

# Physics 194: FYRE

## Clocking Dead Stars with Radio Telescopes

Fall 2017, David Kaplan, Joe Swiggum

### Syllabus

**Course Description:** This is a research-driven course designed to introduce students to current topics and methodologies in astrophysics research. Students will:

- Learn background material on pulsars and radio astronomy
- Learn introductory Unix usage and python programming
- Learn to conduct observations using the Green Bank Telescope, one of the world's premier radio telescopes
- Participate in small groups to adopt and completely “solve” a pulsar, determining all of the relevant physical information and placing it into the context of the larger population
- Work as a class to “solve” a binary pulsar, which has the potential to be significantly more interesting but which is much rarer and requires new concepts and techniques
- Write proposals for new telescope time in small groups, which will be judged by an external panel of collaborators. The best proposals may be awarded time on the Green Bank Telescope

**Overarching Course Goal:** Students will gain an appreciation for how topics from a range of areas of basic physics provide the building blocks for understanding the workings of the Universe.

**Prerequisites:** calculus, physics (AP not required).

Preferred: Some programming experience. We will also recommend online training to incoming students in advance of the course.

**Lectures:** Monday 1p-2:15p; Wednesday 1p-2:50p, Physics 122 [NOTE LOCATION]

- Attendance and participation at lectures is required.

### Lecturers:

- Contact both lecturers: [astro-fyre-instruct@uwm.edu](mailto:astro-fyre-instruct@uwm.edu)
- Prof. David Kaplan
  - Office: KIRC 4075
  - Office hours:
    - Tuesday, 9:00am-10:00am
    - Or by arrangement (email or drop by)
  - Email: [kaplan@uwm.edu](mailto:kaplan@uwm.edu)
  - Phone: 414-229-4971
- Dr. Joe Swiggum
  - Office: KIRC 4092
  - Office hours:
    - Thursday, 10:00am-11:00am
    - Friday, 10:00am-11:00am
    - Or by arrangement (email or drop by)

- Email: [swiggumj@uwm.edu](mailto:swiggumj@uwm.edu)
- Phone: 414-229-6360

**Course Website:** <http://www.gravity.phys.uwm.edu/~kaplan/fyre/>

Lecture notes, reading assignments, and problem sets will be posted there.

**Programming basics** will be done through <https://groklearning.com>. Support with GROK is via [support@groklearning.com](mailto:support@groklearning.com).

### **Course Textbook:**

None

### **Evaluation:**

- Problem sets (weekly): 10%; grade will be best 10 of 11 problem sets
- Weekly in-class lab assignments: 50%
- Participation: 20%
- Final proposals and presentations (Friday Dec 22 12:30pm-2:30pm): 20%

The final will be a presentation of a final project completed in groups of 2.

### **Expectations:**

- Feel free to ask questions in class or in private.
- Homework assignments are due at the beginning of class
- Announcements will be made via email — please check frequently

**Assignments:** Weekly assignments will be posted on the course website and handed out in class. Each assignment will consist of a number of single- or multiple-part problems that are homework (private study) exercises for you, the student. Students are encouraged to discuss the problem sets with each other but are not allowed to copy each other.

### **Time Investment:**

- Lectures: 3 hours/week
- Final project preparation: 25 hours
- Weekly problems/assignments: 4 hours/week
- Reading and preparation for lectures: 1.5 hours/week
- Total: 144 hours for a 14 week semester, or 48 hours/credit

**Calculator:** Please bring a simple scientific calculator to each lecture, discussion, and test. (N.B. You do **NOT** need a fancy and expensive programmable calculator such for basic calculations). You may use a calculator during tests, but note that you will lose a substantial number of points for clumsy and inaccurate work with a calculator (example: if you forget to switch your calculator from degree to radian mode when you should do so, expect a substantial loss of points; your answer(s) will be hopelessly inaccurate).

**Makeups:** Students will be able to turn in one problem set late, provided there is a reasonable excuse. The instructor must be notified in advance of the intent to not turn in the problem set, and it will be due before the class following the one in which it was originally due. Note that at least one assignment will be dropped for each student before final grades are calculated. Tests will be rearranged for students who have conflicts with religious observance (see below for official UW

policy). No make up tests will be allowed except in cases of: illness resulting in hospitalization or an emergency/urgent care visit to a physician; family emergencies/bereavement; and verifiable traveling difficulties (such as snow emergencies). All such absences must be supported by appropriate documents. It is the responsibility of each student to attend the tests. Oversleeping, lapses of memory, and similar excuses will not be considered grounds for a make-up. If a student misses any test, including the final, for medical reasons, a physician's note (clearly showing the signature and letterhead of the physician) must be produced before a make-up can be allowed or (if the final has been missed) an incomplete awarded. The note must state clearly that, in the physician's opinion, the student was not fit to take the test. A note stating only that a student visited (for example) the Norris Health Center is not sufficient. Notes from family members/relations are not acceptable; if the parent/family member is a physician, such notes could constitute a reportable breach of medical ethics.

**University Policies:** For information on university policies such as religious observances, incompletes, discriminatory conduct, and so forth, see: <http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf>

**Detailed Syllabus:**

- Scientific method
- Astronomy research
- Astronomy literature
- Shell usage
- Programming
- Peer review
- Basic statistics
  - Central limit theorem
  - Least squares fitting
  - Poisson statistics
- What is a pulsar?
- Electromagnetic spectrum
- Radio telescopes & radiometer equation
- Pulsar searching
- Pulsar timing
- Binary pulsars and Kepler's laws

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## **OTHER IMPORTANT INFORMATION**

1. **Discriminatory conduct (such as sexual harassment):** Discriminatory conduct will not be tolerated by the University. It poisons the work and learning environment of the University and threatens the careers, educational experience, and well-being of students, faculty, and staff. See: [https://www4.uwm.edu/secu/docs/other/S\\_47\\_Discrimina\\_duct\\_Policy.pdf](https://www4.uwm.edu/secu/docs/other/S_47_Discrimina_duct_Policy.pdf)

2. **Cheating and academic misconduct:** all work handed in for grading (including electronic submissions) must be the result of your own efforts. Copying the work of another student or reproducing the solutions/answers to problems from an on-line or other source and presenting them as your own, original work, will be regarded as cheating. Cheating/academic misconduct will

be dealt with by the instructor according to the UW policies and procedures. Cheating on exams or plagiarism are violations of the academic honor code and carry severe sanctions, including failing a course or even suspension or dismissal from the University. See: <http://www4.uwm.edu/dos/conduct/>

3. **Special Consideration.** The principle of equal treatment of all students shall be a fundamental guide in responding to requests for special consideration. No student should be given an opportunity to improve a grade that is not made available to all members of the class. This policy is not intended to exclude reasonable accommodation of verified student disability, or the completion of work missed as the result of religious observance, verified illness, or justified absence due to circumstances beyond the student's control. (**Authority:** UWM Faculty Documents 860B and 1927)

4. **Religious observance.** In the syllabus, you will find a schedule of tests. Please inform the instructor ASAP and no later than MONDAY FEBRUARY 13<sup>TH</sup> if you see a conflict with religious observance. Also inform the instructor ASAP and no later than MONDAY FEBRUARY 13<sup>TH</sup> if the deadline of a quiz or an assignment conflicts with religious observance. A suitable date/time for the test (that does not conflict with the religious observance) or other deadline can then be arranged. Please note the following official UW policies: <http://www4.uwm.edu/secu/docs/other/S1.5.htm> See also: <http://uwm.edu/academicaffairs/wp-content/uploads/sites/32/2014/12/calendar.pdf>

**Authority: UWS 22 and UWM Fac. Doc. 1918**

*I. Declaration of policy. It is the policy of the board of regents that students' sincerely held religious beliefs shall be reasonably accommodated with respect to all examinations and other academic requirements. The board of regents adopts this chapter in order to ensure that all institutions of the university of Wisconsin system have in place appropriate mechanisms for ensuring the reasonable accommodation of students' sincerely held beliefs, and for appeals related to these matters.*

*II. Accommodation of religious beliefs.*

*1. A student shall be permitted to make up an examination or other academic requirement at another time or by an alternative method, without any prejudicial effect, where:*

*(a) There is a scheduling conflict between the student's sincerely held religious beliefs and taking the examination or meeting the academic requirements; and*

*(b) The student has notified the instructor, within the first three weeks of the beginning of classes (within the first week of summer session and short courses), of the specific days or dates on which he or she will request relief from an examination or academic requirement.*

*2. Instructors may schedule a make-up examination or other academic requirement before or after the regularly scheduled examination or other academic requirement.*

*3. Instructors shall accept, at face value, the sincerity of students' religious beliefs.*

*4. Student notification of instructors and requests for relief under sub. (1) shall be kept confidential.*

*5. Complaints of failure to provide reasonable accommodation of a student's sincerely held religious beliefs as required by this rule may be filed under UWM Complaint and Grievance Procedures.*

*6. The chancellor shall, through appropriate institutional publications (to include at a minimum the Schedule of Classes and Bulletin), provide notification to students and instructors of the rules for accommodation of religious beliefs, and of the procedure and appropriate office for filing complaints.*

5. **Students with disabilities:** please give me the written authorization issued by the Accessibility Resource Center (ARC) **as soon as possible**. Suitable arrangements can then be made. Students with special requirements/learning disabilities should see me as early as possible during the semester: this is the student's responsibility. The ARC will issue formal instructions to me about how students with disabilities are to be accommodated. See: <http://www4.uwm.edu/sac/> for ARC contact information.

6. **Students called to active military duty:** accommodations for absences due to call-up of reserves to active military duty are available at this link: [http://www4.uwm.edu/current\\_students/military\\_call\\_up.cfm](http://www4.uwm.edu/current_students/military_call_up.cfm)

7. **Complaint procedures:** Students may direct complaints to the head of the academic unit or department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy. See: [https://www4.uwm.edu/secu/docs/other/S\\_47\\_Discrimina\\_duct\\_Policy.pdf](https://www4.uwm.edu/secu/docs/other/S_47_Discrimina_duct_Policy.pdf)

For your information:

**Chair of Physics:** Professor Prasenjit Guptasarma: KEN 3077, (414)229-6497, [pg@uwm.edu](mailto:pg@uwm.edu)

**Dean of Students' Office:** <http://www4.uwm.edu/dos/>

**Equity and Diversity:** <http://uwm.edu/equity-diversity-services/about/>

8. **Grade appeal procedures:** A student may appeal a grade on the grounds that it is based on a capricious or arbitrary decision of the course instructor. Such an appeal shall follow the established procedures adopted by the department, college, or school in which the course resides or in the case of graduate students, the Graduate School. These procedures are available in writing from the respective department chairperson or the Academic Dean of the College/School. Two useful links are given below.

[http://www4.uwm.edu/secu/docs/other/S\\_28\\_Grade\\_Appe\\_by\\_Students.pdf](http://www4.uwm.edu/secu/docs/other/S_28_Grade_Appe_by_Students.pdf)

<http://uwm.edu/letters-science/advising/answers-forms/policies/appeal-procedure-for-grades>