



# Explaining the Universe

WRPS194

## Instructor Info —



Prof. Karen Masters



Student Hrs: Zoom drop-in time TBD, or book at: <https://calendly.com/karenlmasters>



Observatory A



[www.haverford.edu/users/klmasters](http://www.haverford.edu/users/klmasters)



[klmasters@haverford.edu](mailto:klmasters@haverford.edu)

## Course Info —



Prereq: None



Tue/Thur



1-2.30pm



Observatory

## Overview

In this seminar we will explore the biggest questions in the Universe, along with other recent developments in astrophysics via a series of writing assignments. Topics are likely to include black holes, dark matter, dark energy, the Big Bang, exoplanets and life in the Universe.

As with all First Year Writing Seminars, you will have opportunity to develop the reading, research and writing skills necessary for success writing about any topic with clarity and appropriate conciseness. Our practice texts will relate to questions in astrophysics - as explained to a variety of audiences, and in a variety of writing styles.

You cannot write about a topic without understanding it first. Class-time will be a mixture of discussion of the astrophysical content that you will need to understand in order to be able to articulate the questions, and a set of topics aimed at covering different aspects of the writing process. We will also cover some of the estimation techniques of scientists, which are so useful for gaining a basic physical understanding of objects in space.

## Assignments and Tutorial Sessions

All written assignments should be handed in via Moodle submission. In almost all cases there will be an opportunity for revision. Each of the first drafts will be worth just 5% of your final grade, while the revisions will be counted more. The deadline will always be Monday (11.59pm).

After each draft submission all students will be required to attend a tutorial session in a group which I will assign. Students will read the drafts of the other students in their group. In this session we will discuss each draft, before resubmission.

You will not be able to participate fully in class if you do not keep up with the writing assignment schedule. In particular extensions are not possible for first drafts (due to the tutorial schedule). Always just hand in your best draft at the time of the deadline. However, if requested in advance, a 48 hour extension will be granted no questions asked for any final (revised) submission. If you do not ask in advance, or go beyond 48 hours, 10% credit will be lost each day that any assignment is late, up to 50% off. Any assignment can be handed in late for 50% marks.

## Grading Scheme

The expectation is that you will attend every class (please email about classes you miss due to illness - preferably in advance). Please do not come to class with Covid symptoms. Participation will be graded; this is evaluated via your success handing in material (including drafts) on time, your engagement in reviewing work by your peers, and your engagement in class discussions (I value all types of contributions - from those who find it easy to speak up in class, and those who don't).

5%	Participation
5%	First Assignment
10%	Second Assignment (5% draft; 5% resubmission)
15%	Third Assignment (5% draft; 10% resubmission)
5%	Presentation
20%	Fourth Assignment (5% draft; 15% resubmission)
40%	Final Project (10% on presentation - 5% each on two drafts and 20% on final submission)

# FAQs

? Will I learn how to use a telescope in this class?

! No. But you are encouraged to join the Public Observing Team if you wish to learn to use the telescopes.

? What is astrophysics?

! The use of physics to understand and learn about objects in the night sky. All areas of physics, as well as a lot of chemistry (and some biology) are important to the full understanding of astrophysical objects.

? What's the difference between astronomy and astrophysics?

! There really isn't a difference in the modern usage. An Astronomer is someone who observes objects in the night skies, while an Astrophysicist is someone who uses physics to interpret objects in the Universe. All professional astronomers these days are also astrophysicists. At Haverford the Astrophysics Major is basically the same as the Physics Major with an Astro emphasis, while the Astronomy Major has more astronomy and less core physics.

? What is your favorite astronomical object?

! Galaxies. These are giant collections of stars, gas, dust and dark matter, which contain most of the material in the Universe.

## Reading Material

Students will be asked to read selected sections from a variety of sources which are attempting to explain or describe the Universe we live in (provided on reserve, or electronically). This variety will allow us to bring in diverse voices on the topics covered. Readings will include sections from the following books:

*The Edge of the Sky*, by Roberto Trotta

*How Do you Find an Exoplanet*, by John Asher Johnson

*A Grand and Bold Thing*, by Ann Finkbeiner

*The Glass Universe*, by Dava Sobel

There is no need to buy these. E-copies of all should be available through the library, and I will make copies of pages set as required reading.

## Diversity and Inclusivity Statement

Our classroom should be a place where all members will be treated with respect. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Science is done by people, and is historically built on a small subset of privileged voices. In this class, we will make an effort to read work from a diverse group of scientists, but limits still exist on this diversity. I believe that integrating a diverse set of experiences is important for a more comprehensive understanding of science. We may discuss issues of diversity in astrophysics as part of the course from time to time. Please contact me (in person or electronically) or submit anonymous feedback if you have any suggestions to improve the quality of the course materials.

## Honor Code and Academic Integrity

The Honor Code is one of the things I value most about Haverford, and I will trust students in my class to abide by its principles. Collaboration is an important part of science, and is encouraged, however please give credit to those whose contributions or feedback aided your work.

Plagiarism is the practice of taking someone else's work or ideas and passing them off as your own. In my experience in science writing it can be a tricky concept to learn to recognise the crucial differences between quoting, paraphrasing and plagiarism, and when and how to cite other work. We will discuss these issues, along with what is and what isn't plagiarism in class, and if you are ever unsure please discuss with me.

## Accommodation Statement

Haverford College is committed to providing equal access to students with a disability. If you have (or think you have) a learning difference or disability - including mental health, medical, or physical impairment, please contact the Office of Access and Disability Services (ADS) at [hc-ads@haverford.edu](mailto:hc-ads@haverford.edu). The Coordinator will confidentially discuss the process to establish reasonable accommodations.

Students who have already been approved to receive academic accommodations and want to use their accommodations in this course should share their verification letter with me and also make arrangements to meet with me as soon as possible to discuss their the specific accommodations. Please note that accommodations are not retroactive and require advance notice to implement.

It is a state law in Pennsylvania that individuals must be given advance notice if they are to be recorded. Therefore, any student who has a disability-related need to audio record this class must first be approved for this accommodation from the Coordinator of Access and Disability Services and then must speak with me. Other class members will need to be aware that this class may be recorded.

## Draft Class Schedule

### Fundamentals

Date	Topic	Assignment/Reading
Week 1: Jan 18th	Introductory Material (order of magnitude skills)	-
Week 1: Jan 20th	<i>Citation and avoiding Plagiarism in Astro/physics</i>	Read materials on Moodle on Plagiarism, including the writing centre statement

### Black Holes

Week 2: Jan 25th	How to Build a Star (workshop on "back of the envelope" physics skills)	Assignment 1 (A1): "Letter"
Week 2: Jan 27th	The Deaths of Stars – <i>Techniques for brainstorming and planning</i>	Reading: Ch12 of <i>The Glass Universe</i>
Week 3: Feb 1st	How to Make a Black Hole	A: Find an example of a black hole in popular culture
Week 3: Feb 3rd	<i>Visit from Science Librarian</i> – Weird Science of Black Holes	Reading: "It Starts with a Bang" (blog post)
Week 4: Feb 8th	<i>Visit from Writing Center Tutor</i> – Black Holes in Popular Culture – <i>Peer Feedback</i>	A2: Critique of a BH in Popular Culture (draft due)
Week 4: Feb 10th	More Black Holes – <i>The Superpower that is Close Reading</i> – <i>How to use Wikipedia appropriately</i>	Reading: TBC (close reading practice)
Week 5: Feb 15th	TUTORIALS on Assignment 2 Draft	A: Peer feedback
Week 5: Feb 17th	TUTORIALS on Assignment 2 Draft	

### The Universe

Week 6: Feb 22nd	How to Build the Universe? (The Big Bang) – <i>Public Speaking for Scientists</i>	A2: Critique of a BH in Popular Culture (second submission)
Week 6: Feb 24th	What is Dark Matter? – What is Dark Energy? – <i>Jargon Busting</i> – <i>Choosing the right language for your audience</i>	Selected reading from "The Edge of the Sky". Watch selected YouTube videos of scientists speaking.
Week 7: Mar 1st	TUTORIALS on Assignment 3 Draft	A3 - Jargon Busting (first draft)
Week 7: Mar 3rd	TUTORIALS on Assignment 3 Draft	Reading: Peer Feedback on Jargon Busting drafts

### Spring Break Mar 5-13th

Date	Topic	Assignment/Reading
<b>The Universe Cont.</b>		
Week 8: Mar 15th	Mapping the Universe – <i>Writing Formal emails</i>	A3 - Jargon Busting (second submission)
Week 8: Mar 17th	Special Collections Visit.	Selected readings from <i>A Grand and Bold Thing</i> .
<b>Life in The Universe</b>		
Week 9: Mar 22nd	How to Detect an Exoplanet – <i>The Lab Report – Formal Scientific Writing</i>	A: Research paper proposal “email”
Week 9: Mar 24th	What Would it be like to Visit an Exoplanet?	Selected reading from <i>How Do you Find an Exoplanet</i> , by John Asher Johnson. Close reading of a NASA “Exoplanet Travel Poster” caption.
Week 10: Mar 29th	TUTORIALS on Assignment 4 Draft	A4 - Exoplanet Travel Brochure
Week 10: Mar 31st	TUTORIALS on Assignment 4 Draft	Selected reading from <i>How Do you Find an Exoplanet</i> , by John Asher Johnson.
Week 11: Apr 5th	Is there Life in the Solar System (outside Earth)? – <i>Workshop on LaTeX - Typesetting yourself, and handing large reference lists</i>	A4 - Exoplanet travel (2nd draft)
Week 11: Apr 7th	The Drake Equation (estimation in practice) – <i>Including Equations and Mathematics in Writing</i>	Reading: TBA
<b>Other Big Questions</b>		
Week 12: Apr 12th	Class cancelled	
Week 12: Apr 14th	Pitches for “Big Question”	Presentation Practice assignment
Week 12:	TUTORIALS on Draft Introduction	
Week 13: Apr 19th	Topic on Astrophysics Selected by Class	A: Draft Introduction for Research Paper
Week 13: Apr 21st	<i>What have we learned? Discussion of writing in the sciences</i>	Reading: Something on science writing
Week 14: Apr 26th	Presentations on Research paper	Full Draft of Research Paper
Week 14: Apr 28th	Presentations on Research paper	
Week 14:	TUTORIALS on Final Research Paper Draft	
<b>Exam Period May 2-13th - Research paper deadline May 13th</b>		

## List of Assignments

### *Assignment 1 (5%): Letter Writing*

This assignment is a simple letter to a non-scientist friend/family member (real or imaginary) explaining your writing seminar assignment into "Explaining the Universe".

A good letter will

- reference one item on the syllabus you are particularly excited about, and one thing you find confusing/are worried about
- be formatted like a proper letter (i.e. include an Address, Date, Dear (Name), Opening, Body, Closing, Signature - see: <https://owlcation.com/academia/Examples-of-how-to-write-informal-letters-in-English-Personal>)
- include minimal spelling and grammatical errors
- be approximately a page long (~200-500 words)
- be submitted as a PDF

### *Assignment 2 (10%): Black Holes in Popular Culture*

This assignment (which you will hand in as a draft, and a resubmission) is a short description and critique of a representation of a Black Hole found somewhere in popular culture.

Both submissions are required. There will also be a peer feedback step. A good critique will

- be 1-3 pages long (~200-900 words).
- be neither too brief or unnecessarily wordy
- be submitted as a PDF
- be in informal language (e.g. imagine you are writing a blog post)
- describe in a couple of sentences how/where the Black Hole is described or visualised, this might also include an image/screengrab of the black hole which has a caption including credit line (not required if the black hole is only described in words)
- include a full reference for the reader to find the Black Hole (e.g. link to a Youtube video if possible)
- describe at least one aspect of an accurate Black Hole the representation got correct (if nothing is correct that should be stated instead)
- describe at least one aspect of an accurate Black Hole the representation got incorrect (if nothing is incorrect that should be stated instead)

### *Assignment 3 (15%): Jargon Busting*

The book *The Edge of the Sky*, by Roberto Trotta, attempts to explain concepts in cosmology using only the 1000 most common words in English. The "Simple Wikipedia" ([https://simple.wikipedia.org/wiki/Main\\_Page](https://simple.wikipedia.org/wiki/Main_Page)), similarly using only basic English vocabulary. For this assignment you will provide two versions of an explanation of "The Big Bang" model of the Universe. In the first you must use technical language, and explain the concept to other scientists. In the second version, you should constrain yourself to only the most common words in English (and/or the Wikipedia "Simple English") rules. If you wish you may use more than the 1000 words selected by Trotta, but every word you use must be in this list of the 3000 most common words: <https://www.ef.edu/english-resources/english-vocabulary/top-3000-words/>. Each explanation should be a page long in a legible font.

### *Presentation Practice (5%): Topic Pitch*

This will be a 90s (1.5 minute) persuasive talk, supported by 1 slide, in which you will present a question in astrophysics to the class that you would like to see as the final topic we cover. The class will reach the final decision by a discussion until consensus is reached.

### *Assignment 4 (20%): Exoplanet Travel Brochure*

In the style of a travel brochure, you will describe four exoplanets which are assigned to you. Each description should be no more than a page long, and include at least one estimate of a physical condition (e.g. temperature, surface gravity) done by you. You may use artists impressions found on the web (properly credited) to illustrate your guidebook. We will combine all entires into a travel brochure to be shared with the whole class.

### *Final Assignment (10% on presentation; 30% on report): Research Paper*

In this final assignment, you will pick a topic of particular interest to you in astrophysics. The final paper is expected to be 10-15 pages long. The assignment will comprise multiple parts:

1. A proposal. This should be in the format of an email to an imaginary Professor who is an expert on the topic, laying out the reasons for your choice and asking for their advice on your selection.
2. A draft of the introduction (1-2 pages of text, plus figures as needed) (5%)
3. A full draft of the paper (aiming for 10 pages) (5%)
4. A class presentation (5-7 minutes each; in the last week of class; 10%)
5. Submission of the final paper (during finals week; 20%)