

Astronomy Of The Southern Skies

Physics 112 January 2009
Gustavus Adolphus College
Syllabus - October Version

Instructors: Drs. Charles F. Niederriter, Carey Freeth, and Ms. Debora S. Niederriter

Textbook: *Universe*, Kaufmann and Freedman, Freeman Press 8th Edition

Lab Text: *Astronomy Lab Manual*, Gustavus

Star Chart: *Southern Sky Planisphere*

Course Policy and Evaluation

1. Class Times:

The course will run from 5th January through to the 5th February: Mornings, from 9:00 to 12:00, will be occupied with formal lecture/, seminar presentations and practical work. Early afternoons will be available for computer based practical work and group projects. Some special lectures will be setup, as well. Evening observing as weather permits.

2. Evaluation:

Exams	50%	A	94 - 100	C+	74 - 78
Laboratory	15%	A-	90 - 94	C	70 - 74
Homework	15%	B+	86 - 90	C-	66 - 70
Group Work	10%	B	82 - 86	D+	62 - 66
Observing	10%	B-	78 - 82	D	58 - 62
		F	0 - 58		

Assignment of final letter grades will also take into account the instructors' subjective evaluation of the student's attendance, initiative, class participation, preparation, and evidence of improvement.

3. Objectives, Goals, and Expectations:

This course is intended to lead students to an understanding and appreciation of the Universe. Astronomy and Astrophysics is an observationally driven science. The ever changing relationship between observations and their interpretation is stressed throughout the course. There have been clear periods when observational astronomy has driven theoretical astronomy and others where the roles have been reversed. This course is designed to illustrate the methods used by scientists (particularly astronomers) and to describe how these methods have changed over the course of history. The student will learn about the relationships between observations and theories by studying examples from astronomy and physics. In this course we will also discuss the relationships between science and mathematics, science and religion, and science and society.

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At the end of the course students should be able to:

- describe the tools and techniques used by Astronomers and Astrophysicists .
- describe the major astronomical sources observed in the Universe and their characteristics
- discuss the observed distribution of these sources in the Universe.
- demonstrate an understanding of the historical background to man's interpretation of astronomical observations.
- present physical explanations for the appearance and behaviour of astronomical sources.
- explain how astronomical objects evolve from formation to death.

The student beginning this course will be expected to understand basic mathematical principles such as those taught in high school algebra and geometry. During the course of the semester, algebra and geometry will be used extensively to discuss physical processes. The student will also be introduced to some concepts in trigonometry to illustrate the connection between mathematics and science but the student is not expected to use trigonometry to solve any problems. It is hoped that over the course of the semester the math skills of most students will improve as a result of the assignments in this course.

4. Laboratories:

- 1: Dance of the Planets
- 2: The rotation of Mercury
- 3: Lenses and Telescope optics
- 4: Spectroscopy
- 5: Comparative planetology: The surface of Mars
- 6: Jupiter's Moons
- 7: Photometry of the Pleiades
- 8: Classification of Stellar Spectra
- 9: Multi wavelength observations using SKYVIEW and other image data bases (e.g. MSX, IRAS)
- 10: ESO/UKST Sky Survey experiment
- 11: Radio astronomy of Pulsars
- 13 :Hubble's Law
- 14:Large Scale Structure - Where the Galaxies Are

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5. Course Content and Tentative Schedule:

<u>Day</u>	<u>Topic</u>
Saturday 3 rd	Arrive in Christchurch. Time to settle into accommodation (Tour of Christchurch)
Sunday 4th	Tour of Akoroa Area
Monday 5 th	Ancient Observatories and Archeoastronomy Rising/setting of stars and planets, Seasons Motion and Phases of the Moon, Eclipses, Gravity, History of Science Labs 1 & 2 – Observation and Star Chart, Dance of the Planets
Tuesday 6 th	Matter and Light, Optics, Telescopes, CCDs Lab 3 – Lenses and Telescopes and Spectrum of a Substance
Wednesday 7 th	Overview of the Solar System and Earth, Atmosphere, Magnetic Field, Plate Tectonics, ExtraSolar Planets, Moon and Mercury: Features, Structure, Formation, Evolution Lab 4 – Rotation of Mercury and Jupiter’s Moons
Thursday 8 th	Venus, Mars, & Jupiter: Features, Structure, Formation, Evolution Lab 5 – Lunar Features, etc.
Friday 9th	Field trip to Mt. John Observatories, Mt. Cook, Queenstown, Te Anau, Milford Sound, Fox Glacier and West Coast.
Wednesday 14th	
Thursday 15 th	Venus, Mars, & Jupiter: Features, Structure, Formation, Evolution The Outer Planets, moons, and rings, Comets, Meteors
Friday 16 th	Review and Exam 1
Friday 16th	Field trip to Nelson Area, Abel Tasman National Park
Sunday 18th	
Monday 19 th	The Sun: Features, Structure, Formation, Evolution Stars: Measuring Temperature, Radius, Mass, HR Diagram, Birth of Stars Lab 6 – Spectroscopic Classification
Tuesday 20th	Day at Leisure
Wednesday 21 st	Fly to Sydney (Early), Drive to Wollongong, Tour Wollongong

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Thursday 22nd Main Sequence Evolution, Death of Stars, Neutron Stars, Supernovae, Black Holes

Lab 8 – Photometry of Pleiades

Friday 23rd The Milky Way Galaxy, A Universe of Galaxies, Quasars, Active Galaxies, Gamma Ray Bursters, etc.

Lab 9 – Hubble’s Law

Saturday 24th Tour Sydney Area, Including Manly Beach, The Harbour and Rocks Area, Darling Harbour, Museums, etc.

Sunday 25th Rainforest, Waterfalls, and Blowhole Tour in Kiama Area

Monday 26th Australia Day – Day at Leisure

Tuesday 27th	Field trip to Coonabarabran and Siding Spring Mountain Observatories – Via Blue Mountains
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Thursday 29th	Return to Wollongong
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Friday 30th Cosmology, The Beginning of the Universe, The Big Questions Life, The Universe

Lab 10 - Large Scale Structure

Saturday 31st Jervis Bay Tour

Sunday Feb. 1st Day at Leisure

Monday 2nd Fly to Cairns

Tuesday 3rd and Wednesday 4th	Tour Cairns and Great Barrier Reef
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Thursday 5th Review, **Final Exam**

Friday 6th Fly Home via Sydney, Auckland, and Los Angeles