

Above & Beyond

Syllabus for: Above & Beyond: Astronomy, Physics, Astrobiology

The Learning Center at PARI
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We welcome you to the 2021 Camp “Above & Beyond: Astronomy, Physics, and Astrobiology” at PARI.

Our team will provide you with the exciting opportunity to explore the wide range of disciplines that fall within the space sciences, as well as training and access to the very same tools and resources used by researchers.

Course Description

Above and Beyond is an in-depth, two-week experience that is designed to immerse high school students in the multi-faceted world of space science and research. Participants will explore the universe through astronomy, physics, and astrobiology. They will complete two projects, one with a research team, and the other individually.

The program models the research process that college graduate students, undergraduates, and researchers in the fields of Astrophysics, Astronomy, and Astrobiology follow to produce publishable work. Participants are given the knowledge and tools they need to conduct an investigation into a celestial object and draw conclusions from their findings under the guidance of PARI staff, educators, and professionals in the field. This work is done in research groups where team work is emphasized.

Topics in the field of Astrobiology that address life in space, human or otherwise, are the focus of individual projects. The research that is conducted here often delves into areas on the cutting edge of human exploration of space and give students a chance to show off their individual work.

Guest speakers share their experiences working in space science and related disciplines and the paths they took to reach them. Topics like the exploration of other planets, space law and ethics, variable stars, and meteorites are among those frequently presented by our array of partners.

PARI Site

Students will stay at PARI, a 200+ acre campus at 3000 feet in elevation in the heart of the Pisgah National Forest. This unique setting in the land of waterfalls gives access to a beautiful natural world where memories are waiting to be made. Once a satellite tracking station for NASA, the site provides access to radio telescopes, optical telescopes, a planetarium, a world class archive, and an array of other instruments. PARI staff, science advisory board, and partner organizations bring a wealth of knowledge and experience.

Objectives

- Learn fundamental concepts in the field of Astrophysics and apply them in the formulation and execution of a group research project.
- Learn to use radio and optical telescopes and understand their purpose as they relate to the fields of physics, astronomy, and astrobiology.
- Develop research methodology through planning, implementation.
- Analyze data consistently with prior research.
- Formulate conclusions of the nature of celestial objects using scientific data.
- Develop problem solving skills.
- Sharpen presentation skills through the delivery of scientific findings to an audience of peers and professionals.
- Develop teamwork skills by collaborating with others while attempting to solve complex problems.

Packing List

- A laptop, if you have one to bring. There will be computers available for use here as well.
- Pens, pencils, notebooks.
- Required Books listed below.
- Flashlight & extra batteries.
- Rain Gear & Layers (Temperatures can range from 50^o-85^o on some days with rain most afternoons).
- Shoes appropriate for hiking.
- Day pack or bookbag for hiking and field trips.
- Water bottle.
- Bathing suit.
- Bug spray.
- Sun Screen.
- Laundry detergent.
- Masks for entirety of session.
- Games, puzzles, books, etc. (There is no TV service at PARI).
- Linens (sheets, towels, washcloths, pillow & pillow case, blanket).
- Toiletries, a plastic tote is suggested for them as showers and bathrooms will be shared. Shower shoes or flip flops also recommended.
- If you bring extra snacks, they must be stored in a container with a sealable lid. (PARI does NOT provide the container with lid)

Considerations

- Most cell phones do not work at PARI due to remoteness and natural radio shielding (this is what makes it a great place for radio astronomy). Plan to use alternate services like Skype if you anticipate the need to make calls while here.
- Because some astronomy is done at night, be aware that there may be a few days when your sleep schedule is irregular.
- We have a gift shop, so come prepared to find some great souvenirs.

Books			
Title	Author	Format	Required ?
A Student's Guide to the Mathematics of Astronomy	Daniel Fleisch and Julia Kregenow	Hardcover, paperback, or digital	Yes!
Astrophysics is Easy!: An Introduction for the Amateur Astronomer	Michael Inglis	Paperback or digital.	Optional
Radio Astronomy Tutorial	MIT Haystack Observatory	http://www.haystack.edu/edu/undergrad/materials/RA_tutorial.html	Optional
There will be some copies of these books available for purchase at the PARI bookstore. Please contact us if you'd like to buy a copy to pick up on your arrival day.			

Software		
Title	Purpose	Source
AstroImageJ	Astronomical data and image analysis	http://www.astro.louisville.edu/software/astroimagej/
Vstar	Variable star and light curve visualization and analysis	https://www.aavso.org/vstar
GIMP	Image editing	https://www.gimp.org/
Starlight Pro	Binary Star Modeling and Visualization	http://www.midnightkite.com/index.aspx?URL=Binary
Stellarium	Night sky simulation, object identification, coordinates	http://stellarium.org/
TOPCAT	Graphing and data analysis	http://www.star.bris.ac.uk/~mbt/topcat/
DESMOS	Graphing and equation visualization, calculator	https://www.desmos.com/
If you plan to bring a computer with you, this software will be helpful to you during your research. Not all of it is available for all platforms, but it is all free!		

Before you arrive, we suggest you

- Familiarize yourself with the books and software listed above.
- Explore current topics in astrobiology from places like the NASA Ames Research Center Astrobiology Institute <https://astrobiology.nasa.gov> for ideas on what you might take a deeper look into during the session.
- Think about the types of objects or research methods you might like to explore. Would you search for exoplanets or measure the rotation and expansion of nebulae and super nova remnants? Would you watch for solar events and determine what effect they have on Earth? Would you delve into the vast databases produced by space telescopes, or deep into the past in archival astronomical data to uncover something no one has examined before?
- **Contact us with any questions or concerns. We are happy to help you prepare for an excellent summer!**