

ASTR 420/620 - Exoplanets – Syllabus

Lecture: Fridays 10:30am-1:10pm – EXPL 1004

Instructor: Dr. Peter Plavchan

Cell: (626) 234-1628

Office: Planetary 243

Email: pplavcha@gmu.edu

Office Hours: M,Tu 11a-12p, Discord 24/7 + by appointment

Materials:

Required: *The Exoplanet Handbook* by Perryman

Required: *How Do You Find an Exoplanet* by Johnson

Reference: *Exoplanets* by Seager

Reference: *Exoplanet Atmospheres* by Seager

Exams: None

Homework: There will be homeworks and group projects, covering material from the class.

Grading Policy: Homeworks 100%

A curve will be applied.

Grade determined as follows: Median class course grade will be curved to a B+/A-.

Homework assignments will be accepted until I start grading them, even after the nominal due date. After I start grading, no extensions and partial credit will be allowed, unless approved by unanimous written consent in a private vote from all students present in person in the class when a vote is taken.

Course Outline – ASTR 420/620 – 2018 Spring Semester

Class Date	Week #	Lecture Topics	Notes
1/28	1	Course Overview; Exoplanet History	HW1 out

Class Date	Week #	Lecture Topics	Notes
2/4	2	Solar System Formation & Review	HW 1 due; HW2 out
2/11	3	Keplerian Orbits Pt 1	HW3 out
2/18	4	Keplerian Orbits Pt 2	HW2 due
2/25	5	Detection Techniques: Transits	HW3 due; HW 4 out
3/4	6	ExoStats	
3/11	7	Detection Techniques: Radial Velocities	HW4 due; HW 5 out
3/18	8	--	Spring break
3/25	9	Detection Techniques: Direct Imaging & Future Space Missions	
4/1	10	Detection Techniques: Timing & Microlensing	
4/8	11	Exoplanet Demographics	
4/15	12	Planet Formation	
4/22	13	Planetary Atmospheres	
4/29	14	Planetary Habitability	
5/6	15		Last Class

Course Description:

Are there other Earth-like planets out there? Humanity has pondered this question for millenia. Over the past 25 years, over 3000 exoplanets have been confirmed and/or validated to orbit other stars. These discoveries accelerated with the launch of the NASA Kepler mission in 2009, and will continue to accelerate with the launch of future NASA and European missions such as TESS, the James Webb Space and WFIRST, and with new ground-based observatories and instrumentation. We now know exoplanets outnumber stars in our Galaxy, and that Earth-mass exoplanets with the potential for liquid surface water exist by the billions in our Galaxy alone. Science fiction is now science fact.

This course will cover the modern knowledge of exoplanets, including the recent history of the field, the different discovery methods, important benchmark exoplanets and exoplanetary systems, and the characterization of exoplanet demographics, composition and atmospheres.

We will explore the different tools and techniques employed, making use of theory, simulation, archival research and observations. The field of exoplanet science is fundamentally driven by a revolution in the obtainable precision of traditional astronomical measurements, which have in turn been enabled by new technology, the exploitation of the time domain, and new advanced algorithms that take advantage of increasing computational resources and improved statistical methods. In this course, we will make use of the technology, algorithms, and statistical methods that underlie these advances in precision and look towards the future unexplored vistas of the exoplanet field.

Overall goal:

The goal of this course is to introduce you to the theoretical, observational, statistical, computational techniques used by exoplanet astronomers.

The skills you will develop in this class are extremely useful for a wide variety of careers including, but not limited to, astronomy. We are committed to making this course useful for your future career goals, whatever they may be. Please let us know what those goals are, as best you know them at this stage. We want to help you see how you might apply what you are learning and shape the course to best meet your goals, where that is possible.

Computers:

The use of computers is fundamental to astronomical work so they are going to play an important role in this class. We will also use professional software for detailed plotting and analysis of the reduced data (such as TOPCAT, ExoFAST, RADVEL, and others).

Working with computer programs takes time and effort, but these are important and very marketable skills for future jobs. Take the time to work on your computer skills and particularly your programming skills and you will reap the benefits in this class and in looking for jobs in the future.

You will be expected to write and/or use some programs in a programming language of your choice (Matlab, Python).

Useful Campus Resources:

Writing Center: A114 Robinson Hall; (703) 993-1200; <http://writingcenter.gmu.edu>

Counseling and Psychological Services (CAPS): (703) 993-2380 <http://caps.gmu.edu>

Policies:

Withdrawal: If you need to withdraw from this course you must do it within the University established time frame. For fall 2017 the last day to withdraw with no tuition penalty is September 5. From then on tuition penalties apply. The last date to drop, with a 67% tuition penalty, is September 29. See the GMU academic calendar <http://registrar.gmu.edu/calendars/fall-2017/> for other important dates.

Students with Disabilities: Please contact Disability Services (SUB I, Room 4205, Phone 703-993-2474, <http://ods.gmu.edu>) if you have a learning or physical disability that will require accommodation in the astronomy laboratory. You must obtain the proper paperwork and notify your instructor in advance to be accommodated.

Academic Integrity:

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. Collaborative group work is encouraged in the lab, but it will be considered academic dishonesty to attach your name to work when you did not actively participate and contribute.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

As a faculty member and designated "Responsible Employee," I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's [Title IX Coordinator](#) per [university policy 1412](#). If you wish to speak with someone confidentially, please contact the [Student Support and Advocacy Center](#) (703-380-1434), [Counseling and Psychological Services](#) (703-993-2380), [Student Health Services](#), or [Mason's Title IX Coordinator](#) (703-993-8730; cde@gmu.edu).

Name and pronoun use: If you wish, please share your name and gender pronouns with me and indicate how best to address you in class and via email. I use he/him for myself and you may address me as Professor Plavchan or Dr Plavchan in email and verbally.

Safe Return to Campus: All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check prior to coming to campus. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, Red, or Blue email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An [appropriate facemask](#) must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks will always be welcome in the classroom.

If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other concern, students should check Blackboard and/or Discord for updates on how to continue learning and for information about any changes to events or assignments.