Topics: Review some things we skipped, practice problems

Reading:

- Read about Eratosthenes on pp. 32 - 33 of Ryden and Peterson (first full paragraph on p. 32 to end of partial paragraph on p. 33, but especially Fig. 2.2).
- Review pp. 229 - 230 of Ryden and Peterson (the appendix on radioactive dating).
- You may want to review – or at least be ready to find relevant material in – some other parts of the Ryden and Peterson Ch. 9 reading from last week, given that we will work on problems 9.9 and 9.10 in class.

Summary of work to submit:

- Nothing to submit for Tuesday's class.

Overview:

We'll go back to the Earth-Moon system scale (size of the Earth, Moon, and their distance) to solidify both conceptual understanding and practice angular position and trigonometry concepts that could be useful on the midterm. We'll look at radioactive dating that we didn't get to last time – what it is, how it works, and how it is used. And we'll use class time to work in groups on two problems from the end of Ch. 9. The material isn't directly going to be on the midterm, but these problems (9.9 and 9.10 on p. 231) employ a lot of concepts we discussed during the first four weeks (and thus are covered by the midterm). Plus, the problem solving and physical thinking will be useful practice. And you'll compute basically from a measurement of the air pressure at sea level and your knowledge of physics the mass of the Earth's atmosphere.

Commentary on the reading, viewing, and other preparation:

Back in the second week, when we discussed the scale of the Solar System, starting with the Earth and Moon, we used radar to measure the distance and angular size (plus distance) to infer the Moon's real size. And it was stated in the textbook that the Greeks made a parallax measurement of the distance to the Moon (can you describe how that works?).

But the Greeks also measured the size of the Earth.

And then using their insight that a lunar eclipse is caused by the Earth's shadow falling on the Moon, they used the shape of the shadow relative to the Moon to determine that the Moon is about 3.5 times smaller than the Earth. You can see that below and can imagine doing it from one real image (like the second moon in from either side, where you can see the relative curvature of the Earth compared to the Moon).

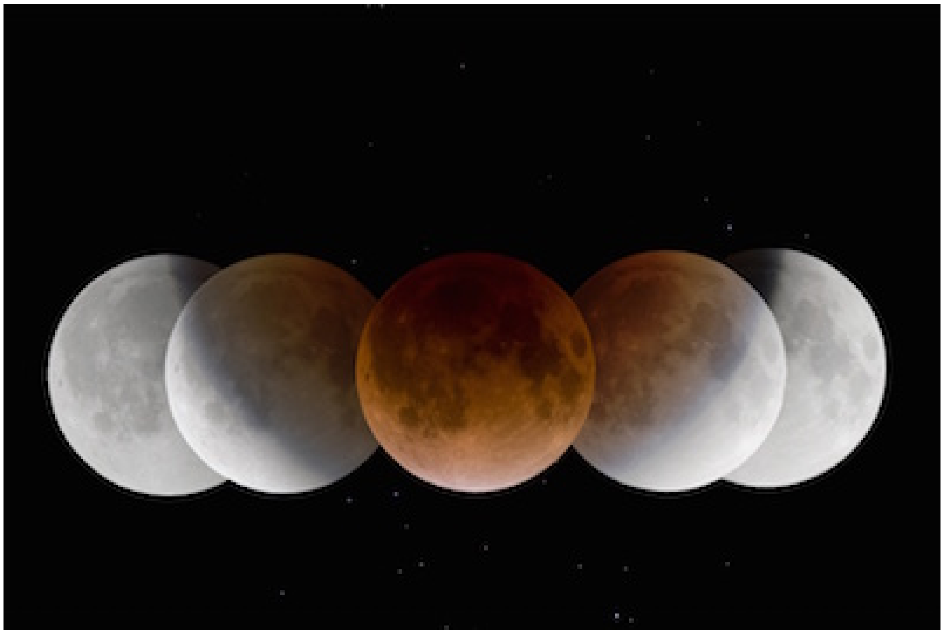

Fig. 1 Time-lapse of the Moon during a lunar eclipse (Earth's shadow passing across the Moon, or the Moon passing through Earth's shadow).

When you review Eratosthenes's measurement of the Earth's circumference, can you visualize what each person would measure locally?

Do you see how the fact that the Sun is very far away makes its rays hitting the Earth nearly parallel to each other? And how that makes for all sorts of nice and convenient geometry?

I am repeating here some of the information at the end of the last assignment, mostly taking out stuff we already talked about.

Radioactive dating: Useful for all sorts of things. Recall that each element has isotopes (varieties with more or fewer neutrons) some of which are often radioactive. That means they undergo spontaneous reactions in their nuclei that give off energy and result in one isotope being changed into another or even into another element.

If you know how much of a radioactive substance there was at one time, and then you measure less of it at a later time, you can figure out how much time has passed if you know the rate at which it decays. The governing equation is 9.26. Translate that equation into words! You can use the word "proportional" and eliminate the equal sign and constant of proportionality from your translation.

Take a look at problem 9.5 on p. 230.

And then also problems 9 and 10 on the next page. We will do at least some of these in class. That is, you will do them!