Spring 2-1-2017

ASTR 353.01: Galactic Astrophysics and Cosmology

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Astronomy 353: Galactic Astrophysics and Cosmology Spring 2017

Overview:

Instructor:	Daniel Reisenfeld
Office:	CH Clapp Bldg. CHCB 121
Phone:	243-6423
Text:	*An Introduction to Modern Astrophysics (Second Edition)* by Bradley Carroll & Dale Ostlie (Pearson/Addison Wesley, 2007)
Lectures:	MWF, 10:00 – 10:50. CHCB Room 231, and occasionally in the PFNAC Planetarium
Office Hours:	M: 11 – 12; Tu: 2 – 3; W: 3 – 4; Th: 12 – 12:45, 2 – 3, and other times when you can catch me.
Course web site:	Moodle. `https://moodle.umt.edu` The course Moodle site contains course information, selected lecture presentations, syllabus, assignments, and solutions.

Description:
This course is intended to provide a fairly rigorous introduction to the field of galactic and extragalactic astronomy and cosmology, at roughly the same level as the stellar astrophysics course (ASTR 363-364). We will study the properties of the Milky Way and other galaxies, galactic evolution, the large scale structure of the universe, active galaxies and quasars, and cosmology, including the early universe. We will cover chapters 24 through 30 in the text.

Prerequisites:
I will assume that you are familiar with all areas of physics at the level of PHSX 215/217, and it will be helpful to have taken modern physics (Physics 341), but not required. Calculus through the level of M 273 (Multivariable Calculus) (or equivalent) is required.

Grading:

First exam:	20%
Second exam:	20%
Final exam:	30%
Homework:	25%
Class participation	5% (see below)

Class Meetings:
I will spend most of each class period lecturing, but class participation will also be an important part of the course. We will sometimes go over homework problems during class. I will frequently ask you questions, and I expect you to ask me questions too. **Note:** each student will be required to give a very brief presentation reviewing a current research topic pertaining to the course. Details will be given in the first class meeting.

Homework:
Homework will be assigned weekly. The assigned problems will be collected, graded, and returned. Homework will be due by **5:00 PM** on the due date, typically Wednesdays. There will be a late penalty of 10% off per day late (weekends and holidays excluded). If you have a conflict with the due date, it is recommended that you turn in the assignment early or talk to me ahead of time to see if other arrangements can be made. **I am much more agreeable if you talk to me ahead of time rather than after the fact.** You are encouraged to work together on the homework problems and to see me if you need hints; however, the work you turn in must be your own.

Exams:
There will be two mid-term exams and a final exam. The final, which will be on **Monday, May 8th** from 10:10-12:10, will be comprehensive, but it will slightly emphasize the material in the last part of the course. Exams will be closed book except for a calculator and one sheet (8½" x 11") of paper with anything written on *one* side that you want. Exams will be self-scheduled (any two hour block on the specified days). Make-up exams may be given in exceptional circumstances, but only if arranged in advance.

Travel:
As an active researcher in Space Science, it is a requirement that I travel for part of the semester. Because of the small class size, I will try to reschedule classes to make up any days that have a travel conflict. If this is not possible, I will arrange for a substitute instructor to cover the class. Thanks in advance for your understanding and patience with whatever confusion my travel may cause.

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Targeted Course Syllabus

Week	Week of	Topics	Chapter
1	1/23	Course Introduction, structure of the Milky Way	24.1, 24.2
2	1/30	Kinematics of the Milky Way	24.3
3	2/06	The galactic center; the Hubble sequence	24.4, 25.1
4	2/13	Spiral, irregular and elliptical galaxies (Monday holiday)	25.2, 25.4
5	2/21	Details of spiral structure; spiral density wave theory	25.3
6	2/27	**Exam 1 (3/01)** Galaxy interactions; Galaxy formation	26.1, 26.2
7	3/06	The distance scale; the Hubble law	27.1-27.2
8	3/13	Galaxy clusters; intro to active galaxies	27.3, 28.1
9	3/20	*Spring Break*	
10	3/27	Radio galaxies; unified model for AGN	28.2, 28.3
11	4/03	Quasars; intro to cosmology	28.4, 29.1
12	4/10	**Exam 2 (4/10)** Classical cosmology; cosmic background radiation	29.1-29.2
13	4/17	Relativistic Cosmology	17.2, 29.3
14	4/24	Observational tests of cosmology	29.4
15	5/01	The early universe and inflation	30.1, 30.2
16		**Final Exam:** Monday, 5/8 , 10:10 am – 12:10 pm	

Drop/Add/Auditing:
Course **Add/Drop** can be performed online until **February 10rd**. **Add/Drop** can be performed with the instructor's and advisor's signatures until **April 3rd**. Last day to drop with petition is **May 5th**. Students interested in **auditing** the course must choose so on or before **February 10th**.

Student Conduct Code:
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/vpsa/policies/student_conduct.php

Disability Modification:
Students with disabilities will receive reasonable modifications in this course. Your responsibilities are to request them from me with sufficient advance notice, and to be prepared to provide verification of disability and its impact from Disability Services for Students. Please speak with me after class or during my office hours to discuss the details. For more information, visit the Disability Services for Students website at http://www.umt.edu/disability

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LEARNING OUTCOMES:

By the end of this course, it is expected that the student will be able to:

- Quantitatively describe the scale, structure and kinematics of the Milky Way Galaxy, with special emphasis on the local solar neighborhood and the galactic center
- Develop a working knowledge of the classification of three main galaxy types (spiral, elliptical and irregular), and the physical parameters that describe their scale, structure and kinematics
- Understand the dynamics of galaxy interactions, collisions and mergers
- Quantitatively apply various techniques to determine distances to galactic and extra-galactic objects
- Develop a quantitative understanding of the Hubble Law
- Understand the nature of galaxy clusters
- Understand the role of dark matter on the kinematics of galactic and extra-galactic objects on all scales
- Quantitatively describe the emissions from active galaxies
- Employ the equations of General Relativity in one dimension to describe the structure and evolution of the Universe
- Understand how observational cosmology is used to determine the structure and evolution of the Universe
- Understand the role of dark energy in the evolution of the Universe in the past and future
- Develop a qualitative understanding of the early Universe (prior to galaxy formation).