INST 2403 The Expanding Universe

Welcome to the Class!

Glad you're here!

Welcome to the Class!

- Astronomy is an exciting topic
- Get some sense why scientists love what they are doing



Monday's Solar Eclipse



Otterbein Students in the Totality Zone down in Tennessee



Totality



Safe Viewing – Pinhole "Camera"





Making Sense of the Set-up



A Major Theme: Making Sense

• Think for yourself

• Ask questions if things don't make sense

 "Making fun of science is really talking about science"

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Course Materials

• Textbook:

- *The Expanding Universe*, Preliminary Edition, by Uwe Trittmann (Cognella 2017)
- Need <u>WebAssign</u> access, too!
- Course Web Page: <u>http://faculty.otterbein.edu/utrittmann/is2403-02/</u>
- Observatory schedule, lecture notes, study guides, the syllabus, notices, online resources, ...

The Textbook

• ...will arrive shortly (or has it arrived?!)

• Astronomy by way of science, history, philosophy, cultural history...

Feedback much appreciated!

The whole universe in 14 weeks ?!

- The focus is on concepts, not facts; on the methods and tools of science:
 - How do we know?
 - How can we measure it?
 - How can we predict it?

Assignments and Grading

Rooftop Visit + Essay	2%
Activities	8%
	(total)
Participation	3%
Constellation quiz	7%
Homework	18%
Skylab	12%
	(total)
3 in-class tests 10% each	30%
Final exam (comprehensive!)	20%



- Come to
 experience the night sky with your own eyes
- Write a short summary of your experience

I went to Starry Monday this Wednesday and got to observe the moon, Saturn, Mars, and Jupiter through the telescope. Also I got to look for constellations such as Leo (where the moon was), Ursa Major, Ursa Minor, etc. I enjoyed looking at the moon the most because you could really see the craters as well as mountains on the moon. Looking at Mars with the naked eye was also interesting because I never noticed how much redder it actually looks than the rest of the stars that we could see. Saturn was neat to look at in the telescope because we could see its rings, and Jupiter was interesting because we could see its moons surrounding it. Starry Monday was a really fun and interesting experience because we actually got to look at some of the things we talk about in class.





Photos taken with student's iPhone through telescope eyepiece!

Activities

- Small-group work
- In-class discussion
- active learning of important concepts

• Show up, participate, learn, receive credit!

Participation

- Ditto: Show up, participate, learn, receive credit
- Be prepared to think of an answer when prompted
 - Have you read the memo?



Participate by Peer Instruction

- Peer instruction is learning by instructing your fellow students and being instructed by them
- The process involves 6 steps:
 - Mini-lecture by course instructor
 - Conceptual multiple-choice question is put up
 - Flash-cards are used to "poll the audience"
 - A few minutes of discussion between students
 - "Final answer" via flash-cards
 - The instructor explains the correct answer

Who was the first man on the Moon?

- Yuri Gagarin
- Buzz Aldrin
- Neil Armstrong
- John Glenn

Concept Questions

- Concept questions maybe easy to answer, but are not simple
- You need background knowledge to answer them
- They teach you how to use facts and knowledge to find the answer to a problem
- They test if you got the concept rather than just knowing facts

It is New Moon. In one week, what will the phase of the Moon be?

- New Moon
- First Quarter Moon
- Full Moon
- Last Quarter Moon

Why it works

- Carefully chosen questions
- It is easier to be convinced and to convince if the reasoning is sound and hence the answer correct



Weekly Homework

- Will use <u>WebAssign</u>, an online homework system
 - Password & username: first initial plus last name all lowercase, e.g. utrittmann
 - HW due on Friday evenings

Skylab

- Equivalent of a term paper, but more experimental
- Start early weather is always a factor
- Ask questions!
- First Draft due Oct 18
- Full Skylab due last day of class

Basic Observations in Astronomy

• We see (on clear days!):

- A very bright disk that is up about 12 hours. It comes up in a specific direction, rises higher until it reaches a maximal altitude in a second direction, then sinks lower until disappearing in a direction opposite of the direction where is came up
- A less bright object that changes its appearance and is also up for a (different) duration of 12 hours. Same rise/set pattern as very bright object.
- When the very bright disk is not visible, we see many tiny specs of light of different brightness and color

Basic Observations in Astronomy

• We see further:

- The tiny specs move across the sky as the hours go by. One group moves across the sky in 12 hours. Same rise/set pattern as bright object.
- The position of the specs wrt other specs is fixed, but they move wrt to the ground
- Careful observation reveals a handful of exceptions from this rule:
 - some bright specs move slowly wrt to the other fixed specs, and also are visible 12 hours. Same rise/set pattern as bright object.
 - One spec sits at the center of this motion and does not move

Naming Patterns in the Sky

- These patterns repeat every day, let's name them
 - Sun
 - East, South, West
 - Moon
 - Daytime + Nighttime = Day (needs to be revisited later!)
 - Planets
 - Polaris, the North Star

Activity: Observing the Sun's Shadow

• Measuring the length of the shadow, we can infer the sun's position