

Lecture tomorrow (as scheduled 9:30 am Pick 016) -
Complete Pre-reading Quiz ONLINE BEFORE LECTURE

(https://canvas.uchicago.edu/courses/21144/discussion_topics/183893)

Hi Everyone, Our final lecture will continue as regularly sc...

(https://canvas.uchicago.edu/courses/21144/discussion_topics/183893)

Posted on:

Jun 3, 2019 at 7:16am

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(https://canvas.uchicago.edu/courses/21144/discussion_topics/183893)

PSD Photographer in Lecture Today

(https://canvas.uchicago.edu/courses/21144/discussion_topics/179714)

Hi Everyone, A photographer from the UChicago Physical ...

(https://canvas.uchicago.edu/courses/21144/discussion_topics/179714)

Posted on:

May 16, 2019 at 4:25am

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(https://canvas.uchicago.edu/courses/21144/discussion_topics/179714)

ASTR 12720 1 (Spring 2019) Exoplanets

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PHSC 12720: Exoplanets

Spring 2019

Basic Information

Instructor: Prof. Leslie Rogers (larogers@uchicago.edu (<mailto:larogers@uchicago.edu>), pronouns: she/her/hers)

Classes: T Th 9:30 – 10:50 Pick 016

Labs: organized by Julia Borst Brazas, starting 2nd week

Website: canvas

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Teaching Assistants

Andrew Neil (aneil@uchicago.edu (<mailto:aneil@uchicago.edu%C2%A0>))

Fei Xu (feixu@uchicago.edu (<mailto:feixu@uchicago.edu>))

Learning Objectives

- To gain an understanding of the intellectual beauty of astronomy in general and exoplanets in particular, that is, to gain an understanding why some people devote their life to the field;
- To learn fundamental facts about exoplanets and how we know these things;
- To gain practice applying math and physics to learn about the physical world;
- To instill the confidence to be a life-long learner in areas involving numbers, scientific concepts, and technology;
- To develop an ability to evaluate the strengths and weaknesses of arguments based on the use of data, technical claims, and scientific theories encountered in the media.

Prerequisite/Degree Requirements

In order to satisfy the general education physical sciences requirement, PHSC 10800, PHSC 10100, PHSC 12700 or PHSC 12710 must be taken before PHSC 12720 to form an approved sequence. If PHSC 12720 is to be taken as an elective, the prerequisite is recommended but not required.

Approved PHSC sequences: PHSC 12700-12720, PHSC 12710-12720, PHSC 10800-12720 or PHSC 10100-12720.

This class can also be used for the Astronomy minor.

Course Description

The past two decades have witnessed the discovery of planets in orbit around other stars and the characterization of extra-Solar (exo-) planetary systems. We are now able to place our Solar System into the context of other worlds and a surprising conclusion that most planetary systems look nothing like our own. A challenging next step is to find planets as small as the Earth in orbit around stars like the Sun. The architecture of planetary systems reflects the formation of the parent star and its protoplanetary disk, and how these have changed with time. This course will review the techniques for discovery of planets around other stars, what we have learned so far about exoplanetary systems, and the driving questions for the future, including the quest for habitable environments elsewhere. Although quantitative analysis will be an important part of the course, students will not be expected to employ mathematics beyond algebra.

Textbook:

"How do you find an Exoplanet" by John Asher Johnson, ISBN 9781400873999, Available for free online

through the UChicago Library: <http://pi.lib.uchicago.edu/1001/cat/bib/11452153> (<http://pi.lib.uchicago.edu/1001/cat/bib/11452153>)

Supplemental Textbooks:

"Planetary Sciences" by Imke de Pater and Jack J. Lissauer, ISBB 9780521853712, Available for free online through the UChicago Library: <http://pi.lib.uchicago.edu/1001/cat/bib/11724132> (<http://pi.lib.uchicago.edu/1001/cat/bib/11724132>)

"Introduction to Modern Astrophysics" by Bradley W. Carroll & Dale A. Ostlie, ISBN 9780805304022, On Reserve in Library, Relevant Chapter scanned on Canvas

Office Hours

I will hold office hours on Mondays 4-5pm in ERC 537. Students are always welcome to contact me to set up an appointment to meet outside of these regular hours. I am invested in everyone being successful in this class!

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. Find our class page at: <https://piazza.com/uchicago/spring2019/astr127201exoplanets/home> (<https://piazza.com/class/jtk9yw6zunmdy?cid=4>)

Grading

40% Exams

30% Labs

10% Attendance/In-Lecture Participation

10% In-class Pre-Reading Quizzes

10% Participation in Online Forums

There will be two **exams** for the class: one midterm and a comprehensive final. The exam score will be either the average of the two scores or the final, whichever is highest.

Attendance at the weekly 2hr lab is mandatory. Not completing all 4 labs will automatically result in a failing grade for the course.

The lab syllabus can be found [here](#). It and the lab manual can be found in the Files section of Canvas in the "Labs" folder.

There will be no graded homework sets for the class. Instead, a portion of every class will be devoted to an

active learning session where you and your peers will work through and homework-like quantitative problems and concept problems with instructor guidance. Participation in these sessions is mandatory and will count towards your **participation** grade.






Students are expected to **complete the assigned reading(s) prior to each lecture**. An in-class **quiz based on the reading** (consisting of ~4 multiple choice questions) will be given each lecture. The quiz may occur at any point during the lecture (so plan to be on time and stay to the end). The lowest 2 scores on the reading quizzes will be dropped.













Attendance in lecture will be taken at the same time as the in-class reading quizzes. To earn a “perfect” attendance grade, students may miss no more than 2 lectures (for any reason) from lecture #2 onward.













In addition to in-class attendance and participation, students also receive points for **participating in the Piazza online discussion forums**. To earn a perfect Piazza participation grade, students should make one thoughtful post per lecture relating to the course content (missing no more than 2 lectures as in the attendance and reading quiz grades). Examples of “thoughtful posts” include asking a substantive question, answering another student’s question, correcting/expanding upon a previous answer, commenting on a posted article, posting a news article. Sign up for Piazza here: piazza.com/uchicago/spring2019/astr127201exoplanets (<http://piazza.com/uchicago/spring2019/astr127201exoplanets>)













Quality **grades** will be assigned post-facto based on the cumulative score. Regardless of the class performance, a 90% cumulative score guarantees an A-, 80% a B-, 70% a C-, and 65% a D. The grades will only be curved up, if at all, and not down.























Course Summary:



Date	Details	
Tue Apr 2, 2019	 Lecture 1: Introduction: What is a Planet? What is an Exoplanet? (https://canvas.uchicago.edu/calendar?event_id=79330&include_contexts=course_21144)	9:30am to 10:50am
Thu Apr 4, 2019	 Lecture 2: Why do planets move as they do? (https://canvas.uchicago.edu/calendar?event_id=79331&include_contexts=course_21144)	9:30am to 10:50am
Tue Apr 9, 2019	 Lecture 3: Solar System Overview (https://canvas.uchicago.edu/calendar?event_id=79332&include_contexts=course_21144)	9:30am to 10:50am
Thu Apr 11, 2019	 Lecture 4: Techniques: radial velocity (https://canvas.uchicago.edu/calendar?event_id=79333&include_contexts=course_21144)	9:30am to 10:50am
Mon Apr 15, 2019	 Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732)	due by 3:30pm

Date	Details
	(Lab Section 1)
Tue Apr 16, 2019	<div>  Lecture 5: Telescopes (https://canvas.uchicago.edu/calendar?event_id=79313&include_contexts=course_21144) </div> <div>  Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (Lab Section 3) </div>
Wed Apr 17, 2019	<div>  Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (Lab Section 4) </div> <div>  Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (Lab Section 5) </div>
Thu Apr 18, 2019	<div>  Lecture 6: Techniques: transits (https://canvas.uchicago.edu/calendar?event_id=79314&include_contexts=course_21144) </div>
Tue Apr 23, 2019	<div>  Lecture 7: Techniques: transits (continued) (https://canvas.uchicago.edu/calendar?event_id=79315&include_contexts=course_21144) </div> <div>  Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (2 students) </div>
Thu Apr 25, 2019	<div>  Lecture 8: Techniques: direct imaging (https://canvas.uchicago.edu/calendar?event_id=79316&include_contexts=course_21144) </div>
Mon Apr 29, 2019	<div>  Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) (Lab Section 1) </div>
Tue Apr 30, 2019	<div>  Lecture 9: Techniques: direct imaging (continued) + Midterm Review (https://canvas.uchicago.edu/calendar?event_id=79317&include_contexts=course_21144) </div> <div>  Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) (Lab Section 3) </div>
Wed May 1, 2019	<div>  Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) </div>

Date	Details	
	(Lab Section 4)	
	 Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) (Lab Section 5)	due by 6:30pm
Thu May 2, 2019	 Midterm Exam (https://canvas.uchicago.edu/calendar?event_id=79324&include_contexts=course_21144)	9:30am to 10:50am
	 Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (1 student)	due by 11:59pm
Mon May 6, 2019	 Preliminary Piazza Participation (https://canvas.uchicago.edu/courses/21144/assignments/173114)	due by 11:59pm
Tue May 7, 2019	 Lecture 10: Direct Imaging (https://canvas.uchicago.edu/calendar?event_id=83261&include_contexts=course_21144)	9:30am to 10:50am
Wed May 8, 2019	 Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) (1 student)	due by 6:30pm
Thu May 9, 2019	 Lecture 11: Techniques: microlensing, astrometry, and timing (https://canvas.uchicago.edu/calendar?event_id=79326&include_contexts=course_21144)	9:30am to 10:50am
Tue May 14, 2019	 Lecture 12: Statistical distributions of exoplanets (https://canvas.uchicago.edu/calendar?event_id=79319&include_contexts=course_21144)	9:30am to 10:50am
Thu May 16, 2019	 Lecture 13: Planet formation (https://canvas.uchicago.edu/calendar?event_id=79327&include_contexts=course_21144)	9:30am to 10:50am
Mon May 20, 2019	 Lab 3: Detecting exoplanets with the transit method (https://canvas.uchicago.edu/courses/21144/assignments/173152) (Lab Section 1)	due by 1:30pm
Tue May 21, 2019	 Lecture 14: Planetary structure and composition (https://canvas.uchicago.edu/calendar?event_id=79328&include_contexts=course_21144)	9:30am to 10:50am
	 Lab 3: Detecting exoplanets with the transit method (https://canvas.uchicago.edu/courses/21144/assignments/173152) (Lab Section 3)	due by 3:30pm

Date	Details	
Wed May 22, 2019	 Lab 3: Detecting exoplanets with the transit method https://canvas.uchicago.edu/courses/21144/assignments/173152 (Lab Section 4)	due by 1:30pm
	 Lab 3: Detecting exoplanets with the transit method https://canvas.uchicago.edu/courses/21144/assignments/173152 (Lab Section 5)	due by 6:30pm
Thu May 23, 2019	 Lecture 15: Exoplanet atmosphere observations https://canvas.uchicago.edu/calendar?event_id=79320&include_contexts=course_21144	9:30am to 10:50am
Sat May 25, 2019	 Lab 3: Detecting exoplanets with the transit method https://canvas.uchicago.edu/courses/21144/assignments/173152 (1 student)	due by 11:59pm
Tue May 28, 2019	 Lecture 16: Planet Habitability (https://canvas.uchicago.edu/calendar?event_id=79321&include_contexts=course_21144)	9:30am to 10:50am
	 Lab 4: Using Kepler's Laws to find the density of Jupiter https://canvas.uchicago.edu/courses/21144/assignments/173660 (Lab Section 1)	due by 1:30pm
	 Lab 1: Scale of the solar system and local stellar environment (https://canvas.uchicago.edu/courses/21144/assignments/168732) (1 student)	due by 11:59pm
Wed May 29, 2019	 Lab 4: Using Kepler's Laws to find the density of Jupiter https://canvas.uchicago.edu/courses/21144/assignments/173660 (Lab Section 3)	due by 3:30pm
Thu May 30, 2019	 Lecture 17: Life and biosignatures https://canvas.uchicago.edu/calendar?event_id=79329&include_contexts=course_21144	9:30am to 10:50am
	 Lab 4: Using Kepler's Laws to find the density of Jupiter https://canvas.uchicago.edu/courses/21144/assignments/173660 (Lab Section 4)	due by 1:30pm
	 Lab 4: Using Kepler's Laws to find the density of Jupiter https://canvas.uchicago.edu/courses/21144/assignments/173660 (Lab Section 5)	due by 6:30pm
Sat Jun 1, 2019	 Lab 2: Detecting exoplanets with the radial velocity method https://canvas.uchicago.edu/courses/21144/assignments/169695 (1 student)	due by 3:30pm

Date	Details
Mon Jun 3, 2019	 Lab 2: Detecting exoplanets with the radial velocity method (https://canvas.uchicago.edu/courses/21144/assignments/169695) (2 students) due by 11:59pm
Tue Jun 4, 2019	 Lecture 18: The Fermi paradox: Where are they? + Class Synthesis (https://canvas.uchicago.edu/calendar?event_id=79322&include_contexts=course_21144) 9:30am to 10:50am  6/4 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/175670) due by 9:30am
Thu Jun 6, 2019	 Exam for Graduating Seniors (https://canvas.uchicago.edu/calendar?event_id=79323&include_contexts=course_21144) 9:30am to 11:30am  Lab 3: Detecting exoplanets with the transit method (https://canvas.uchicago.edu/courses/21144/assignments/173152) (1 student) due by 11:59pm
Tue Jun 11, 2019	 Final Exam (https://canvas.uchicago.edu/calendar?event_id=79610&include_contexts=course_21144) 10:30am to 12:30pm
	 4/11 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/169412)
	 4/16 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/170241)
	 4/18 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/170366)
	 4/23 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/171022)
	 4/25 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/171554)
	 4/30 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/172119)
	 4/4 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/168162)
	 4/9 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/168961)
	 5/14 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/174200)
	 5/16 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/174177)
	 5/21 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/174730)
	 5/23 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/175377)
	 5/28 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/175378)
	 5/30 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/175706)
	 5/9 Quiz (https://canvas.uchicago.edu/courses/21144/assignments/173386)
	 Final Exam (https://canvas.uchicago.edu/courses/21144/assignments/177507)

Date	Details
	 Midterm (https://canvas.uchicago.edu/courses/21144/assignments/172726)
	 Roll Call Attendance (https://canvas.uchicago.edu/courses/21144/assignments/168164)