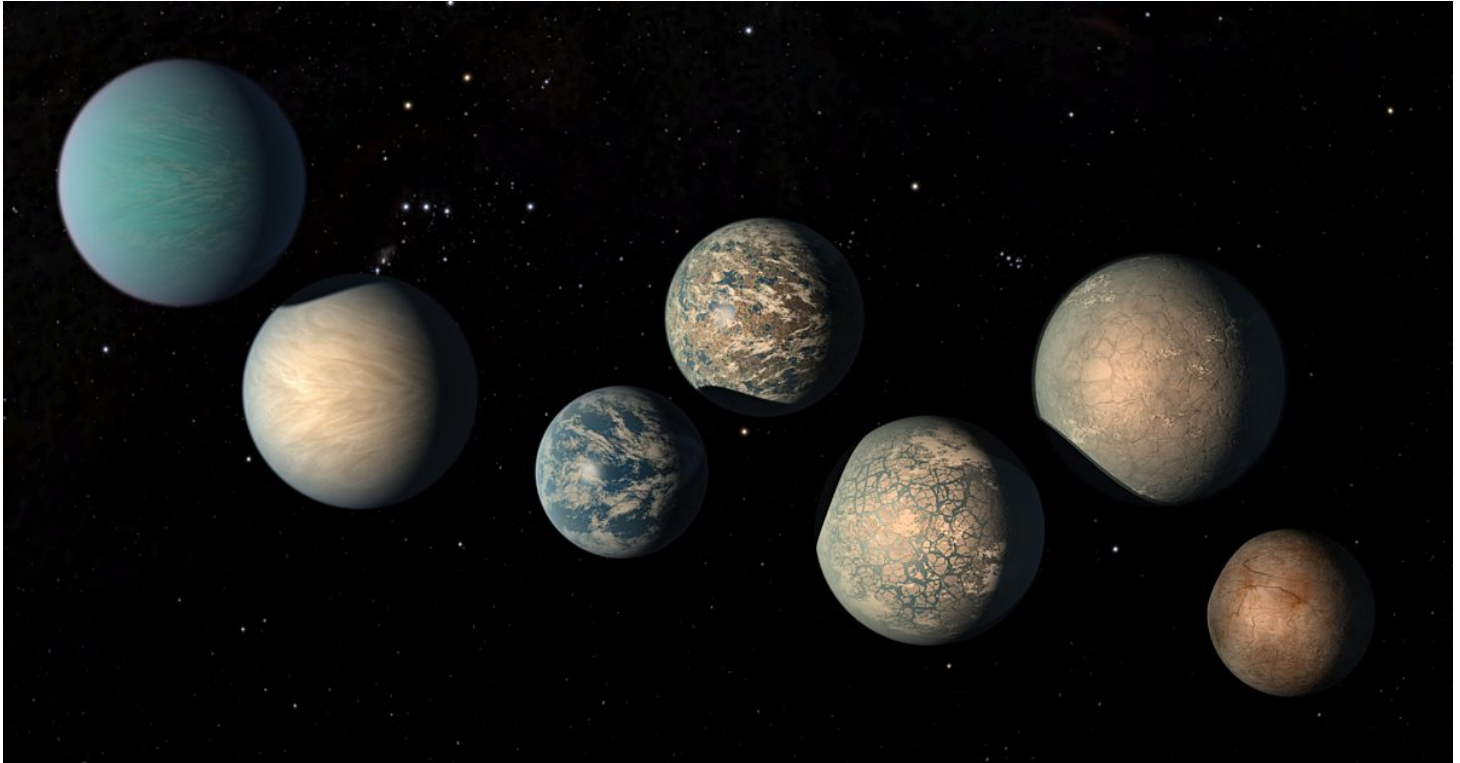


## Syllabus for Astronomy 7939: Exoplanets



### Your Instructor

Professor: Sarah Ballard

- Email: [sarahballard@ufl.edu](mailto:sarahballard@ufl.edu)
- Phone: 352-294-1866
- Office Hours/Location: Mondays and Thursdays, 2-3 PM

## General Information

This course is a survey of the rapidly-evolving field of the detection and characterization of planets orbiting other stars, designed for graduate students. While the course will draw on material from other graduate courses (particularly stellar astrophysics and radiative processes), you'll be fine taking these courses concurrently. I will attempt to convey the breadth of scientific knowledge of exoplanets along two axes: time (how planets form and planetary systems evolve), and space (the occurrence rates of exoplanets across the Milky Way, in addition to the composition of individual planets and their atmospheres). A major component of the course will be coding assignments in Python.

**A major component of this course is group work;** students will be assigned into teams for the semester, with one lecture period per week devoted fully to worksheets for group problem solving. You will submit these at worksheets end of the day. **This means that in-person attendees must bring a laptop and headphones to class--** your group discussions will take place online, to facilitate discussion for both in-person and remote students in your group.

This course will have no midterm or final exam. Homeworks (7 total), in-person weekly group worksheets (14 total), a paper presentation of a famous paper in the scientific literature about exoplanets, and a final project will contribute toward your grade.

Topics for the course include: orbital mechanics, proto-stellar collapse and star formation, models of planet formation, methods of detecting extrasolar planets, composition and physical structure of planets, planetary atmospheres, principles of "habitability", and biosignatures.

## Materials:

Both textbooks for this course are available for free online to UF students through the library. Note that you will need to be logged into a VPN client in order to access them.

- **Exoplanets**, edited by Sara Seager (ISBN 9780816529452)
- **Planetary Sciences** by de Pater and Lissauer (ISBN-13: 978-1107091610)
- Supplementary textbook *How to Find an Exoplanet* by John Johnson (ISBN 9781400873999)

## Course Assessment

Your grade is based on:

### **30%: In-class activities:**

*Worksheets (25%)*: These will be curved, so that the mean score is set to 85% (B), and a standard deviation above and below the mean will be B+ and B-, respectively. Note that showing your work is required for credit.

*Presentation of a exoplanet paper from the literature (5%)*

### **40%: Homework**

Your lowest homework score will be dropped. Late homework loses 50% credit but is still worth doing. Note that showing your work is required for credit.

### **30%: Final project**

Replicating a canonical result in exoplanets, using a Bayesian toolset (whether or not the original paper used one). You will have the option of selecting from three projects that dramatically shaped our understanding of exoplanets, each of which infers a key property from existing observational data.

### **Grading scale:**

>93.3 is an A  
90-93.3 is a A-  
86.6-89.9 is a B+  
83.3- 86.6 is a B  
80-83.3 is a B-  
76.6-79.9 is a C+  
73.3- 76.6 is a C  
70-73.3 is a C-  
66.6-69.9 is a D+  
63.3- 66.6 is a D  
60-63.3 is a D-  
<60 is an F

## Course Calendar

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Week	Day	Date	Topic	Paper	What's due
1	Mon	8/23	Welcome/Overview Orbital mechanics	---	--
	Wed	8/25			---
	Fri	8/27			In-class worksheet
2	Mon	8/30	Orbital mechanics Formation & Evolution	---	---
	Wed	9/1			---
	Fri	9/3			In-class worksheet, HW1
3	Mon	9/6	Holiday Formation & Evolution Radial velocity	ALMA Partnership 2015 <a href="https://arxiv.org/pdf/1503.02649.pdf">[Link] (https://arxiv.org/pdf/1503.02649.pdf)</a>	---
	Wed	9/8			---
	Fri	9/10			In-class worksheet
4	Mon	9/13	Radial velocity	Mayor & Queloz 1995 <a href="https://web.pa.msu.edu/courses/2011spring/AST208/mayorQueloz.pdf">[Link] (https://web.pa.msu.edu/courses/2011spring/AST208/mayorQueloz.pdf)</a>	---
	Wed	9/15			---
	Fri	9/17			In-class worksheet, HW2
5	Mon	9/20	Transits	Charbonneau et al. 2001 <a href="https://arxiv.org/pdf/astro-ph/9911436.pdf">[Link] (https://arxiv.org/pdf/astro-ph/9911436.pdf)</a>	---
	Wed	9/22			---
	Fri	9/24			In-class worksheet
6	Mon	9/27	Transits	Lissauer et al. 2011 <a href="https://arxiv.org/pdf/1102.0291.pdf">[Link] (https://arxiv.org/pdf/1102.0291.pdf)</a>	---
	Wed	9/29			---
	Fri	10/1			In-class worksheet, HW3
7	Mon	10/4	Microlensing & direct imaging	Marois et al. <a href="https://arxiv.org/pdf/0811.2606.pdf">[Link] (https://arxiv.org/pdf/0811.2606.pdf)</a>	---
	Wed	10/6			In-class worksheet

	Fri	10/8	Occurrence rates & demographics  Holiday		---
8	Mon	10/11	Occurrence rates & demographics	Dressing et al. 2015  [Link] <a href="https://iopscience.iop.org/article/10.1088/0004-637X/807/1/45/pdf">_(https://iopscience.iop.org/article/10.1088/0004-637X/807/1/45/pdf)</a>	---
	Wed	10/13			---
	Fri	10/15			In-class worksheet, HW4
9	Mon	10/18	Internal composition	Xu et al. 2014  [Link] <a href="https://iopscience.iop.org/article/10.1088/0004-637X/783/2/79/pdf">_(https://iopscience.iop.org/article/10.1088/0004-637X/783/2/79/pdf)</a>	---
	Wed	10/20			---
	Fri	10/22			In-class worksheet
10	Mon	10/25	Atmospheres	Robinson et al. 2014  [Link] <a href="https://www.pnas.org/content/pnas/111/25/9042.full.pdf">_(https://www.pnas.org/content/pnas/111/25/9042.full.pdf)</a>	---
	Wed	10/27			---
	Fri	10/29			In-class worksheet, HW5
11	Mon	11/1	Dynamics	Ballard et al. 2011  [Link] <a href="https://iopscience.iop.org/article/10.1088/0004-637X/743/2/200/pdf">_(https://iopscience.iop.org/article/10.1088/0004-637X/743/2/200/pdf)</a>	---
	Wed	11/3			---
	Fri	11/5			In-class worksheet
12	Mon	11/8	Host stars	Shields et al. 2013  [Link] <a href="https://www.liebertpub.com/doi/pdf/10.1089/ast.2012.0961">_(https://www.liebertpub.com/doi/pdf/10.1089/ast.2012.0961)</a>	---
	Wed	11/10			---
	Fri	11/12			In-class worksheet, HW6
13	Mon	11/15	Patterns & trends	Fischer & Valenti 2005  [Link] <a href="https://iopscience.iop.org/article/10.1086/428383/pdf">_(https://iopscience.iop.org/article/10.1086/428383/pdf)</a>	---
	Wed	11/17			---
	Fri	11/19			In-class worksheet

14	Mon	11/22	Habitability & extremophiles  Holiday  Holiday	Sousa-Silva et al. 2020  <a href="https://www.liebertpub.com/doi/pdf/10.1089/ast.2018.1954">[Link] (https://www.liebertpub.com/doi/pdf/10.1089/ast.2018.1954)</a>	---
	Wed	11/24			---
	Fri	11/26			In-class worksheet, HW7
15	Mon	11/30	Habitability & extremophiles  Remote detection of life	Carrigan 2009  <a href="https://iopscience.iop.org/article/10.1088/0004-637X/698/2/2075/pdf">[Link] (https://iopscience.iop.org/article/10.1088/0004-637X/698/2/2075/pdf)</a>	---
	Wed	12/2			---
	Fri	12/4			---
16	Mon	12/6	Remote detection of life	---	Final project due 12/14
	Wed	12/8			

## Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/) [\(http://www.dso.ufl.edu/drc/\)](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

## Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu> [.\(https://evaluations.ufl.edu\)](https://evaluations.ufl.edu). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/> [.\(https://evaluations.ufl.edu/results/\)](https://evaluations.ufl.edu/results/).

## Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom. Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all.

## University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or

implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/> [\\_ \(https://sccr.dso.ufl.edu/process/student-conduct-code/\)\\_](https://sccr.dso.ufl.edu/process/student-conduct-code/)) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## Counseling and Wellness Center

Being a student can be a very stressful experience. For contact information for the Counseling and Wellness Center, look to <https://counseling.ufl.edu/> [\\_ \(http://www.counseling.ufl.edu\)\\_](http://www.counseling.ufl.edu), or call 352-392-1575, 8am-5pm Monday through Friday. If you need mental health services urgently for yourself or others after business hours, phone consultation with a counselor is available 24 hours a day, 7 days a week. Call UF CWC at 352-392-1575 or the Alachua County Crisis Center at 352-264-6789.