ASTRONOMY I-2
Course Description and Syllabus

This course is a sequence of student directed projects utilizing research and observational resources including on line communication with a professional observatory and/or in person use of observational tools in which students 1)design a research program, 2) control or use a telescope, 3) operate a CCD camera, spectrograph, or other data recording device(s), 4) obtain, reduce, and analyze data, 5) explore the theoretical understanding of their results, and 6) report the results of their investigation in a formal format.

The sequence of projects include the following categories:

I. Solar System Studies (approximately 4 weeks)
Students will select a problem to study relating to a solar system component (e.g., planets, comets, asteroids, etc.). This project will introduce students to the caliber of work expected in this course while studying a topic for which their astronomical understanding is relatively high. Solar system topics will include application of Newtonian physics including Kepler's laws.

II. Stellar/Galactic Studies (approximately 4 weeks)
Students will select a problem to study relating to stars, binary stars, eclipsing binaries, evolved/compact objects, star clusters (open and globular), or stellar evolution. This project will allow students to engage in a comprehensive study of the nature of a particular object including the determination of its physical properties, its history, and its probable future. Application of Newtonian physics, electromagnetic principles, atomic physics, statistical processes, and interaction with professional astronomers are integral parts of this investigation.

III. Cosmological/Extra-galactic Studies (approximately 4 weeks)
Students will select a galaxy or other remote object(s) for study. This project will allow students to investigate the nature of objects at great distance in space and time. Of particular importance will be the determination and comparison of the object's distance based on different methods and how these results bear upon cosmological theory including the value of the Hubble parameter and the age of the universe.

IV. Mathematical Modeling (approximately 4 weeks)
Students will select a star whose properties are reasonably well established. Students will make measurements of the star's brightness and spectral characteristics. Using their understanding of stellar structure, students will derive the star's properties for use as boundary values in the construction of a mathematical model of the star. The model itself will be a computer program simultaneously solving the four differential equations for mass, temperature, luminosity, and pressure as a function of the star's radius. A key component of this investigation is the determination of a reasonable function for the star's density as a function of radius.

A final project, chosen from among the above categories, presented orally and as a written thesis constitutes the final examination for this course (approximately 2 weeks).

Curricular resources we will use:

Foundations of Astronomy by Michael Seeds, seventh edition, 2003 Brooks/Cole division of Thompson Learning, Publishers.

Internet resources including

Sky Online (http://skytonight.com) and related links.
SEDS (http://www.seds.org.html)
Space Telescope Science Institute (http://www.stsci.edu)

The Chaffey High School Library and Mr. James' library of astronomical books and periodicals.

Grading Criteria:

Four Research Topics = 80%
Final Research Topic and Presentation = 20%

Each topic will be evaluated on the basis of the quality of presentation of the statement of a problem to be investigated, proposal of observations and research to be undertaken, documentation of experimental results, mathematical and diagrammatic content, discussion of conclusions, error analysis and evaluation of results with respect to current theoretical understanding, and recommendations for further research.

Grading on a "points earned" basis:

90% - 100% = A
80% - 89% = B
70% - 79% = C
60% - 69% = D
less than 60% = F

You will maintain your notebook from Astronomy I as a factual and organizational resource.