimum of 2 hours with us to accomplish the NRAO tour, exhibit hall scavenger hunt, and a stop in the gift shop. Most activities are designed for groups of 20. Please plan for a longer stay if you bring a large group, we will need to rotate smaller groups through more than one activity. Radio Astronomer For A Day, highly recommended for students ages 10 and up, requires an overnight stay.



### Site Tour 🖐🖐🖐🖐

Group Size: 40 Suitable for all ages.

Duration: 60 minutes per group.

- All NRAO field trips include a tour of the radio telescopes - but that's not all. Our tour includes science demos, a Q/A with a knowledgeable staff person and a short film.

### Exhibit Hall Concept Quest 🖐🖐🖐🖐

Group Size: 40+ Suitable for 3rd Grade and up.

Duration: 30 – 40 minutes per group.

- Students complete a scavenger hunt to answer science and engineering questions as they interact with our hands-on exhibits.

### Radio Astronomer For A Day 🖐🖐🖐🖐

Group Size: 5 – 30 Suitable for 5th graders and up.

Duration: Minimum of 24 hours including one overnight stay.

- Students working in research teams investigate cosmic objects with the NRAO's 40 foot diameter radio telescope. During an overnight stay, students learn how to operate the telescope and complete inquiry-based projects, becoming, in fact, radio astronomers. RAFAD is a truly unique intensive real-life scientific experience.

### Be An RFI Detective 🖐🖐🖐

Group Size: 20 Suitable for all ages.

Duration: 40 minutes per group.

- NRAO technicians use high tech equipment to hunt down Radio Frequency Interference. Students can join in the hunt as they search the Science Center for sources of man-made radio sources. Fun and eye-opening!

### Exploring Our Solar System 🖐🖐🖐

Group Size: 20 Suitable for all ages.

Duration: 30 minutes per activity.

- Students investigate the size and scale of our solar system. We have three hands-on activities to choose from: Pocket Solar System, Worlds in Comparison, and Moon and Earth. You can do one or select all three.

### StarLab 🖐🖐

Group Size: 20 Suitable for all ages.

Duration: 40 minutes per group.

- Constellations and celestial motions presentation under an inflatable planetarium balloon.

### Solar Viewing (weather permitting) 🖐

Group Size: 20 Suitable for 5th grade and up.

Duration: 30 minutes per group.

- If it's sunny we can pull out our special H-alpha telescope and students can safely view sunspots, solar flares, filaments and plagues.

### GBT Engineering Design Challenge 🖐🖐🖐🖐

Group Size: 40 Suitable for all ages.

Duration: 60 minutes per group.

- Students will investigate engineering by designing, building and testing a support structure that can hold up a "radio telescope dish". Best structure wins!



# Plan Your Visit

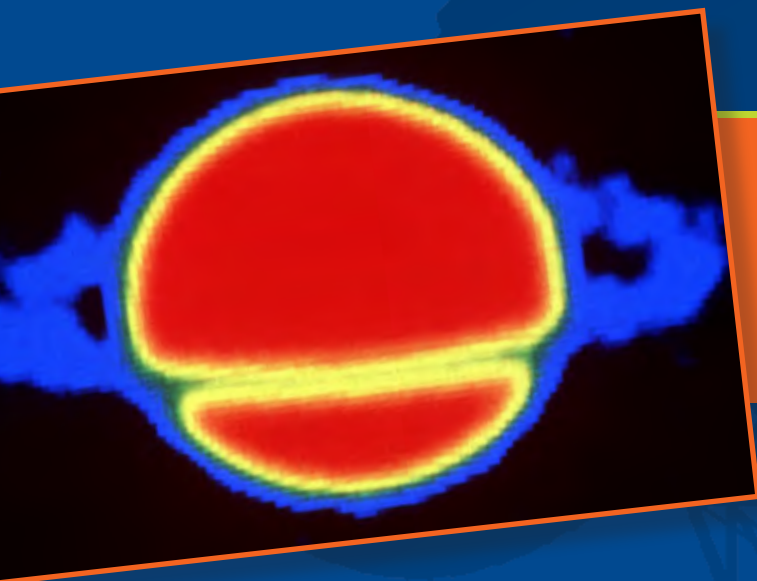
## Before you come to Green Bank:

1. Contact us to set the date. Determine how many students and how many chaperones will be on the trip. We recommend 1 chaperone per 10 students. Chaperones should accompany students in all activities. We'll also need to know the grade/age range of your group, and how long you can stay.
2. Select the activities you'd like to do given the size of your group and your time constraints, and we will design a custom itinerary for you.
3. Plan for your meals. If you are planning a day trip, our Starlight Café can provide your lunch. Meal arrangements should be made in advance for groups of 20 or more. You can find our Starlight Café menu and box lunch order form on our website.

## Overnight Trips

Educational groups visiting the Green Bank Science Center may stay in the NRAO Bunk House, pictured above. This comfortable and affordable dormitory can accommodate up to 60 students (30 girls and 30 boys). Students bring their own sleeping bags or linens. Chaperones stay in separate but attached bedrooms. Meal options are available. Bus driver accommodations may be arranged on-site or nearby.

If you stay overnight, meals are usually arranged at the Observatory Cafeteria. Meals for student groups include: breakfast, lunch and dinner. See our website for pricing. Please bring your tax exempt documentation if you are a school or non-profit group.



**Introduce your students to radio astronomy with one of the following activities on our website.**

- Take a Multiwavelength Tour of the Orion Constellation
- Make a radio picture
- Tour the Radio Solar System
- Check out Caltech's Multiwavelength Astronomy web site:  
<http://www.ipac.caltech.edu/outreach/Multiwave/multiwave.html>

**Contact us at [gbt-tours@nrao.edu](mailto:gbt-tours@nrao.edu) or 304-456-2164**

# Area Attractions



Stay overnight at NRAO and your students can experience even more outstanding educational opportunities nearby. Here's a sample! For more information contact the Pocahontas County Convention & Visitors Bureau at [www.pocahontascountywv.com](http://www.pocahontascountywv.com) or 800-336-7009.



## **Snowshoe Mountain Resort** • Snowshoe, WV, 30 min. west of NRAO.

- Year round activities. • Group pricing available.

877-411-4FUN • [www.snowshoemtn.com](http://www.snowshoemtn.com)



## **Cranberry Mountain Nature Center and Cranberry Glades Botanical Area**

- Near Hillsboro, WV, 50 min. from NRAO.
- Educational exhibits. • Unique habitat, plants and animals. • Half mile handicap accessible boardwalk through an Arctic Tundra bog. • Open spring through fall.

304-653-4826 • [www.fs.fed.us/r9/mnf/sp/naturecenter.html](http://www.fs.fed.us/r9/mnf/sp/naturecenter.html)



## **Beartown State Park** • Near Droop, WV, 1 hr. from NRAO.

- Unique natural area featuring massive boulders, overhanging cliffs and unusual rock formations. • Self guided with interpretive signs or guided tours through advanced arrangements. • Open April through October.

304-653-4254 • [www.beartownstatepark.com](http://www.beartownstatepark.com)



## **Edray State Trout Hatchery** • Edray, WV 50 min. from NRAO.

- Tour an operating fish farm. • Learn about and see live rainbow, brook and brown trout. • Free tours.
- Reservations are necessary.

304-799-6461



## **Cass Scenic Railroad State Park** • Cass, WV 15 min. from NRAO.

- Preserved 19th century logging railway town. • Historic train rides. • Company store gift shop and restaurant.
- Open May through October. • School group discounted rates.

1-800-CALL-WVA • [www.cassrailroad.com](http://www.cassrailroad.com)



## **Droop Mountain State Park** • Droop, WV 55 min. from NRAO.

- Official Civil War Discovery Trail site.
- Free tours. • Guided tours available with advance arrangements.
- Open year round.

304-653-4254 • [www.droopmountainbattlefield.com](http://www.droopmountainbattlefield.com)



## **Pearl S. Buck Birthplace Museum** • Near Hillsboro, WV 50 min. from NRAO.

- Tour the preserved birthplace of the Pulitzer Prize and Nobel Laureate author.
- See hundreds of period artifacts.
- Open Mon. – Sat., May – Oct. • Fee applies and reservations are suggested.

304-653-4430 [www.pearlsbuckbirthplace.com](http://www.pearlsbuckbirthplace.com)



## **Seneca Rocks Discovery Center** • Seneca Rocks, WV, 1 hour north of NRAO.

- One of the best known landmarks in West Virginia. • Self-guided interpretive hiking trail open year round.
- Discovery Center (open Apr. – Oct.) features free exhibits, films and gift shop.

304-567-2827 [www.fs.fed.us/r9/mnf/sp/srdc.html](http://www.fs.fed.us/r9/mnf/sp/srdc.html)



## **Seneca Caverns** • Riverton, WV 1 hr. northeast of NRAO.

- West Virginia's largest caverns. • Explore 1 mile of trails 165 feet underground.
- Lesson Plan guides available upon request. • Gemstone mining. • Fee applies, reservations suggested.

304-567-2691 • [www.senecacaverns.com](http://www.senecacaverns.com)



## **Durbin Greenbrier Valley Railroad** • Elkins, WV 60 min from NRAO

- Explore surrounding mountains and valleys from an entirely new perspective – aboard one of four unique trains! • Fee applies, reservations required.

877-686-7245 • [ticketinfo@mountainrail.com](mailto:ticketinfo@mountainrail.com) • [mountainrailwv.com](http://mountainrailwv.com)





# Special Programs

Our education staff in partnership with NRAO astronomers and engineers have created captivating special programs for students, youth groups, families and teachers.

## Especially for Boy Scouts

In a fun, fast-paced overnight stay, boy scouts can earn their astronomy badge. As part of the experience, scouts will use NRAO's 40 Foot Radio Telescope!

New! NRAO is proud to offer the Electronics Badge experience on a trial basis! Scouts will build a working circuit to take home with them, tour NRAO's electronics lab, and conduct tests on our 40 Foot Radio Telescope. An overnight visit is required.

## Girls Scout Badge Programs

Your troop can earn a Brownie Try-It, Junior Badge, or Cadette/ Senior/ Ambassador Interest Project Patch at one of our inspiring badge programs. We can work with you to develop a unique STEM interest badge or provide a program for one of the legacy badges such as Sky Search. An overnight stay is recommended.

## 4-H Programs

We are super excited to announce a brand new program for 4-H called Skynet Junior Scholars, which will enable youth to conduct astronomy observations with world-class telescope over the internet! Training for 4-H club leaders is provided. Contact us for more information!

We host the annual 4-H Science Experiment for our local 4-H clubs every year and can host the activity for your club as well. Contact us to set it up!

## Programs for Teachers and Students

West Virginia Governor's School for Math and Science. NRAO, in partnership with the National Youth Science Foundation hosts an annual residential program for 60 high school freshmen from West Virginia. For more information visit: <http://www.govschools.wv.gov/GSMS>



**The Pulsar Search Collaboratory.** This award winning National Science Foundation sponsored program engages high school teachers and students in cutting edge radio astronomy research. This is a national program- you do not need to be from West Virginia to apply.

## Programs for Families

**Monthly Star Parties.** Rain or Shine. Once a month, NRAO staff will treat you to views of the night sky through optical telescopes. If it rains, don't worry. You are invited into our portable planetarium for a stellar presentation.

**Family Science Labs.** Select Saturdays from 10-12. Four times a year, NRAO staff guide kids of all ages through fun-filled, hands-on science projects. We provide all materials. Each lab highlights a different science/engineering theme.

**Annual Family Science Day.** Held each year in the fall, this is our can't miss Open House event. Conduct science experiments, test your engineering skills and participate in rare, behind-the-scenes tours of the Observatory labs and telescopes.



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