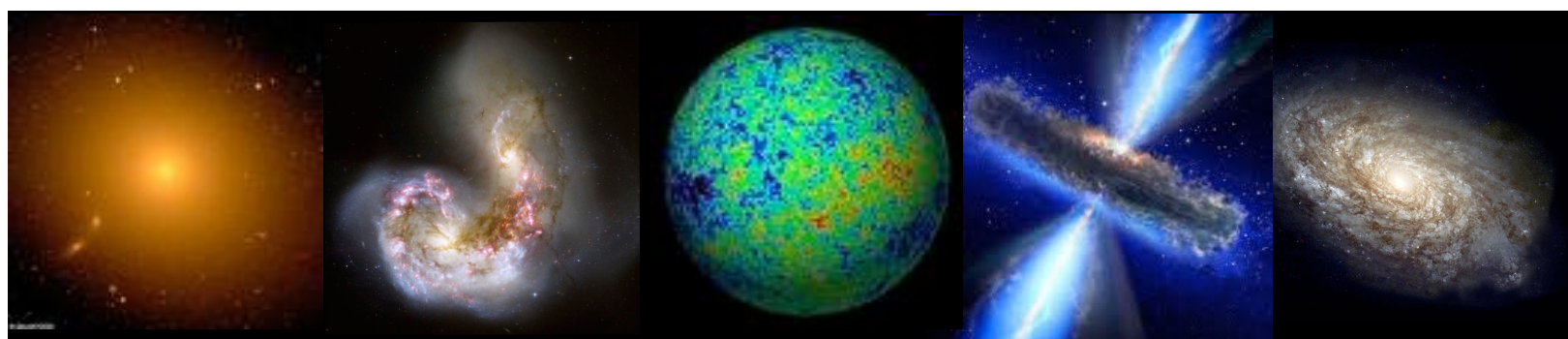


# ASTRO 610; Fall Semester 2018

## THEORY OF GALAXY FORMATION



### Course Description

This course prepares the student for state-of-the-art research in galaxy formation and evolution. The course focusses on the physical processes underlying the formation and evolution of galaxies in a LCDM cosmology. Topics include Newtonian perturbation theory, the spherical collapse model, formation and structure of dark matter haloes (including Press-Schechter theory), the virial theorem, dynamical friction, cooling processes, theory of star formation, feedback processes, elements of stellar population synthesis, chemical evolution modeling, AGN, and supermassive black holes. The course also includes a detailed treatment of statistical tools used to describe the large scale distribution of galaxies and introduces the student to the concepts of galaxy bias and halo occupation modeling. During the final lectures we will discuss a number of outstanding issues in galaxy formation, and the students will present and discuss their term paper on a current topic in the field of galaxy formation & evolution.

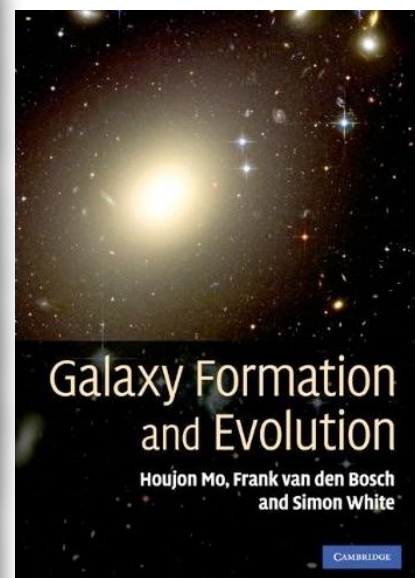
**Instructor:** Prof. Frank van den Bosch (Office: 52 HH # 320)  
[frank.vandenbosch@yale.edu](mailto:frank.vandenbosch@yale.edu)

**Course Website:** <http://campuspress.yale.edu/astro610/>

**Lecture Hours:** Monday & Wednesday 9.00 - 10.15am  
WTS B60

**Textbook:** Galaxy Formation & Evolution  
(Mo, van den Bosch & White)

**Grading:** 40% Final Exam  
30% Term Paper & Presentation (topic picked in class)  
30% Problem Sets



# Preliminary Schedule

week	Date	Topic	MBW
1	Wed 08/29	Introduction; A Broad Brush Overview of Galaxy Formation	chapter 1
1	Fri 08/31	Cosmology (Riemannian geometry, FRW metric, cosmological distances)	§3.1
2	Wed 09/05	Relativistic Cosmology (GR, Friedmann eqs)	§3.2
3	Mon 09/10	Newtonian Perturbation Theory: linearized fluid equations	§4.1
3	Wed 09/12	Newtonian Perturbation Theory: baryonic perturbations	§4.1
4	Mon 09/17	Newtonian Perturbation Theory: dark matter	§4.1
4	Wed 09/19	Transfer Function and the Cosmic Microwave Background	§4.3 - §6.7
5	Mon 09/24	Non-linear collapse and Relaxation	chapter 5
5	Wed 09/26	Press-Schechter Theory, Excursion Set Formalism and Halo Mass Function	§7.2
6	Mon 10/01	Press-Schechter Theory, Excursion Set Formalism and Halo Mass Function	§7.2
6	Wed 10/03	Merger Trees and Halo Bias	§7.3 - §7.4
7	Mon 10/08	Structure of Dark Matter Halos	§7.5
7	Wed 10/10	Large Scale Structure	§6.1 - §6.2 - §6.5
8	Mon 10/15	Halo Model and Halo Occupation Statistics	§7.6 - §15.6
8	Wed 10/17	NO CLASS: Fall Break	
9	Mon 10/22	Galaxy Interactions & Transformations	chapter 12
9	Wed 10/24	Cooling Processes & Photo-ionization Heating	§8.1 - §8.3 - §8.4
10	Mon 10/29	Star Formation	§9.1 - §9.3 - §9.5
10	Wed 10/31	NO CLASS	
11	Mon 11/05	Supernova Feedback	§8.6 - §10.5
11	Wed 11/07	Structure and Formation of Disk Galaxies	chapter 11
12	Mon 11/12	Structure and Formation of Elliptical Galaxies	chapter 13
12	Wed 11/14	Numerical Simulations	App C
13	Mon 11/19	NO CLASS: Thanksgiving Break	
13	Wed 11/21	NO CLASS: Thanksgiving Break	
14	Mon 11/26	Semi-Analytical Models of Galaxy Formation; putting it all together	
14	Wed 11/28	Student Presentations	
15	Mon 12/03	Student Presentations	
15	Wed 12/05	Student Presentations	