

ASTR 540 STRUCTURE AND DYNAMICS OF GALAXIES

Fall 2016

Details

Lecture times/location:

Monday & Wednesday at 10:00-10:50am, SO 202.

Occasional make up lectures will be held on Friday at 10:00-10:50am.

Professor: Dan Stark

Office: 322

email: dpstark@email.arizona.edu

Office hours: by appointment

Textbooks:

Galactic Astronomy, (1998), by Binney & Merrifield.

Galactic Dynamics, Second Edition (2008), by Binney & Tremaine.

Galaxy Formation and Evolution (2010), by Mo, van den Bosch, & White.

Grading

30% homework

30% literature discussions

40% exams

Homework

There will be 4 assignments throughout the semester. Students should first attempt to solve problems on their own. Books and published papers may be consulted, but students should not look at old homework solutions. Discussion of the problems with other students is permitted after students have tried the problems on their own. The submitted homework should represent each student's individual work. Homework will be submitted in class on the due date. Anything turned in after the due date will be considered late. Work turned in before the next class period will receive 75% credit. Work turned in two class periods following the due date will receive 50% credit. Work turned in more than two class periods late will not receive credit. Exceptions can be made for some circumstances (e.g., observing runs, necessary travel, illness).

In-Class Literature Discussions

Each student will be responsible for leading one short discussion on a recent journal article that is related to one of the topics we are discussing. The reviews will be informal (no keynote/powerpoint presentation) and similar in style to the astro-ph coffee presentations. The paper review should last roughly 7 minutes and will be followed by a class discussion lasting another 7-9 mins. All students are expected to participate in the discussion over the course of the semester. Everyone will be responsible for reading the papers and handing in a short summary. While students are free to discuss the papers with their classmates, the summaries should be written

independently. The journal articles and dates of the literature reviews are listed below. More details will be provided about the expectations for the paper summaries at a later date.

Exams

There will be two exams. Both will be closed book. The first will take place in class on October 17, covering roughly the first half of the course. The second exam will be on Friday Dec 9 from 10:30 am to 12:30 pm in the normal lecture room and will mostly focus on the second half of the course material.

Lectures / Reading / Homework (subject to change)

BM=Binney & Merrifield

BT=Binney & Tremaine

MvW= Mo, van den Bosch, & White

8/22 Galaxies historical overview; BM 1

8/24 Distance determinations; BM 2.1 - 2.2, 7.2-7.4

8/29 Intro to Galactic archaeology, Stellar populations I; BM 3.3 - 3.6.2, 5.2, **HW 1 handed out**

8/31 Stellar LF, IMF; BM 3.6.3-3.7, BM 5.1.9

9/5 **No Class** (Labor Day)

9/7 Stellar populations II; BM 5.2, **Literature 1**

9/12 Galactic Disk - structure, kinematics, BM 10.4 **HW 1 due**

9/14 Galactic components: halo, bulge, bar, center - I, BM 10.2, 10.5 **Literature 2**

9/19 Galactic components: halo, bulge, bar, center - II

9/21 Local group, dwarf galaxies, **Literature 3**

9/26 Galactic Rotation Curve; BM 10.3, 9.1-9.2, BT **Literature 4**

9/28 Stellar Dynamics I; BT 2 **HW 2 handed out**

10/3 Stellar Dynamics II; BT 3

10/5 Stellar Dynamics III; BT 4 **HW 2 due**

10/10 Dynamics of star clusters, core collapse, BT 7 **Literature 5**

10/12 Intro to Galaxies, BM 4.1

10/17 **Exam 1**

10/19 **No Class**

10/24 Star Formation In Galaxies, MvW 9, **HW 3 handed out**

10/26 Stellar Population Synthesis, Chemical Evolution Basics, MvW 10.3-10.4, BM 5.2

10/28 Disk Galaxies I (make up class), MvW 11, BM 4.4 + 11.3 **Literature 6**

10/31 Disk Galaxies II, **HW 3 due**

11/2 Disk Galaxies III, BT 6.1 **Literature 7**

11/4 Galaxy Interactions, mergers, transformation I, MvW 12, BT 8 (make-up class)

11/7 Galaxy Interactions, mergers, transformation II, **Literature 8**

11/9 Elliptical Galaxies I, MvW 13

11/14 Elliptical Galaxies II

11/16 Elliptical Galaxies III, **Literature 9-10, HW 4 handed out**

11/18 Galaxy Clusters, Environment (makeup class), MvW 12.5 **Literature 11**

11/21 Active Galaxies, MvW 14

11/23 Galaxy Evolution and Cosmic Star Formation History, MvW 15

11/28 **Literature 12, 13, 14**

11/30 **No Class**

12/5 First Galaxies and Reionization, **Literature 15, HW 4 due.**

12/7 No Class

12/9 Exam 2 (10:30am-12:30pm)

Literature Assignments

1. **Dynamical Versus Stellar Masses in Compact Early-Type Galaxies: Further Evidence for Systematic Variation in the Stellar Initial Mass Function**, Conroy et al. 2013, ApJ, 776, 26.
2. **Light, Alpha, and Fe-peak Element Abundances in the Galactic Bulge**, Johnson et al. 2014, AJ, 148, 67.
3. **The progenitors of the Milky Way stellar halo: big bricks favoured over little bricks**, Deason et al. 2015, MNRAS, 448, 77.
4. **Beasts of the Southern Wild : Discovery of nine Ultra Faint satellites in the vicinity of the Magellanic Clouds**. Koposov et al. 2015, ApJ, 805, 130
5. **Magellan/M2FS Spectroscopy of the Reticulum 2 Dwarf Spheroidal Galaxy**, Walker et al. 2015, ApJ, 808, 108.
6. **KMOS^{3D}: Dynamical constraints on the mass budget in early star-forming disks**, Wuyts et al. 2016, accepted in ApJ, arxiv:1603.03432.
7. **The MOSDEF Survey: Dynamical and Baryonic Masses and Kinematic Structures of Star-forming Galaxies at $1.4 \leq z \leq 2.6$** , Kriek et al. 2016, ApJ, 819, 80.
8. **The Eating Habits of Milky Way Mass Halos: Destroyed Dwarf Satellites and the Metallicity Distribution of Accreted Stars**, Deason et al. 2016, ApJ, 821, 5.
9. **The MASSIVE Survey. II. Stellar Population Trends Out to Large Radius in Massive Early-type Galaxies**, Greene et al. 2015, ApJ, 807, 11
10. **MOSFIRE Spectroscopy of Quiescent Galaxies at $1.5 < z < 2.5$. I - Evolution of Structural and Dynamical Properties**, Belli et al. 2016, submitted to ApJ, arXiv:1608.00608
11. **Spectroscopic Confirmation of the Rich $z = 1.80$ Galaxy Cluster JKCS 041 using the WFC3 Grism: Environmental Trends in the Ages and Structure of Quiescent Galaxies**, Newman et al. 2014, ApJ, 788, 51.
12. **Massive molecular outflows and evidence for AGN feedback from CO observations**, Cicone et al. 2014, A&A, 562, 21.
13. **The dominance of quenching through cosmic times**, Renzini 2016, MNRAS, 460, 45
14. **A Simple Technique for Predicting High-redshift Galaxy Evolution**, Behroozi & Silk 2015, ApJ, 799, 32
15. **Detection of an oxygen emission line from a high-redshift galaxy in the reionization epoch**, Inoue et al. 2016, Science, 352, 1559.

