

ASTRONOMY 353, Astrophysics: From Black Holes to
the First Stars

Unique No. 48005, Spring 2013

CLASS MEETS: TTh 12:30-2pm in RLM 15.216B

INSTRUCTOR: Prof. Volker Bromm

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Office Hours: W 4-5pm, or by appointment

COURSE WEBSITE:

<http://www.as.utexas.edu/astronomy/education/spring13/bromm/353.html>

TEACHING ASSISTANT: Aaron Smith

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Office Hours: TBA

Recitation Sections: TBA

COURSE OBJECTIVES: We will cover the exciting phenomena happening at the end of a star's life: supernova explosions and gamma-ray bursts, and the formation and properties of compact remnants (white dwarfs, neutron stars, and black holes). This will lead us to topics at the current frontier of astrophysics. You will learn to look at the physics behind these cutting-edge phenomena, and make things as simple as possible, but still capture the important effects.

TEXTS:

There is no required text that you have to buy. But there are some optional books that you may find useful. Those will be placed on reserve in the PMA (RLM 4th floor) library. To cover the course material, we will provide you with detailed lecture notes, available to you for downloading from the course website.

The optional texts are:

- A.C. Phillips: "The Physics of Stars" (2nd edition), Wiley
- Dan Maoz: "Astrophysics in a Nutshell", Princeton University Press
- Oyvind Gron/Arne Naess: "Einstein's Theory" (Springer)

GRADING: Your final grade will be based on a point system:

In-class Quizzes	10
2 In-class Exams	2x15
Homework	40
2 Group Projects	20

We won't have a Final Exam.

The following grading scheme will be used:

A = 89 - 100

A- = 85 - 88

B+ = 82 - 84

B = 72 - 81

B- = 70 - 71

C+ = 68 - 69

C = 62 - 67

C- = 60 - 61

D = 50 - 59

Any score below 50 is failing (F).

HOMEWORK AND GROUP PROJECTS:

The smaller problem sets and the two more extended group projects will contain analytical and numerical parts. I assume that you know one high-level language (C, Fortran, IDL, Mathematica, ...), enabling you to solve problems numerically. Please ask if you feel you need to catch up on your computer literacy. We will be glad to suggest ways to quickly get up to speed if necessary.

QUIZZES: We will have frequent in-class, unannounced quizzes, where you will work with 1 or 2 of your colleagues to solve small problems (with a duration of about 10 mins each). The quizzes will not test your memory by asking you to remember some fact or another. Instead, the quizzes will often ask you to devise an "order-of-magnitude" (back-of-the-envelope) solution to a problem based on the material that we have introduced in class.

Quantitative Reasoning (QR) FLAG:

This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade

to come from your use of quantitative skills to analyze real-world problems.

COURSE AND UNIVERSITY POLICIES:

- CLASS ATTENDANCE:

It is important that you come to class. You will not be successful otherwise in following the course material. In addition, we will have unannounced quizzes. If you miss one, there will be no make-up quiz. But you are allowed to miss up to 2 quizzes without penalty; make sure to talk to me if you have to be absent from class more than 2 times, so that we can discuss your situation.

- EXAMS: There will be no final exam. Instead, we will have two in-class exams, covering 1/2 of the course material each.

There will be make-up exams ONLY for students with valid excuses.

- PLAGIARISM: Scholastic dishonesty, in particular any plagiarism, will be prosecuted in accordance with the university guidelines. In simplest terms, plagiarism occurs if you represent as your own work any material that was obtained from another source, regardless how or where you acquired it.

Please have a look at:

http://deanofstudents.utexas.edu/sjs/scholdis_plagiarism.php

There, you find a more detailed description of what constitutes plagiarism in its various forms. In particular, have a careful look at "paraphrasing".

- RELIGIOUS HOLIDAYS: University policy is to respect religious holidays. If you have to miss a lecture or exam because of a religious holiday, you will not be penalized. But you need to tell me ahead of time.

- NOTICE: Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.

COURSE CONTENT:

- Introduction

- Basic Physics of Compact Objects

- Stellar Evolution: Brief Overview

- White Dwarfs
- General Relativity I: Spacetime and Geodesics
- General Relativity II: Field Equation
- Neutron Stars
- Black Holes
- Hawking Radiation
- Supernova Explosions
- The First Stars in the Universe
- Epilogue: The Cosmic Frontier