The phases of the Moon (cont'd); oddballs in the sky; exam review

Astronomy 101
Syracuse University, Fall 2018
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Announcements

- Exam is next Tuesday
  - Slack-message me if you are left handed and you haven't already
- I'm behind on messages and will catch up soon

Extra help for the exam

- Help session in my office tomorrow, 9:30-11:30
- I will lead a review in the Physics Clinic on Sunday, 2-5

Two opportunities for extra credit

- Suggest a question for the first exam:
  - Go to the Google Form listed on the website
  - Suggest a question for the first exam
  - If I like it I'll use it, and you'll get 10% extra credit

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- Meme contest:
  - The best five science memes (all the way back to the start) in `ast101memes` will get 5% extra credit on the first exam
  - You may vote with Slack "reacts" for your favorite

We want this to be the best class for you that we can. This is your class more than it is mine!

If you have any feedback for me – anything that I can do differently, or anything that I can do to make your experience in here or in lab better – please let me know.

Especially if something is not going well, I want to hear your candid feedback.

I had a long Slack conversation with a student last night about something that happened in lab that she wasn't happy about, and was very glad to get her feedback.

Figuring out things related to moon phases

Note that:

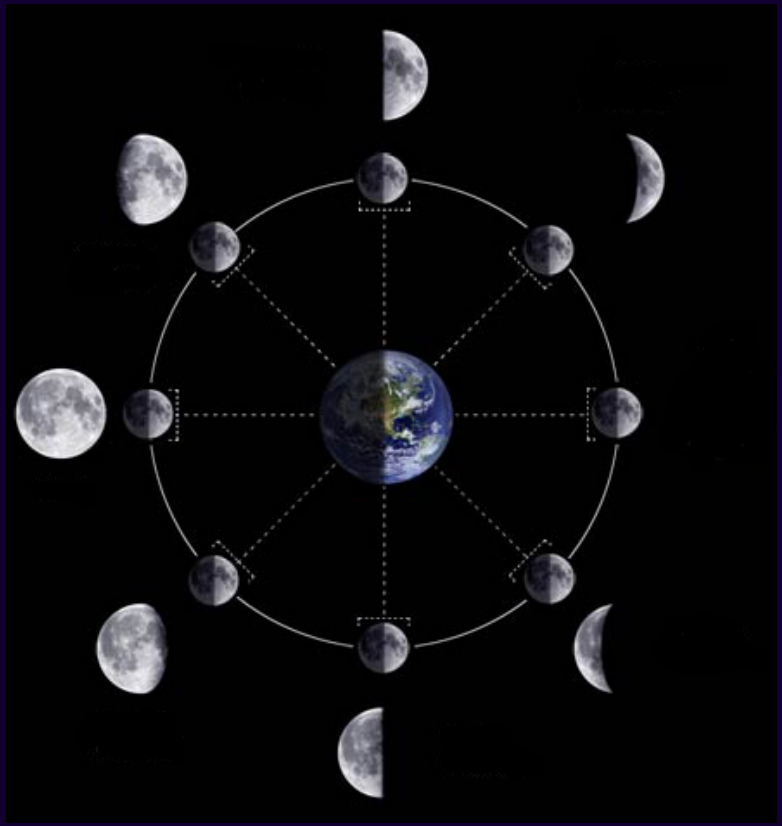
- Half of the Moon is always sunlit (facing toward the Sun)
- Half of the Moon is always visible from Earth (facing toward the Earth)
- The Moon orbits the Earth counterclockwise as seen from above the North Pole once a month
- The Earth rotates counterclockwise as seen from the North Pole (from west to east) once a day

To figure out the phase of the Moon:

- Draw the Earth, lunar orbit, Moon, and direction of sunlight
- Figure out which half of the Moon is lit and label it
- Figure out which half of the Moon we can see, and determine what it looks like

To know when it rises and sets:

- Figure out which half of the Earth is lit and label it, to tell you night/day
- Remember how the horizon works (it rotates counterclockwise)
- This will tell you what time of day the Moon rises and sets



You can figure all of this out by drawing pictures.

Do this on warmup problems, tutorials, exams...

Complete *Lecture Tutorials* pp. 81-88.

When the waxing half moon is just rising over the horizon, it is closest to:

A: 6AM
B: Noon
C: 6PM
D: Midnight

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The planets: what has gone wrong?

Demo on *Stellarium*

The planets: what has gone wrong?

Demo on *Stellarium*

Sometimes some planets appear to go backwards ("retrograde motion").

This tells us that celestial sphere model can't be literally true. Why does it work for everything else?

- The celestial sphere model works if things appear to only rotate around the Earth.
- The stars are so far away that only the Earth's rotation matters
- The Earth orbits the Sun, so we just pretend that the Sun is on a different sphere turning a bit slower, taking into account both our revolution around it and our rotation
- The Moon orbits the Earth, so we again put the Moon on a different sphere, turning slower
- ... but how can we get a sphere to go forwards and backwards?
- **The celestial sphere model gets the motion of the planets badly wrong**

Oh, you sweet summer child...

Why are the changes in the seasons in *Game of Thrones* so terrifying?

Oh, you sweet summer child...

Why are the changes in the seasons in *Game of Thrones* so terrifying?

... they're unpredictable!

We've long used the immutability of the sky as a symbol for constancy. The cycles of the Sun, Moon, and stars don't ever change, but some things do!

These unexpected things in the sky once terrified people; now we know why they happen.

Eclipses

You know that during a new moon, the Moon lies roughly between the Earth and the Sun.

However, the Moon's orbit is tilted just a bit, so it usually passes over or under the Sun.

If it passes in front, you get a solar eclipse!
This terrified many of the ancients – "the Sun got eaten! We're doomed!"

Eclipses

You know that during a full moon, the Earth lies roughly between the Moon and the Sun.

Same deal: usually the Earth's shadow misses the Moon. Sometimes it doesn't!

Here some light is refracted by the atmosphere. The blue component is scattered away by the atmosphere; the red component bends and hits the Moon.

Meteors

Orbits of things in the Solar System are not always close to circular.

There are lots of small things in the Solar System, many of which have elongated orbits that sometimes cross ours.

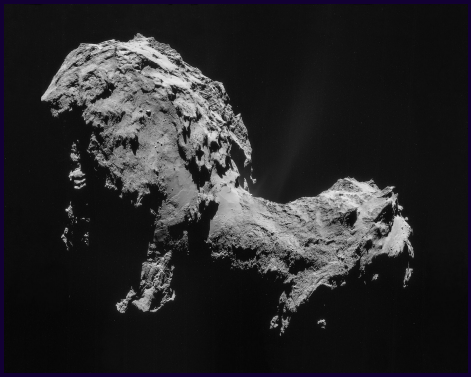
Meteors:

- Little rocky or metallic bits of matter that orbit the Sun
- Sometimes they get to Earth and glow as atmospheric drag heats them
- Sometimes they hit the surface, and we get chunks of space-slag
- Historical cultures sometimes used them as easy access to metal

Comets

Comets are "dirty snowballs" whose orbits are *highly* elongated.

- Mostly made of ice
- When they get close to the Sun, the heat melts bits off of them
- This stream of stuff reflects sunlight and makes the comet's "tail"
- Historical cultures were often terrified of them, but they're just space-snowballs



The exam

- Around 30 multiple choice questions
- Bring:
  - A pencil
  - Knowledge of your SUID (or your student ID card)
  - A single side of an 8.5x11 page of handwritten notes
  - Your blow-up Earth

The exam: what to study

The exam covers, in descending order of emphasis:

- The material in the *Lecture Tutorials* and Lab 3
- The material in the other labs
- The material we talked about in class that was *not* in the Lecture Tutorials, including demos, videos, etc.
- The material in the textbook
- Most importantly, the stuff in Chapter 1 giving a sense of scale about the Solar System and Universe.

Any questions from last year's exam?