Course Overview

Official Course Catalog Description: Survey of basic observational data for determining structure of Milky Way Galaxy. Includes luminosity functions, stellar distributions, solar motion, stellar populations, kinematics and dynamics of general and peculiar stellar motions.

Purpose and Course Content: The general purpose of this course is to acquaint you with the observational methods, analytical and synthesis techniques, and astrophysical insight of an important subfield of stellar astrophysics, namely the study of stellar dynamics. Other purposes are to provide you with some research and computational experiences. We will discuss such topics as

- photometric and spectroscopic observations of stars;
- the distribution of stars in the color-magnitude and color-color diagrams and the effects of interstellar dust;
- the characteristics of open and globular clusters;
- the distributions of stars within our Galaxy, including the thin and thick disks, the bulge, and the halo;
- potential theory
- orbits of stars
- collisionless systems
- dark matter

Student Learning Outcomes: Upon the successful completion of this course, the student will

- have an understanding of stellar populations;
- understand the basics of gravitational potentials;
- know the historical development of the study of stellar kinematics;
- will be able to compute orbits in various potentials;
- will have an understanding of galactic structure.
**Relation to Other Courses:** This course will be a tremendous benefit to those students who carry out research on basic galactic dynamics, whether it be for a Senior Project, MS degree, or a future Ph.D. degree. There is some overlap in material between this course and ASTR 610 (Binary Stars), such as orbital dynamics.

**Enrollment Information**

**Prerequisites:** You should have a *thorough* understanding of the material covered in ASTRO 101. Astronomy 450 is required. Physics 350 and/or 608 are very helpful, as are course such as MATH 342A and 342B.

**Adding/Dropping Procedures:** Add codes are available upon request starting January 23, 2014. The last day to add or drop the class or change the grading basis is February 4, 2014.

**Course Materials**


**Recommended Materials:** Other recommended books are *Galactic Astronomy* by James Binney & Michael Merrifield and *The Physical Universe* by Frank Shu. Although this book is a bit old, it gives a very good introduction to basic physical concepts. Another good text is *An Introduction to Modern Stellar Astrophysics* by Ostlie & Carroll. As the course progresses, I may hand out additional reading material that covers the current topic in more depth.

**Options for Accessing Course Materials:** None.

**Course Structure and Conduct**

**Style of the Course:** This course will be a traditional lecture course. The subjects covered will include:

- Introduction to stellar populations, initial mass function (1 week);
- Discussion of basic kinematics, local standard of rest, Oort constants (2.5 weeks);
- Discussion of basic equations of dynamics, relaxation (1 week);
- Introduction to potentials measurement (1 week);
- Spherical systems, Poisson’s Equation, Lagrangian dynamics (2.5 weeks);
- Hamilton’s equations (1.5 weeks);
- Integration of orbits (1 week);
- Nearly circular orbits (1.5 weeks);
- Two dimensional potentials, bars, Collisionless Boltzmann Equation (2 weeks).

**Individual and Group Activities Required:** There will be six to eight homework assignments, due at roughly two week intervals. As scientists, you must be able to clearly and concisely communicate your results to the scientific community. Organization and presentation of results are skills required to be a publishing scientist. In essence, your homework problems are a small example of scientific publishing, which will be refereed by your instructor. The following are a few guidelines that you should follow in preparing your problem sets for submission.

- State clearly in *words* just what the problem is.
• Justify equations used. What do they have to do with the problem? Define symbols. Diagrams are often helpful. Plot the functional form of equations when requested (or required for your own understanding).

• Make each step of the solution clear. Show explicitly where numbers come from (especially unit conversions).

• Please work independently, except on those problem sets that are defined as group projects.

There will be some computer programming. The required languages are FORTRAN (exceedingly preferred) or C. All of you should have accounts on rohan.sdsu.edu. You will receive accounts on castor.sdsu.edu, which is a departmental Linux box with 8 CPUs, or another server. I will review basics such as editing a file, running the compiler, calling a subroutine, defining a function, etc.

There will also be a “Journal Club presentation near the end of the semester, which may also include a written report.

Technology Utilized in the Course: Class notes that are in electronic form will be made available via Blackboard.

**Course Assessment and Grading**

Exam Dates: There will be two 2-hour exams, each worth 250 points. The midterm exam will be held on Thursday, March 13, 2014 at 15:30 and the final exam will take place Thursday, May 15, 2014 at 13:00.

Scored Activities and Weighting by Percentage of Total Score: The homework assignments will be worth a total of 200 points. Finally, there will be a short term paper and a class presentation worth 50 points total. Points will be deducted for assignments that are turned in late.

Grading Scale: The nominal scale for the conversion of percentages to letter grades is as follows:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Letter</th>
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<tbody>
<tr>
<td>90%-100%</td>
<td>A</td>
</tr>
<tr>
<td>80%-89%</td>
<td>B</td>
</tr>
<tr>
<td>70%-79%</td>
<td>C</td>
</tr>
<tr>
<td>60%-79%</td>
<td>D</td>
</tr>
<tr>
<td>&lt; 59%</td>
<td>F</td>
</tr>
</tbody>
</table>

The thresholds for a particular letter grade may be lowered at the discretion of the instructor.

Graduate and undergraduate expectations and grading will be on the same scale. The stringent undergraduate prerequisites mean that only undergraduate students who are advanced enough to handle the graduate-level material can register for the course. Any skills that are beyond the standard undergraduate level will be taught in the course itself.

Excused Absence Make-up Policies: Make-up exams will be given for missed exams provided prior notice is given to the instructor. Late homework will penalized at the rate of 5% per day.

**Other Course Policies**

Attendance Policy: Class attendance is not mandatory, although you will find that it is much easier to do well in the course if you come to the lectures.

Classroom Etiquette: I expect that the students will maintain a professional atmosphere and show respect to their fellow students.

In particular, the following is prohibited in the classroom:
• Cell phones, laptop computers and similar devices (please turn them off!).
• The reading of newspapers, magazines, etc.
• Talking above a whisper.
• Eating or drinking anything noisy.

*Any form of behavior deemed to be inappropriate by the instructor will not be tolerated. A student will be advised once by the instructor that his/her behavior is inappropriate. The first time this inappropriate behavior is repeated, the matter will be turned over to the University’s Judicial Procedures Office for appropriate disciplinary action.*

**Statement of Plagiarism:**

*Cheat* in any form, which includes plagiarism (see page 483 of the University’s 2013-2014 General Catalog for a definition), is a grave offense. Cheating will not be tolerated, and evidence of cheating by a student will result in an automatic “F” as that student’s grade. Any evidence of cheating will be promptly reported to the Judicial Procedures Office.

**Safety Issues**

The CSU takes the issue of classroom and campus safety very seriously. The office of Business and Financial Affairs has set up a web site where SDSU staff, faculty, and students can find information about San Diego State University’s emergency preparedness plan and opportunities for training on many aspects of the classroom/workplace. See [http://bfa.sdsu.edu/emergency/](http://bfa.sdsu.edu/emergency/).

In particular, please note the following:

**Campus Safety:**

• Be aware of your surroundings.
• If you see something suspicious, report it!
• If you have an emergency, call 911 from any phone on campus.
• Other incidents, call Campus Dispatch at 4-1911.
• In the evening, call Campus Escort if you would like an escort to your vehicle or campus dorm.

**Classroom Safety**

• If there is an emergency, stay calm, and follow the procedure in the flip book.
• Follow the Evacuation Route if you need to evacuate. *We evacuate to the Mediterranean Garden,* and a roll call will occur there. Please show up at the evacuation area since your absence from roll call could cause resources to be used that could be used to help others who may actually be in trouble.
• “Shelter in place” is usually called when a person that is carrying a weapon on campus has become violent and has injured others, or is threatening to injure others. Lock the door from outsiders, only open to the Department Safety Officer, PDS, or other officials of the University.

Note that during any emergency, *students should not use their cell phones.* The lines of communication are critical to keep open for emergency information. Only Staff and Faculty should keep their cell phones on, and only receive calls if the situation calls for it.