Texas Tech University Department of Physics

CRN 26865 Astronomy 2401 Observational Astronomy

Course Information Autumn, 2010

Lectures: 3.30-4.50 pm Tu, Sc 112: 3.30-4.50 pm Th, Sc 121.
It is imperative that you attend regularly, since there is no text. Also the Thursday class will be mostly devoted to computer work that you will put into practice the following week.

Laboratory Sessions: Observatory: Meet at sunset. Actual time will vary throughout the semester.
In the event of cloud, we will meet in Sc 121 at 8.00 pm.

Instructor: Assistant Professor Maurice Clark. Office: Sc 014 Phone: 806-742-3781
Email: maurice.clark@ttu.edu

Office Hours: Wednesday 4:00-5:00. Friday 3.00-4.00 PM. These are the times when I will be available in my office for discussions on any problems you might be having with the course. You are also welcome to come up to my office at any other time, although I cannot guarantee to be available.

Grading:

Essays	2 x 7%	14%.	
Project		20%.	
Observing Portfolio:		20%	
Computer Labs	7 x 3%	21%	
Comprehensive final		25%	(Just what the name implies)

Grades: The following are the grades to be awarded for this course and the *approximate* scores for which they will be awarded.

A	Has met the course objectives with distinction.	85% +
B	Has met the course objective with credit	73% - 84%
C	Has met the course objectives.	60% - 72%
D	Has met some of the course objectives.	50% - 59%
F	Has failed to meet the course objectives.	49% or less.

Course Format:

As the name implies, this course is about observational astronomy. While the labs and observing sessions will give you practical experience in observing the universe and in analysing those observations, the lectures will give you the "theoretical" background into why we use certain types of equipment and why we perform the analysis the way we do. There are no weekly assignments or mid-terms, however twice during the semester, you will be required to submit a paper dealing with some aspect of the course material just covered, that you have researched yourself, and there will be a comprehensive final exam at the end of the course. We will be covering the course material in lecture format on Tuesdays, while the Thursday class will be either a lecture or and lab session on the computers, devoted to going over what you will need to know in order to be able to operate the telescopes and process and analyse CCD images, and also to discussions about the requirements for the essays. However I want to encourage you to ask questions during the lecture. Whether about the lecture or about any problems you encounter. Remember…. NO question is too stupid to ask!!! If you are unsure about something, it is almost certain the several others will be as well. Be sure to let me know if I mention something you are unfamiliar with and help me adjust the pace of the course to better suit your needs.

Course Purpose:

Astronomy 2401 is aimed at those who have an interest in astronomy and who would like to learn more about how to observe the universe and image some of the wonders it contains. It is intended to satisfy the interests of someone who intends to continue in astronomy professionally and anyone who is interested in astronomy as a hobby. For those interested (or who inadvertently become interested), it will give you the tools to continue astronomy as a lifelong interest. Since it assumes a certain level of knowledge of astronomy, it has the prerequisite of either AS 1400 or AS 1401. Students who do not have either of these, may be permitted to enroll in the course provided they can demonstrate to the course instructor that they have sufficient background knowledge of astronomy.

Expected Learning Outcomes:

Upon completion of this course, students will be able to:

1. Gain proficiency at operating a computer-controlled telescope and imaging equipment, and to find objects in the sky.
2. Understand the different types of modern detectors used by astronomers, their operation, and their limitations.
3. Use a CCD and a DSLR to take images of celestial objects and then process those images either as "pretty pictures" of analyse them scientifically.
3. Have the tools needed to continuing enjoying astronomy on their own as a hobby if desired, including using a simple telescope to make observations of and identify celestial objects.
4. Understand the various types of variable stars, their study, and their importance in astronomical research.
5. Understand the various methods used to discover extra-solar planets and the results of those searches.
6. Research a celestial object. Image that object, and then present the results of that work verbally to their peers.

The objective of the study of the natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the bases for building and testing theories. The natural sciences investigate the phenomena of the physical world.

Students graduating from Texas Tech University should be able to: explain some of the major concepts in the Natural Sciences and to demonstrate an understanding of scientific approaches to problem solving, including ethics.

(1) Labs/Night-time Observing sessions: A major part of the course is learning how to use telescopes both for visual observation and for taking images. Another important component of the course is learning how to process and analyse images taken with a CCD. Therefore, every week during the semester you will have an observing session scheduled at the observatory. If the weather is unfavourable for observing that week, there will be an indoor lab session conducted in the computer room. Due to the sometimes questionable Texas weather, we will need to be very flexible as to whether we will be indoors doing a computer lab or outdoors observing. Also, as the semester progresses, the time of sundown will vary, especially with daylight saving time. So we will need to be flexible as to the starting time of the observing sessions. Finally, *be warned*, at times during the semester it will get *very cold at the observatory*! So *dress appropriately*.

(2) Observing Portfolio: Making observations is of little use unless they are recorded. Therefore An important component of your grade for this course comes from your observing portfolio. This portfolio will contain all of your observing records and logs, sketches of objects that you have observed visually, prints of objects you have imaged, and any other relevant material.

(3) Essays: During the semester you will be required to write 2 essays dealing with material covered during classes. These should be about 4 pages in length and you will be expected to research the material yourself. The material covered in class will only be an introduction.

The papers that you hand in should be the result of your own work, with ideas expressed in your own words. Violations of this policy are taken very seriously. Plagiarism and collusion are considered very serious offences. Please remember the following, which is part of the Standard Texas Tech Policies that apply to all of your classes:

Students will foster a spirit of academic integrity, and they will not present work as their own that was not honestly preformed by them. For a complete description of this policy see Texas Tech Operating Policy 34.12.

Throughout the semester, I hope you take the opportunity to talk to your fellow ASTRO 2401 students about the material you are learning, and how to apply it during exams and essays — sometimes the best way to learn something is to hear it more than one way, or to try and explain it to someone else! However, please remember that in the end, all of your work must be your own. Indeed, you'll want to make sure that you understand the material yourself, for when you walk into the lecture hall to take your exam, you will have no one to help you but yourself!

(4) Project: Towards the end of the semester, you will be asked to make a classroom presentation dealing with some object in the sky that you have researched and imaged for yourself. The presentation should be about 5 minutes duration and should cover why you chose this particular object, interesting information about the object that you have found, the displaying of images you have taken of the object and a discussion of the taking and processing of these images.

(5) Final Exam: This will be a comprehensive exam held during the scheduled exam time and will cover material from class and from the labs, as well as any material that you have been assigned to read.

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Course Syllabus

Here is a tentative outline of the lecture topics for the term and the associated lab work.
Some modifications may be made depending on how the weather co-operates! ☹

	Date	Topic	Work Due	Labs
Week 1	Th Aug 27	Using a computerized telescope:- Control software.		Lab 1: Using "The Sky"
Week 2	Tu Aug 31 Th Sept 2	Using a computerized telescope:- Set-up and Alignment. Planning and Recording Observations:- Importance of record-keeping. Observing log recommendations.		Observing: Using a telescope:- Telescope Set-up Lab 2: Planning Observations
Week 3	Tu Sept 7 Th Sept 9	Using a CCD: What is a CCD. DSLR imaging. Webcams.		Observing: Using a telescope:- Visual observing
Week 4	Tu Sept 14 Th Sept 16	Image Processing:- Calibration Reasons for calibration. Theory of image processing. Dark frames. Flat Fields.		Observing: Using a telescope:- Moon observing
Week 5	Tu Sept 21 Th Sept 23	Image Processing:- Monochrome. Using Photoshop.	Observation portfolio due. Interim grade	Observing: CCD imaging:- Black & White. Lab 3: Image Processing:- Black & White.
Week 6	Tu Sept 28 Th Sept 30	Theory of colour imaging. RGB Images Powerpoint presentations:- Choosing your object.	Essay 1 due	Observing: CCD imaging:- Black & White.
Week 7	Tu Oct 5 Th Oct 7	False-colour narrow-band images. Image Processing:- Colour		Observing: CCD imaging:- Colour.
Week 8	Tu Oct 12 Th Oct 14	Student Holiday: No Classes Variable Stars I:- Cepheids.		
Week 9	Tu Oct 19 Th Oct 21	Variable Stars II:- Long-period variables. Eruptive variables.		Observing: CCD imaging:- Colour. Lab 4: Image Processing:- Colour.
Week 10	Tu Oct 26 Th Oct 28	Variable star photometry:- Photometry theory. Filtered/unfiltered. Photometry software.	Observation portfolio due. Interim grade	Observing: CCD imaging:- Variable star photometry.

Week 11	Tu Nov 2 Th Nov 4	Asteroid Astrometry:- What is astrometry? Why undertake it? Astrometry software.	Essay 2 due	Observing: CCD imaging:- Project imaging. Lab 5: Photometry
Week 12	Tu Nov 9 Th Nov 11	Planetary imaging:- Problems in imaging the planets. Planetary image processing software.		Observing: CCD imaging:- Project imaging. Lab 6: Astrometry
Week 13	Tu Nov 16 Th Nov 18	Extra-solar planets:- Searches for extra-solar planets.		Observing: CCD imaging: Planets Lab 7: Image Processing:- Planets
Week 14	Tu Nov 23 Nov 24-28	Observing extra-solar planetary transits. Thanksgiving Break		Observing: CCD imaging: extra-solar planetary transits?
Week 15	Tu Nov 30 Th Dec 2	Spectroscopy Project presentations.	Observation portfolio due Final Grade	Observing: CCD imaging: extra-solar planetary transits?
Week 16	Tu Dec 7 Th Dec 9	Project presentations. No Classes		
Week 17		Final Exam Time yet to be set		