Course Description and Goals: Astronomy 105 (AS105) focuses on the search (and study of) extraterrestrial worlds, some of which may harbor life. We will embark on a detailed examination of our solar system, and the discovery and characterization of the almost 2000 confirmed planets orbiting other stars. This course will examine alien worlds we can touch, alien worlds on which we can land (or have landed), alien worlds that are studied from a great distance, and the question of how common life is in the Universe. Students will use telescopes to observe the worlds of our solar system, investigate alien worlds as portrayed in cinema, learn the tools needed to interpret astronomical observations, and be exposed to the myriad discoveries coming from current studies of extrasolar planets, including recent results that indicate planets around other stars appear to be common. The primary goal for this class is for students to learn that science is a process that is alive today – students will see first-hand that science changes!

Class Times:

CAS AS105 A1: Lecture: Tue, Thu: 2:00-3:20 (Tsai Center)

Teaching Fellows:

Nick Macdonald
Email: nmacdona@bu.edu
Office: CAS 411

Emmet Golden-Marx
Email: emmetgm@bu.edu
Office: CAS 605A

Eunkyu Han
Email: eunkyuh@bu.edu
Office: CAS 524
Phone: 617-353-6554

Office Hours:
West: Mon 2:30-3:30 (CAS 422A); Tue 10:00-11:00 (CAS 422A); Thur 9:00-10:30 (Pavement Coffee House - Comm. Ave.)
Macdonald: Tue 3:30-4:30 (CAS 411); Wed 2:00-3:00 (CAS 411); or by appointment
Golden-Marx: Tue 4:30-5:30 (CAS 524); Fri 11:00-12:00 (CAS 524); or by appointment
Han: Tue 11:00-12:00 (CAS 524); Wed 11:00-12:00 (CAS 524); or by appointment

Note on office hours and questions: Please make use of office hours (both mine and the TFs’). They are designed to set up a personal setting where you can feel comfortable asking questions that may not seem appropriate in class. I have found that students who make use of my office hours tend
to be much more successful in my class. You can go to any of the office hours listed above (even if you cannot attend those from your TF).

The best way to get information is to ask questions. No instructor is perfect, myself included. If I do a poor job in explaining some concept, please raise your hand and ask me to rephrase.

**Discussion Sections:** You are required to register for one of the discussion sections, which are listed as separate sections (see below) but are part of the same course. Your grade will be a combination of the coursework and activities completed in these sections. Discussion sections will be with one of the TFs in either Room 521 or B04 of the CAS building. Attending discussion is strongly encouraged because there will be some assignments that can only be completed during sections – if you miss it without prior arrangement, you cannot make it up.

CAS AS105 A2: Mon (CAS 521) – 1:00-2:00 (Macdonald)
CAS AS105 A3: Tue (CAS 521) – 1:00-2:00 (Han)
CAS AS105 A4: Mon (CAS 521) – 2:00-3:00 (Macdonald)
CAS AS105 A5: Wed (CAS 521) – 1:00-2:00 (Macdonald)
CAS AS105 A6: Tue (CAS B04) – 11:00-12:00 (Golden-Marx)
CAS AS105 A7: Wed (CAS 521) – 4:00-5:00 (Han)
CAS AS105 A8: Fri (CAS B04) – 2:00-3:00 (Golden-Marx)
CAS AS105 A9: Thu (CAS 521) – 11:00-12:00 (Golden-Marx)
CAS AS105 B3: Thu (CAS B04) – 1:00-2:00 (Han)

**Optional (Text)books:**

There are no required textbooks for this class. I expect that students will attend class, take notes, ask questions, and with the addition of copies of the lecture slides and other supplemental materials (including excerpts from the Alien Worlds MOOC; see below), will learn the material without the need for a textbook. That said, I will recommend a book that will be useful in better understanding some of the material (*Strange New Worlds*; see below), and put two textbooks on reserve in the Stone Science Library as additional resources.

1) *Strange New Worlds*, 2011, Ray Jayawardhana
2) *Life in the Universe*, 3rd Ed., 2012, Bennet & Shostak

**Web site:** Most of the course information (e.g., lecture slides, homework, readings, etc.) will be available through the BU Blackboard Learn site (http://learn.bu.edu). You will be able to log into the course site by logging into blackboard with your BU username and Kerberos password.

**Background:** Astronomy 105 has no prior course requirements. It is designed with the expectation that you have had high school algebra and an understanding of basic science. Basic mathematical equations should not freak you out. If you have already taken AS101 at BU, then you cannot get Natural Science General Education credit for AS105. For those interested in more mathematical/scientific rigor, you should consider taking AS202 (please let me know if you would like more information).

**Current Science and Scientists:** This class is not designed to prepare you to be an astronomer; rather one of the goals is to give you enough background to understand basic astronomical concepts,
understand how science works and learn about the role that scientists play in shaping our understanding of Alien Worlds. Throughout the semester I will bring in popular articles to class and/or post information to the Facebook group (see below), which we will discuss and introduce you to scientists who will help shape our attitudes toward astronomy and science. We will also hear directly from other scientists who will visit our classroom (both physically and virtually).

**Facebook and Twitter:** AS105 has both a Facebook group (alienworlds) and a Twitter handle (@BUalienworlds). Students are encouraged to join the Facebook group and follow the Twitter account as well as make posts to the Facebook page or Tweet to #alienworlds. Posts should be limited to news related to AS105 content and/or questions about science/astronomy - questions about logistics should be directed to Professor West or one of the TFs via email.

**Daily Traditions:**

*Music:* Most days as you are coming into class I will play a song that has something to do with what we are talking about in class that day or something related to astronomy.

*Questions:* We will always start each day with an opportunity for you to ask questions. Although you should always ask questions at any point during class, I will always reserve the first few minutes for any questions that may have come up overnight. Some of the time you will be asked to share your questions with a partner before asking me.

*Questions of the Day:* All of my lectures begin with a set of questions. These are an outline of what I hope you learn that day. By the end of the day you should be able to answer each question with at least a couple of sentences.

*Astronomy Picture of the Day:* I would like the AS105 students to become familiar with the “Astronomy Picture of the Day” (APOD) website (http://apod.nasa.gov/apod/), which posts beautiful astronomical images with descriptions from professional astronomers. Most days we will take a few minutes in class to look at the APOD, chat about what we are seeing, discuss how it relates to AS105, and hopefully inspire students to continue looking at APOD on the days when AS105 does not meet.

*Minute Papers:* Once a week, at the end of class, you will write for 2-3 minutes about the important points of the lecture/class. In the past, students have used the minute paper to summarize the class, ask probing questions, give feedback to the instructor, and/or discuss ways in which class relates to other topics. You will turn these into your Teaching Fellow (make sure you write your name, section and TF’s name on your minute paper) and your TF will read, comment and answer any questions that come up. Every week I will read the minute papers from several different AS105 sections so that by the end of the course, all of you will have received at least a few responses from me. The minute papers will count towards the participation portion of your grade but will not be graded on content. Instead, it will serve as an evaluation for both your ability to pay attention in lecture and my effectiveness as an instructor. In a given week, you will not know which day the minute paper will be assigned.

**Exams:**

There will be 4 exams in this class:

- Quiz 1 - Online/In-class – Tuesday September 30
- Quiz 2 - Thursday, October 23
- Quiz 3 - Thursday, November 20
- Final - Tuesday, 12/16, 3:00-5:00 PM, Tsai Center
Observing Alien Worlds:

No astronomy class would be complete without the opportunity to view the night sky, look through telescopes, and apply some of what you have learned in this course to direct observations. Boston University has a small observatory on the roof of CAS that we will be using as part of this course.

Observing will be held using telescopes on the roof of CAS. You can access the roof via stairs on the fifth floor (door next to room CAS 522). Take the stairs to the sixth floor, then just keep climbing until you get to the roof.

Observing sessions will be during the week from 8:30-9:30 PM on Mondays, Tuesdays, and Thursdays when it is clear - make sure you arrive promptly at 8:30 (or the doors will lock and you won't be able to complete the observations). To check if it is clear, you can look in the sky and/or call 617-353-2630 (after 6:30), and select option 1 for the Astro 100-level “night lab” message. TFs will lead the observing sessions and I will come to some of them as well (and will let you know when I am going). The nights will not happen when it is cloudy so make sure you do this early! Make sure you go to the observing nights early in the semester (just thought I would say it again). As part of your grade (and enjoyment), you will need to attend 1 clear night and fill in the worksheet that I will provide via Blackboard. However, you are welcome to go as many times as you like.

Other Important Dates

- Museum of Science Planetarium — Thursday, 9/25 at 6:30 PM or Monday, 9/29 at 6:30 PM at the Boston Museum of Science
- Monday Schedule — Tuesday, October 14 — No class
- Parents to class — Thursday, October 16
- Final Exam — Tuesday, 12/16, 3:00-5:00 PM, Tsai Center

Grading:

Participation/Minute Papers: 5%
Night Observing: 5%
Planetarium: 5%
Homework and Class Assignments 30%
Quizzes 30% (10% each)
Final 25%

**Homework and Late Policy:** All homework assignments will be due before 5PM on Wednesdays (specific dates are in syllabus and on the individual assignments). Homework should be placed in the “homework box” labeled “AS105” in room CAS 514 (unless otherwise noted). *No late homework will be accepted.* However, since we realize that unforeseen circumstances occur, each student will get one, penalty-free, late homework assignment during the semester (but it must be turned in within one week of the original due date). If you choose to use your free late homework, please write “late” on the top of your homework assignment. No work can be turned in after the last day of classes (12/10).

No exams can be made up without prior-to-class arrangement. I realize that sometimes life is out of our control so if a problem occurs, come and talk to me (earlier rather than later).
**Laptop Policy:** My personal feeling is that laptops, tablets and/or other electronic devices are distracting and likely result in more time on email, Facebook, etc. than paying attention in class. However, as college students you are all adults and can make that decision for yourself. Therefore, my policy is that electronic note taking is acceptable *except* for the 3rd week of class (9/16 and 9/18), when I would like our class to conduct an “electronic-free” experiment and then let you (electronic note takers) decide which format you like better. Remember to bring paper on which to take notes during that week.

**Cell Phone Policy:** Cell phones MUST be turned off at all times. In the event of a cell phone interruption, I reserve the right to answer your phone and thoroughly embarrass you in front of the entire class.

**Collaboration:** Science often requires us to work together. In doing homework and writing up assignments it is okay and even encouraged that you work together. It is very important that each person turns in his or her own work. Copying will not be awarded any credit. BU has a zero-tolerance policy when it comes to cheating. If you have any questions about the fine line between collaborating and cheating, please come and see me or your TF.

**Flipping the Classroom:** A few times during the semester, we will do something called “flipping the classroom”, where you will prep for class beforehand by watching a short video or doing a quick worksheet and then we will use class time to discuss the material in more detail and give you plenty of opportunities to ask questions. This format has been shown to increase student learning but will only work if you prepare for class – I’m excited to give it a try! Some of the videos and segments will come from the Massive Open Online Classroom (MOOC) that I am putting together for BU on the EdX platform. The MOOC is also called “Alien Worlds.” While no one in AS105 is required to register for the MOOC, I highly encourage you to do so. It may serve as a nice supplement to the class and it’s free!

**Attendance:** CAS policy states,“Students are expected to attend each class session unless they have a valid reason for being absent. Students may be required at any time to account for undue irregularity in attendance, either by personal explanation to their faculty adviser or dean or by written statement from a parent or another authority. Any student who has been excessively absent from a course may be required to withdraw from that course without credit. Students who expect to be absent from class for more than five days should notify their dean promptly.”

**Academic Conduct:** It is your responsibility to know and understand the provisions of the University Academic Conduct Code, which is available online (http://www.bu.edu/academics/).
## Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday</th>
<th>Thursday</th>
<th>Homework</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (9/2-9/4)</td>
<td>Introduction: Alien Worlds</td>
<td>Vocabulary; size, time and other scales</td>
<td>HW 1 (Due 9/17)</td>
</tr>
<tr>
<td>2 (9/9-9/11)</td>
<td>Tools for determining planet properties</td>
<td>Laws of motion, orbits and gravity</td>
<td>HW 2 (Due 9/24)</td>
</tr>
<tr>
<td>3 (9/16-9/18)</td>
<td>States of matter, light</td>
<td>Transiting planets</td>
<td>No new homework</td>
</tr>
<tr>
<td>4 (9/23-9/25)</td>
<td>Solar System Formation</td>
<td>Terrestrial Atmospheres</td>
<td>HW 3 (Due 10/8)</td>
</tr>
<tr>
<td>5 (9/30-10/2)</td>
<td>Quiz 1 (Online/In class)</td>
<td>Guest Lecture (TBD)</td>
<td>No new homework</td>
</tr>
<tr>
<td>6 (10/7-10/9)</td>
<td>Exoplanets: RV Method</td>
<td>Exoplanets: atmospheres/imaging</td>
<td>HW 4 (Due 10/15)</td>
</tr>
<tr>
<td>7 (10/14-10/16)</td>
<td>Monday Schedule</td>
<td>What is a planet?, Pluto?</td>
<td>No new homework</td>
</tr>
<tr>
<td>8 (10/21-10/23)</td>
<td>Sun and Stars</td>
<td>Quiz 2</td>
<td>HW 5 (Due 10/29)</td>
</tr>
<tr>
<td>9 (10/28-10/30)</td>
<td>Stellar evolution</td>
<td>A. West Research</td>
<td>No New Homework</td>
</tr>
<tr>
<td>10 (11/4-11/6)</td>
<td>Flipped Week 1/MOOC</td>
<td>Flipped Week 2/MOOC</td>
<td>HW 6 (Due 11/12)</td>
</tr>
<tr>
<td>11 (11/11-11/13)</td>
<td>Drake Equation and Life</td>
<td>Rare Earth Factors</td>
<td>No new homework</td>
</tr>
<tr>
<td>12 (11/18-11/20)</td>
<td>Guest Lecture (TBD)</td>
<td>Quiz 3</td>
<td>No Homework</td>
</tr>
<tr>
<td>13 (11/25-11/27)</td>
<td>Astronomy in Film</td>
<td>Thanksgiving</td>
<td>HW 7 (Due 12/10)</td>
</tr>
<tr>
<td>14 (12/2-12/4)</td>
<td>Putting it all together</td>
<td>Students Choose</td>
<td>No Homework</td>
</tr>
<tr>
<td>15 (12/9-12/11)</td>
<td>Wrap-up, evaluations</td>
<td>Study Period</td>
<td>No Homework</td>
</tr>
</tbody>
</table>
I have read this syllabus and understand the requirements and policies for Astronomy 105.

Printed Name:

Signed Name:

Date:

Section:

T.F.: 