Astro 406

Lecture 1

Aug 26, 2013

Announcements:

- take a, seat, a syllabus, and problem set 1
- ASTR 401–see me afterwards

Today's Agenda

1. Introductions
2. Overview and Appetizer:
   Preview! No need to take notes today!
3. Course Mechanics
4. ASTR 401

Introductions

Getting to know us

`www: A406 Staff`

Getting to know you

- First course with me? Welcome!
- Returning veterans–welcome back!
  I salute your bravery! Hope triumphs over experience!
- ASTR 350: same Universe, but (some) new jokes
  also new stuff, and deeper level of understanding

Getting to Know You: iClicker Poll

Vote your conscience! = Say what you *really* think!
All answers get full credit!

There is evidence that the Universe is
filled with black holes, near and far
In your opinion, what do we know most confidently?

A the location and mass of the nearest black hole

B the location and mass of the black hole
at the center of our Galaxy

C the total mass of all black holes in our Galaxy

D the total mass of all black holes in the Universe

E hold on! there's maybe evidence, but no incontrovertible *proof* that black holes actually exist at all!

Welcome!

This course sweeping in scale
science applied to the biggest picture
this is the most sweeping course you can take
  this side of Green street.

Note: you are (at great expense)
attending the **Univers**ity of Illinois
you have been promised the Universe...
$\rightarrow$ it's right there in the name!

In this course, we deliver!

Huge range of scales in space and time

in space:

subatomic 10^{-33} cm (Universe "size" at big bang?),
to Milky Way 100,000 lyr across,
to nearest galaxies millions of light years away
to edge of observable universe 10's of billions of light years,
to unobservable universe beyond

also sweeping in time:

10^{-43} sec after big bang
to one galactic "year" of 200 million Earth years
to billions of years in future of cosmos

Taking A406 Here and Now: A Wise Choice

Great *time* to take the course:
Golden Age in study galaxies & universe
new results flooding in–some during this semester
⋆ Fall 2011: third time a Nobel Prize given for cosmology!
Rumor: very interesting / possibly revolutionary results this semester

> We are very lucky to live in an age in which we are still making discoveries. It is like the discovery of America–you only discover it once.
>
> – Cosmologist Richard Feynman, *The Character of Physical Law*

Also great *place* to take this course:
Illinois has major research effort in galaxies and cosmology
both theoretical and observational
including me–my work includes both galaxies and cosmology
so: getting it from the horse's mouth–so to speak

Appetizer: Course Goals

The Big Picture

My goal in this course:
get a familiarity with the big picture

- partly phenomenology–*what* we know: "just the facts"
- but also: *how* and *why* things are as we see them
  Will apply physical principles: "get under the hood"

A brief, whirlwind tour (don't need to write)...

Business

Syllabus
will highlight main points here...
you should read the whole thing carefully

Note: this course will rely heavily on the Web.
syllabus is there.

Course Webpage.
You will want to check often. Lecture images & notes, homework, exam info posted

Prerequisites:
Credit in Phys 211 and 212–i.e., mechanics, EM
and have had calculus
$\rightarrow$ no prior Astronomy courses required (but helpful)

Prerequisites Continued

So what do I expect you to know?

Astronomy: will review what we need to know

Math: vectors, calculus, some ordinary diff eqs

Physics: *do expect* mechanics, some E/M
(i.e., need to know what's a λ)
will develop quantum mechanics as needed,
and whatever atomic, nuclear, and particle physics,
relativity needed

if not sure about prereqs, let me know

ASTR 401

- ⋆ satisfies Advanced Composition GenEd
- ⋆ **required** of Astronomy majors
- ⋆ excellent preparation for techie future, e.g., grad school research warmup, opportunity to earn good recommendation

You are now Astronomers! Welcome to the club!

→ this is a chance to dive in and get up to speed on what the excitement is really about

ASTR 401

Basic structure:

- *choose one short-form, high-impact research article* ("letter") on a hot topic on galaxies and cosmology
- *read and "unpack" the article* – follow the chain of observation and theory it rests on, and place it in context by reading preceding and subsequent articles
- reproduce/verify results when you can
- *write up your findings in a 20–40 page paper* in professional journal format, with bibliography and tables

ASTR 401

Review syllabus

Truthfully: very demanding
- have to *learn to read and understand research literature*
- so that you can unpack into a logical, precise review

Maybe intimidating, but will break up into (many) pieces
and will get frequent feedback from me

Choosing your high-impact article: a crucial decision
- "shop around" by looking at several papers
- titles themselves might be in jargon and thus unfamiliar,
  but don't be intimidated, and be willing to challenge yourself
- yet also: pick a paper you find *interesting*
  and can understand – you'll need to explain it in detail!
- we'll talk about all of this in our one-on-one meeting

Homework:

- read syllabus carefully, note deadlines
- start choosing an article; due Sept 2
- email me by Sept 2 for appointment to talk about your choice
- I will send around a poll to find when we can
  all meet to discuss key points