
Astronomy 102: Black Holes & Time Warps

Prof. Kelly Douglass

Spring 2020

In Astronomy 102, we present a physical and astronomical (but mostly non-mathematical) picture of the workings of Einstein's theory of relativity and its application to black holes and the Big Bang. Black holes turn out to be quite real, and the origin and expansion of the Universe has a lot in common with black holes. All of this is connected with relativity in a manner that is a lot less mysterious than one might think. As we explore the connections, we will find many good examples of the processes by which scientific theories are conceived and advanced.

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Website

The course website can be found at <http://www.pas.rochester.edu/~kdouglass/Classes/Ast102/>; this is the main reference for the course. Here, one can find complete lecture presentations, the electronic homework and exams, as well as other helpful resources.

Blackboard

Various class resources can also be found on the class Blackboard page, including links to the AST 102 lecture, etc. Zoom meeting, and the AST 102 recitation Zoom meeting.

Textbooks

Required: *Black Holes and Time Warps: Einstein's Outrageous Legacy* by Kip Thorne.

Here is a list of supplemental recommended texts for your reference. They will sometimes be referenced during the lecture. You should not feel compelled to buy any of these.

Michael A. Seeds	<i>Foundations of Astronomy</i>
Stephen Hawking	<i>A Brief History of Time</i>
Joseph Silk	<i>The Big Bang</i>

Lectures

Tuesdays and Thursdays from 3:25–4:40PM ~~in Meliora 221~~ on Zoom, conducted by Prof. Douglass. All the material for each lecture will be available to you on the website. It is strongly encouraged that you take notes on the slides during lecture, so either print these out and bring them with you or have them downloaded on your laptop/tablet with note-taking capabilities.

Recitations

Recitations will begin the second week of classes. Joshua and Liam will conduct the recitation sections. You may attend any or all of the sections, but you must register for one. See the Recitations page on the course website for a schedule of events.

Day	Time	Location	TI
Wednesday	2–3:15PM	LeChase 103 Zoom	Joshua
Wednesday	4:50–6:05PM	B&L 203H Zoom	Liam
Thursday	2–3:15PM	B&L 203H Zoom	Joshua
Thursday	4:50–6:05PM	B&L 480 Zoom	Liam

Attendance & class participation

All members of the class are expected to attend all lectures and one recitation each week. This is, of course, for your own benefit. To emphasize the importance of coming to and being an active member of class, class participation will comprise 5% of your final grade for the course. Your class participation score will be based upon the submission of your answers to in-class questions and upon your attendance in recitation.

Films and clips

A few short movies elaborating on or illuminating crucial aspects of the material introduced in lectures or textbooks, as well as some TV clips will be shown during recitations as exhibits of Bad Astrophysics in the Mass Media. These will help you learn to detect the frequent, unintentionally humorous, mistakes made by filmmakers when they refer to astronomy or other sciences. Each film or clip will be followed by a thorough discussion led by the teaching assistants. The films and clips will be shown throughout the semester; screenings will be listed on the Recitations page of the AST 102 web site. You should see each film and clip at least once: the Bad Astrophysics material will appear on each of the exams.

The AST 102 Film Festival

We will also watch two feature-length Hollywood movies, *Star Trek* (2009) and *Interstellar* (2014). They are both good movies, rich in references to and discussions of black holes and related objects, but one of them is scientifically correct *much* more frequently than the other. They will be shown on two different evenings during the semester starting at 6pm both nights. The first movie on the first night will be the second on the second night, and vice versa. Abundant refreshments will be served. You should see each of them at least once, as the material introduced will appear on Exam #3.

Homework assignments

Problem sets will be due roughly every other week at ~~7PM~~ 11:59PM EDT on either Monday or Wednesday (see schedule). Each problem set will involve use of the WeBWorK system, a program that enables students to answer questions interactively with immediate feedback and immediate, automatic grading. In general, your problem sets will be different than your classmates'. Once assigned, your personalized problem sets will be accessible online. Each problem set will be 2.5% of your final grade; with eight total throughout the semester, this means that your homework assignments count for 20% of your final grade for the course.

We strongly encourage you to work together with your fellow classmates on the problem sets. The solutions you submit, however, must be your own thought and expressed in your own words, in accordance with the University's academic honesty policies.

Exams

There will be three exams given either in class or on WeBWorK on Tuesday, February 18, ~~March 31~~ Thursday, April 2, and Tuesday, April 28. Each exam is cumulative, although they will concentrate on any material that was not yet covered on another exam. Therefore, there is no final exam for this class. You must take all three exams in order to pass the course. Each exam is worth 25% of your final grade for this course.

If you miss an exam due to illness or emergency, a make-up exam can be scheduled. All make-up exams will be oral examinations of one hour and fifteen minutes in length. Prof. Douglass will determine if a situation is an emergency or not; her decision is final, whether or not it aligns with your opinion. Suddenly finding yourself with airline tickets for an exam date, for example, does not count as an emergency. Oral exams will be administered and graded by Prof. Douglass.

The best way to study for an exam is by doing the homework and working through the sample exams on the class website (made available a few days before each exam). The TIs will host review sessions the night before each exam.

Academic honesty

According to the UR Academic Honesty Policy, cheating consists of submission of homework or exam solutions that are not your own work, or submissions of solutions under someone else's name. By University rules, any detected act of cheating that is not the result of a simple misunderstanding will be handed over to the Board on Academic Honesty for investigation.

Grading

As outlined above, your grade for this course will be calculated as follows:

Homework	20%
Exam 1	25%
Exam 2	25%
Exam 3	25%
Class participation	5%

No extra credit assignments will be assigned that are not available to the entire class. Final letter grades will be assigned based on an absolute scale (not "by a curve"). The grading scale will be as follows:

Percentage score	≥ 85	≥ 80	≥ 75	≥ 70	≥ 65	≥ 60	≥ 55	≥ 50	≥ 40	< 40
Final grade	A	A-	B+	B	B-	C+	C	C-	D	F
	Satisfactory									Fail

Extra help

Office hours are listed on the course website; if you cannot make the hours, appointments are available. Please ~~come in and see us~~ log into the AST 102 Zoom meeting used for lectures and talk to us. We will also answer questions via email and will often be electronically accessible late into the night when problem set due dates and exams approach. We are happy to answer any questions you have concerning the course by either means. Questions from those who find the material confusing enough that they do not know what to ask are most welcome.

Credit hour policy

This course follows the College credit hour policy for four-credit courses. This course meets two times weekly for three academic hours per week. The course also includes recitations that meet for 1.5 academic hours per week.