Physics 523: Galaxies

Spring 2011
Tuesday and Thursday 1:50-2:10 pm
Earth & Space Sciences Building (ESS) Room 450

Instructor:
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Office hours:
Official: Tuesday and Thursday, 2:10-3:30 PM
Unofficial: Stop by my office anytime.

Course Descriptions
This course introduces observational and theoretical studies of galaxies, and discusses the classification, property, structure, dynamics, stability, and evolution of galaxies. Details are in the course outline below.

Textbooks:
Primary:
"Galactic Astronomy", by Binney and Merrifield
"Galactic Dynamics", by Binney and Tremaine

Secondary:
"Galaxies in the Universe: An introduction", by Sparke and Gallagher
"Galaxy Formation and Evolution", by Mo, van den Bosch, and White

Course Grading:
Homework (30%), Midterm examination (30%), and oral presentations (40%). Students are encouraged to discuss homework problems and questions with other students, but everyone must work out his or her own solutions or answers, and turn in a personal write-up. Students' oral presentations in last 4-5 lectures.

Tentative Course Outline:

I. Introduction and Review
   a. History of galactic astronomy
   b. General outlook on galaxies
   c. Morphological classification
   d. Galaxy groups and clusters
   e. Review: astronomical measurements
   f. Review: stars and stellar evolution
II. Our Galaxy

a. Basic structures: bulge, disk, halo
b. Stars: counts, luminosity and density functions, stellar population, ELS model
c. ISM: phases, distribution
d. Star formation: star forming regions, initial mass function
e. Kinematics: Solar motion, LSR, Oort constants, rotation curve
f. Dynamics: potential theory, decomposition of Galactic components

III. Disk Galaxies
a. Observational summary
b. Stellar orbits in disk potentials
c. Stability of disks
d. Spiral structure & density wave theory
e. Weak and strong bars
f. Warps

IV. Elliptical Galaxies
a. Observational summary
b. Stellar relaxation
c. Stellar hydrodynamics: the collisionless Boltzmann equation
d. Velocity ellipsoids, triaxiality
e. Mass profiles

V. Galaxies in the Local Universe
a. Local group
b. Dwarf galaxies: LMC, SMC and others
c. Starburst galaxies & ULIRG
d. Statistical properties: TF, FP, morphology-density relation, CM relation

VI. Galactic Nuclei
a. Evidence of supermassive black holes in our Galaxy and galaxies
b. Active galactic nuclei (AGN)
c. Seyfert galaxies and the unified model
d. Starburst-AGN connection
e. Jets and outflows

VII. Dark Matter
a. Mass determinations and mass-to-light ratios on various scales
b. Composition of dark matter: MACHO, WIMPS

VIII. Cosmological Distance Scale

IX. Galaxy Evolution and Formation
a. Chemical and photometric evolution
b. Cooling diagram and morphology
c. Global & internal regularity
d. Dynamical friction, cannibalism, and ram pressure stripping
e. Tidal interaction and merger
f. Galaxy luminosity function and its dependence on the environment
g. Models of galaxy formation

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If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services (631) 632-6748 or http://studentaffairs.stonybrook.edu/dss. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

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Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students' ability to learn.