

SYLLABUS: PULSAR SEARCH COLLABORATORY

Course: Pulsar Search Collaboratory (ASTR 250), Spring 2021.

Instructor: Prof. Maura McLaughlin, G59 White Hall.
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Office Hours: As this is an online course there are no scheduled office hours. However, questions will be answered on the Pulsar Search Collaboratory forum. You may also email me at any time and we can set up a discussion on zoom.

The Pulsar Search Collaboratory (PSC): The PSC is a collaboration funded by the National Science Foundation between the Green Bank Observatory (GBO) in Green Bank, WV and West Virginia University (WVU) aimed at increasing scientific and information technology literacy among high-school students. High-school students in any state participating in the program are eligible for course credit. Students should talk their teachers about registering for this credit.

Learning Outcomes: At the completion of this source, students will be able to:

- 1) Analyze radio telescope data in order to discriminate between pulsars and other sources of radio signals.
- 2) Operate the 20-m telescope at Green Bank in order to take astronomical data.
- 3) Understand the physics behind radio astronomy and pulsars.
- 4) Perform mathematical calculations related to pulsars.
- 5) Write a scientific paper to document their work over the course of the program.
- 6) Collaborate with other students, teachers, and astronomers through an online forum.

Course Description: This course will consist of online data analysis of Green Bank Telescope (GBT) data as part of the PSC effort to discover pulsars. The aim of the course is to acquaint students with the scientific method, the power of information technology, and basic astronomical concepts. Students will learn about pulsars and how to search for them through an online course. Students will complete homework related to this course. Throughout, the year they will then participate in online data analysis at their high schools, and interact with astronomers and other students through an online forum. Students will be expected to interact on the forum on a weekly basis. After the first year of participation in the PSC, students will be expected to serve as a mentor to new PSC students.

Course Materials: There is no textbook requirement for this course. All instructional materials and the discussion forum can be found at pulsarsearchcollaboratory.com. The database site can be found at psrsearch.wvu.edu.

Requirements: In order to earn credits for PSC participation, students must participate in all six online classes (ideally attending at the scheduled time, but if not possible watching saved lectures) and complete all homework associated with the course. They must also inspect the required number of datasets throughout the course of the year, present a poster about their work at the Capstone event, and write a final paper on the results of their data analysis. I strongly encourage all students to share a draft with me before this event in order to receive feedback.

Online Data Analysis:

Students must have analyzed 150 pulsar search datasets at psrsearch.wvu.edu by the end of the semester. These datasets must be accurately graded in order to discriminate between pulsars, noise, and radio frequency interference. Candidate pulsar plots should be posted to the forum.

Course Timeline:

Week One: Online Course I: Introduction to the PSC and pulsars

Week Two: Online Course II: Dispersion measure

Week Three: Online Course III: Periodicity search plots

Week Four: Online Course IV: Single pulse Plots

Week Five: Online Course V: Fast Radio Bursts

Week Six: Online Course VI: Digging into pulsar properties

Week Seven: Data analysis and paper topic selected and videoconference with instructor to discuss topics and course progress

Week Eight: Data analysis and paper outline due

Week Nine: Data analysis and paper writing

Week Ten: Paper and poster draft due

Week Eleven: Paper and poster revisions

Week Twelve: Data analysis completed, paper submitted, and poster presented at Capstone event

Paper drafts and final papers should be emailed to the instructor.

Homework Description:

Each week's homework will be due within one week of the remote lecture's delivery:

Week One: Use the 20 Meter Telescope at Green Bank remotely to take data; discuss results on the forum

Week Two: Choose a favorite pulsar – discuss the properties on the forum. Also, complete DM tool practice activity.

Week Three: Use the ATNF Catalog to plot pulsar properties; discuss on the forum

Week Four: Grade practice plots; discuss on forum

Week Five: Begin the certification tests

Week Six: Complete certification tests

Homework results should be posted on the forum at pulsarsearchcollaboratory.com within one week of the online lecture's delivery. Students will receive full credit on homework if it is completed as requested in the assignment. It will not be graded on scientific correctness, as some of the homework assignments are exploratory. Students will also receive full credit for watching the online videos upon submission of the homework (as watching the videos is necessary to complete the homework).

Poster Presentation:

Students will present a poster at the annual Capstone event. This three-day event is held annually at the end of the semester at WVU for all PSC students who satisfy that year's data-analysis requirement. Students who cannot attend the Capstone event in person will present their posters remotely via videoconference at the Capstone event. All students in the PSC program are invited to attend the remote presentation. This poster is expected to either summarize the student's work over the course of the previous year, with example plots and discussion of different sources of radio frequency interference, pulsar plot content, and properties of known pulsars identified or pulsar discoveries. Alternatively, students may pick a particular scientific topic related to pulsars to review. Posters will be graded on scientific accuracy, clarity, organization, and originality.

Final Paper:

Students will write a final paper that either addresses their results throughout the year or a particular topic related to pulsars. This paper must have figures that are clearly captioned and referenced to their sources. It must also have a less than 250-word abstract and an introduction, analysis, and conclusions section. Finally, it must be well cited with the reference format used in the *Astrophysical Journal*. It will be graded on scientific accuracy, clarity, organization, and originality.

Eligibility and Credit: This course is available to PSC members in their Junior or Senior years and is worth three credit hours. Students may take this course once.

Grading:

The grading scale is composed of the following elements:

Pointings completed	20%
Online lecture participation	20%
Online homework	10%
PSC forum participation	10%
Poster presentation	10%
Final paper	30%

<u>Grade Scale</u>	90% – 100%	A
	80% – 90%	B
	70% – 80%	C
	60% – 70%	D
	below 60%	F

Inclusivity Statement:

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in your classes, please advise your instructors and make appropriate arrangements with the Office of Accessibility Services (<https://accessibilityservices.wvu.edu/>)
More information is available at the Division of Diversity, Equity, and Inclusion (<https://diversity.wvu.edu/>) as well. [adopted 2-11-2013]

This course supports all university policies found at <https://tlcommons.wvu.edu/syllabus-policies-and-statements>.