

Office of Academic Affairs  
Tarleton State University  
June, 2005

Master Course Syllabus Outline

Department: Mathematics, Physics, and Engineering

Course Prefix: PHYS113

Official Course Title: Stellar Astronomy

Master Syllabus Approved by Department on: Sept/04/2003, Revised June/18/2005

- I. Catalog Description:  
A laboratory science course of study in the topics of astronomy and astrophysics, including the Sun and its source of energy, stellar formation and evolution, black holes, galaxies, cosmology, and the creation and evolution of the universe.
- II. Prerequisites:  
Two semesters of high school algebra or MATH 101
- III. Expanded Course Description:  
PHYS 113 is primarily designed to provide a laboratory based science class for non-science majors. This course is sufficiently in depth in science and science history to be appropriate for science majors interested in the field. The intent of the course is to provide an understanding of the Sun and its energy source and dynamics. Contrast and compare the Sun to the other stars. Provided an understanding of stellar formation and evolution through their final phase including relativistic ramifications of black hole. Explore the properties of galaxies and their evolution as indicated by active galaxies. The physics and instrumentation used to obtain data on the universe will be discussed. Show the multicultural development of astronomy. With this background and data, a survey of cosmology will be done including: dark matter, dark energy, big bang theory and the theories of the end of the universe. How mankind's activities and astronomical events effect our environment.
- IV. Intended Student Learning Outcome:
  - A. Knowledge:  
Knowledge will be assessed by written essays, multiple choice questions, and written reports.
    1. Be able to describe the historical views of the possible sources of energy for the Sun and their shortcomings and the current view of the energy source.

2. Be able to describe hydrostatic equilibrium, the proton-proton chain, and use Einstein's mass-energy equation to account for the measured energy flux.
3. Be able to describe the various region of the interior of the Sun in terms of pressure, temperature, composition and energy transport.
4. Be able to describe the Sun's size, mass, composition, surface temperature, photosphere surface features (limb darkening, granulation, sunspots, prominences and flares) and the chromosphere and corona.
5. Be able to describe the sunspot cycle and flare and their influence on the Earth's environment.
6. Be able to describe the various methods of stellar distance measurements used and their limitations, including: parallax, spectral parallax, Cepheid variables, super novae, Tully-Fisher relation and the Hubble constant.
7. Be able to define apparent and absolute magnitude and use them to determine distance.
8. Be able to interpret an H-R diagram for the temperature, luminosity, relative size, mass, spectral and luminosity class and the age state of stellar evolution.
9. Be able to identify the types of binary stars from observational data.
10. Be able to describe the birth and evolution of a star from the nebula's original environment to the final stage (white dwarf, neutron star, or black hole) including change of composition and mass-lifetime predictions.
11. Be able to describe the size, density, and other physical properties of white dwarfs, neutron stars and black holes and the various methods to detect them.
12. Be able to describe the singularity and event horizon of a black hole and the relativistic properties including the constant velocity of light, time dilation, length contraction and calculate the Schwarzschild radius.
13. Be able to describe the historical perspective of the assumed size of the universe.
14. Be able to describe the Milky Way galaxy in terms of size, number of stars, interstellar gas, dust and stellar population distribution.
15. Be able to describe the methods and instrumentation used to probe the center of our galaxy and determine its spiral nature.
16. Be able to show that Kepler's laws and the rotation speed of galaxies indicate the presence of dark matter and central black holes.
17. Be able to describe the general shapes, sizes and stellar population make up of the other galaxies

18. Be able to describe and apply Hubble's law to explain the expansion of the universe and determine the distance to galaxies, and the size and age of the universe.
19. In general terms, be able to describe the distribution of galaxies in the local cluster and on the larger scale of the universe
20. Be able to explain quasars and active galaxies in terms of their distance, electromagnetic spectrum, energy output power source and their importance in our understanding of the evolution of galaxies.
21. Be able to describe the aspects of cosmology that are associated with the beginning of the universe (big bang theory, the 3 degree K background radiation etc.) and the end of the universe (close, open and flat universes and the role of dark energy).

B. Skills Outcomes:

1. Be able to apply the learned data and problem solving skills to critically evaluate public policy and information from the media.
2. Be able to make simple physical observations and interpret them in order to build models and understanding.
3. Be able use computer-based simulations to analyze physical phenomenon.
4. Be able to plot and evaluate data for trends and relationships.
5. Be able to perform basic algebra and trigonometry calculations.
6. Be able to research and write reports on scientific topics.

C. Value Outcomes:

1. Gain an appreciation of the interdependence and relationship of mankind and the Earth to the Sun and the universe.
2. Gain an appreciation of the scientific inquiry, model building and data acquisition process.
3. Gain an appreciation of the interdependence between theory and experiment.
4. Develop the confidence needed in order not to be intimidated by science and math.
5. Gain an appreciation of the interplay of society, politics and science, and its past as well as future importance.
6. Gain and appreciation of the simplicity and enjoyment of backyard astronomy.
7. Be more aware of the issues concerning our environment and the purpose of the space program.

V. Academic Honesty: Cheating, plagiarism (submitting another person's materials or ideas as one's own), or doing work for another person who will receive academic credit are all-impermissible. This includes the use of unauthorized books, notebooks, or other sources in order to secure or give help during an examination, the unauthorized copying of examinations, assignments, reports, or term papers, or the presentation of unacknowledged material as if it were the student's own work. Disciplinary action may be taken beyond the academic

discipline administered by the faculty member who teaches the course in which the cheating took place.

- VI. **Students With Disabilities Policy:** It is the policy of Tarleton State University to comply with the Americans with Disabilities Act (ADA) and other federal, state, and local laws relative to the provision of disability services. Students with disabilities attending Tarleton State University may contact the Office of Disability Services at (254) 968-9478 to request appropriate accommodation. Furthermore, formal accommodation requests cannot be made until the student has been officially admitted to Tarleton State University.