



DUKE UNIVERSITY TIP PROGRAM
ABOVE AND BEYOND: ASTRONOMY, PHYSICS, AND ASTROBIOLOGY
AT PISGAH ASTRONOMICAL RESEARCH INSTITUTE
SUMMER 2008
SYLLABUS

Instructors and Group Leader:

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Course Description

Elevated at 3,000 feet, PARI sits on an expansive 200-acre site in the gorgeous Smoky Mountains, 30 miles southwest of Asheville, North Carolina. Once a high-security satellite tracking station for NASA, the observatory at PARI now houses state-of-the-art equipment, including two huge 26-meter radio telescopes similar to those in the famous Very Large Array in New Mexico. Students have access to a portable StarLab planetarium for mapping the stars any time of day and regardless of most weather conditions.

Students will investigate cosmic motion and distances, galaxy and star formation, black holes, and quasars. In addition to these exciting topics, students will operate optical and radio telescopes.

Course Objectives

- 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, and analysis of data
- Formulate conclusions of the nature of celestial objects through the use of scientific data
- Develop problem solving skills
- Learn fundamental concepts in the field of Astrophysics and apply these concepts in the formulation and execution of an independent research project
- 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

Materials

- If you have a computer or laptop, we encourage you to bring it. There are several computers for your use at PARI if you should decide not to bring a computer with you.
- Bring pens, pencils, a notebook, and your required texts
- Bring games, puzzles, books, DVD movies, etc. (there is no TV at PARI!)
- Rooms are furnished with linens, pillows, blankets, clocks, and lamps
- Bring a flashlight

- Some cell phones work – we know Verizon and US Cellular work, but others may not. Please bring a calling card with you!
- Rain is common in the afternoon during the summer – so remember to bring rain gear.
- Bring \$20 for one evening meal at a local restaurant in Brevard that will take place in the last week of the program.

Required Texts

- Download and bring (either electronic or printed) the Radio Astronomy Tutorial located on the MIT Haystack Observatory website (http://www.haystack.edu/edu/undergrad/materials/RA_tutorial.html).
- Purchase *Observing the Universe*. Andrew J. Norton. Cambridge, UK: Cambridge University Press. 2004. 180 pp. ISBN 0-521-60393-5. (\$34.99 paperback)
Available at on-line sources such as amazon.com and bn.com

Daily Schedule

The schedule is shifted to begin at a later time than normal working or school hours because astronomical observations are done in the evening. The agenda is set up to begin about 10 am, but expect to continue each evening after dinner as described in the agenda. Early morning hours before 10 am are set aside for open forum and informal discussion.

The agenda for your two weeks of scientific exploration consists of three main sections. The first few days will be a crash course in astrophysics, encompassing stellar and galactic astronomy, astrobiology, and astronomical instrumentation. As the program continues, we will have fewer formal class sessions and more time for you to complete your research projects. These projects will be completed under the guidance of Duke TIP staff and PARI staff astronomers. In addition, we have invited five scientists to visit the program and talk to you about their work in various areas of physics, astronomy, and astrobiology. I have included information about each scientist and a summary of their presentation as part of the course syllabus. As we approach the end of the program, you will prepare and present a summary of your research to your fellow classmates, and possibly some of the PARI staff. In addition to all of the exciting academics that we have planned during the program, we also have several recreational activities in store for you! It would be a shame for you not to experience the beautiful mountains of Western North Carolina while you are here! For this reason, there will be opportunities to do some hiking, and to go flat water canoeing!

As you look at the schedule, please keep in mind that we have structured your days to accommodate the lifestyle of astronomers. This means that formal class sessions will usually start at 10:00am to allow you to get enough rest after our nighttime observing activities that will be held until after dark. There will be open forum discussion sessions held from 8:00-10:00am each morning if you would like to meet with the instructional staff for additional assistance or to further discuss any of the course topics. If you have any questions about any of the details on the agenda, please e-mail or call me.