

# Astronomy 2010H    Modern Astronomy    Spring 2012

Instructor:            Dr. Andy Layden  
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Class Schedule:    **MWF 11:30am-12:20pm** in 184 Overman Hall  
Office Hours:        **MWF 12:30-1:20 pm, TR 3:30-4:20 pm**, or by appointment.  
Text:                 *Pathways to Astronomy, Schneider & Arny, 2012 (3<sup>rd</sup> Edition).*  
Course Webpage: via Canvas ( <http://bgsu.infrastructure.com> )

**Overview:** This course describes the workings and life cycles of stars and galaxies; black holes and other "exotic" astrophysical phenomena; the mystery of dark matter and dark energy; the expanding Universe and the Big Bang theory of the origins of the Universe; and models describing the possible fate of the Universe. Activities will clarify how astronomers obtain and interpret information about the untouchable stars. We will connect astronomy with human history, culture, and technology, and apply quantitative reasoning strategies to solve astronomy and other problems.

**Learning Outcomes:** Students completing this course successfully will be able to:

- (1) Describe in detail, using proper terminology, the physical nature of stars, galaxies, and the Universe. This provides a knowledge base for a lifetime of enjoying astronomy in newspapers, websites, and amateur-level magazines;
- (2) Describe and critique the scientific explanations for the formation and development of stars, galaxies, and the Universe, using scientific observations and concepts;
- (3) Explain how scientists use observation and mathematics, at the algebra level, to learn more about the cosmos, and use basic forms of some of these methods;
- (4) Trace the historical development of modern Astronomy from the Renaissance to the present, and relate it to other events in the evolution of Western thought and culture;
- (5) Apply critical and quantitative reasoning skills, including estimation, which enable one to better understand and critique technical ideas and proposals found in the media, government and business.

## **Learning Modes:**

**Reading** from the textbook will be assigned on most nights, and some nights there will be external reading. Students will write a short summary of the important points and unresolved questions regarding the reading. This will serve as the student's study guide as well as a springboard for discussion in the following day's class. *Doing the reading ensures you will be prepared for discussions, in-class activities, and new material.*

**In-Class Discussion** in small groups will occur at several times during class. Most classes will begin with 5-10 min of discussion of the reading, during which you can share your ideas and raise questions. Questions that aren't resolved in a small group will be fielded class-wide

afterward. Usually, I'll check whether students have a reading summary; occasionally, the summaries will be collected and reviewed to provide feedback on content and method. Once a week or so, we will have small-group discussions to review historical aspects of recent readings/study, and add them to our time-line. Most activities will be done in group format.

**Activities** are assignments designed to help you get a better hands-on and/or mathematical feel for the concepts about which you have read. We will start them in class but if you don't finish, complete them as homework and turn them in at the beginning of the next class.

**Simulation Labs** are online Java tools that enable a student to interact with graphs and/or visualize the complex 3-D motions found in Astronomy. At home, you will follow instructions and answer questions on a paper student guide, using the online discussion board to share strategies, tips and pitfalls. We will use 3-4 simulations from NAAP ( <http://astro.unl.edu/naap/> ) over the term, plus some other online resources.

**Papers and Presentations** will include a group research project on a major U.S. telescope observatory which will be presented to the class (15 min), and a 4-5 page final paper that integrates the history of modern Astronomy with the development of Western thought and culture since the Renaissance period. Details to follow.

**"Hour" and Final Exams** will be a mixture of multiple choice, short-answer, and essay questions. They will focus on concepts emphasized in class, activities, and homeworks, though your reading summaries should be your starting point for review. A **quiz** will be given early in the term to provide a model for the format as well as feedback on your current study habits.

**Bring to every class:** Calculator, pencil/pen, notebook/paper(binder?) and if possible, your textbook. Your calculator should do square roots and scientific (exponential) notation [for example, the *TI-30Xa* or *Sharp EL-506VB* are ~\$12].

**Help:** If you have questions, I'd be happy to help you during my office hours. Informal free tutoring may be available through the Society of Physics Students, and through the Learning Commons in Jerome Library ( <http://www.bgsu.edu/offices/learningcommons/> ). You may want to form an informal study group.

### **Grading:**

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|--|-------------------------------|
| • Activities, group discussion and class participation                   | 20% of final grade            |
| • Simulation Labs  | 17% of final grade            |
| • Paper & presentation   | 14% of final grade            |
| • One Quiz (25 min)  | 4% of final grade             |
| • Two "Hour" (50 min) Exams  | 20% of final grade (10% each) |
| • One comprehensive Final Exam   | 20% of final grade            |
| • Attend one Stargaze at the BGSU Observatory ( <i>see page 4</i> )      | 5% of final grade             |
| • Optional extra credit ( <i>see list of projects on class website</i> ) | up to 4% of final grade.      |

Grading is the standard: >90% = A, 80-89% = B, 70-79% = C, 60-69% = D, <60% = F. I round up in cases where effort is evident.

Before each exam, I will summarize your current points and post an interim estimate of your course grade via Blackboard or Canvas [my.BGSU.edu](http://my.BGSU.edu). You can check any time you like.

Excused absences: If you need to be out of town for a valid reason, arrange with me before hand how to handle missed assignments. If you are ill for a class or two, email me and I'll accept late work with no penalty. If you are absent for more than 3 classes, I would appreciate a doctor's note (some students inform their Dean's office and they inform faculty).

### **Important Dates:**

- Mon Jan 9 – First day of classes.
- Mon Jan 16 – Martin Luther King Day, no classes.
- **Mon Jan 30 – Quiz** (approximate date, stay tuned).
- **Wed Feb 15 – First Hour Exam** (approx date, stay tuned).
- Mon Mar 5 – Fri Mar 9 -- Spring Break, no classes.
- **Wed Mar 21 – Observatory presentations** (approx date)
- **Wed Apr 4 – Second Hour Exam** (approx date).
- **Mon Apr 23 – History of Astronomy papers due** (approx date)
- Thurs Apr 26 – Last Stargaze.
- Fri Apr 27 – Last day of class, **extra-credit projects due**.
- **Mon Apr 30 – Final Exam, 10:45am – 12:45pm in our classroom.**

### **Rough Calendar:**

Week 1	Topic:	Universe Tour, size ratios, unit analysis.
2		The Sun, the nearest star.
3		Matter, energy, atoms & light.
4-5		Stars: distance, luminosity, temperature, & mass.
6		Force, gravity, Kepler's Laws & mass.
7		Stellar evolution, from birth to death.
8		Stellar remnants: neutron stars & black holes.
9		Telescopes and observing technology.
10		The Milky Way galaxy: structure, motion & change.
11		Galaxies: types, distances, recession and the age of the Universe.
12		Dark Matter: .
13		The Big Bang theory: ideas and evidence.
14		What does the future hold?

## Astronomy Stargaze Schedule -- Spring 2012

The goal of the Stargaze is to give you the opportunity to view the heavens firsthand with the help of experienced instructors. You will learn some constellations, look at stars through a small telescope (8-inch, a typical telescope bought by amateurs), and look at fainter celestial objects through a larger research telescope (20-inch). BGSU is one of a few Universities to have a large telescope on campus, within easy reach of its students. Don't miss this unique opportunity!

A warning: the things you will see won't be as beautifully dramatic as the color pictures in your textbook, which are long exposure photographs taken with large telescopes located at the best observing sites in the world. What you *will* see is light that has traveled huge distances across empty space, captured by your very own eyes. I find it awe-inspiring!

Stargazes begin at the following times:

January 17 – March 1 (standard time)

Sunday

10:00 p.m.

Monday, Tuesday, Wednesday, and Thursday

9:30 p.m.

*No sessions on Sun March 4 through Sun March 11 (spring break)*

March 12 – April 26 (daylight time)

Sunday, Monday, Tuesday, Wednesday, and Thursday 10:00 p.m.

1. We encourage you to **make your stargaze visit early in the semester**. Many sessions (two out of three) are lost to bad weather, especially late in the semester. Do not wait until the end, or you may get closed out by bad weather or inconvenienced by large crowds. *Plan ahead, go early!*
2. Stargaze sessions are held in the Observatory area on the roof of the Physical Sciences Laboratory Building (PSLB). Wait near the elevator on the ground floor. Do not use the stairs, as the rooftop doors are locked. You will be escorted to the Observatory in a group as near as possible to the scheduled time. Each session lasts 45-60 minutes.
3. The maximum size of a group is 20 people on a **first-come, first-served basis**. Everyone who shows up on time will served, but you may have a long wait if the turnout is large and we have to run extra sessions to accommodate everyone. A **sign-up sheet** is put out in the planetarium lobby about one hour before the first scheduled stargaze. You may wait in the Planetarium lobby, or leave and return about 10 min before the next session is due to start.
4. There is no late admission. If you miss the departure of a group, you must wait until the next scheduled time. There are no exceptions and there is no other access to the Observatory.
5. **Look at the sky before you come**. Sessions are held only when the sky is clear and free of clouds. If it's cloudy, partly cloudy, too hazy, foggy, raining, or snowing, the sessions must be canceled. If you live out of town or sky conditions look ambiguous to you, you can call 419-372-8831 for a recorded message telling whether the sessions will be held or canceled. The tape is put in at 9pm, so please do not call earlier than that, or you may get a wrong message.
6. **Bring your student ID card**. This is how you get the points credited to your grade!
7. **Dress warmly**. The roof is usually colder and windier than the ground. Out of consideration for others, there is no smoking, food, or beverages on the roof; please turn off cell phones.
8. The student telescope operators have full disciplinary authority if necessary.