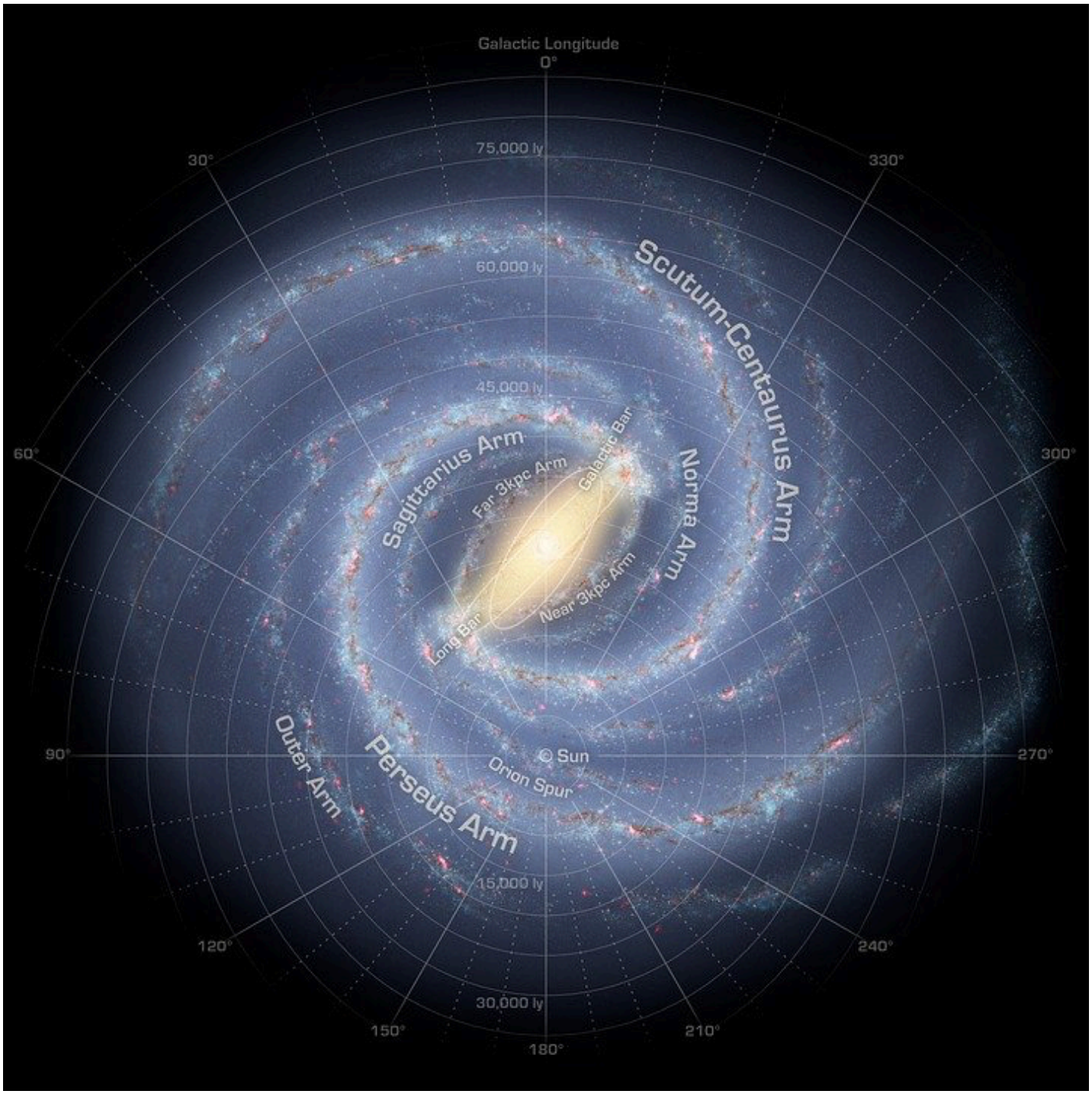
# Our Location in Space




Where are we, why do we see what we see and how does it all work?
Use resources such as Wikipedia and online texts such as astronomynotes and openstax in addition to the resources linked below.
You'll need to do some reading to understand your topic well enough to respond to questions about it. Make sure your sources are credible!

Choose a topic you want to work on and write your name next to the title using a different color. I recommend that you spend 1 or 2 minutes looking at resources for your topic before you commit. You will have the rest of class to research your topic and develop your assessment.

Assessment Options:

1) Discussion: plan to lead a discussion with the class with about 1 minute of intro and at least 5 guided questions. The discussion should be between 4-7 minutes.
2) Presentation with breaks for questions: plan a short presentation using slides with images only, no text other than a title. Speak without notes and stop after each slide to allow time for questions. Do your best to encourage discussion.

It's ok if you don't know the answers to all the student questions that come up in the discussion or the presentation. Do your best!

**Earth**

1. What is a month? What is a year? How do we measure them? Why do we have a leap year? (animation)
2. Why do we have seasons? (link) Why are seasons felt so differently at different latitudes? What does the angle of the sun's rays have to do with this? (link)
3. Why do we have a spring equinox but a summer solstice? What's the difference? What is special about the sun rising and setting on the equinoxes? How does the sun rise between the equinox and the solstice? (link)
4. Why do hurricanes in the northern hemisphere spin counterclockwise and in the southern hemisphere they spin clockwise? (link) How does that relate to the spin of the Earth? (link) Does that affect smaller fluids like the water in a toilet - does a toilet flush differently in each hemisphere? (video)
5. What is the ecliptic? What are right ascension and declination? (link) What is the celestial sphere and how do we determine the reference points such as the north celestial pole? (text)
6. [*tough topic*] What is a sidereal day (also called a stellar day)? A synodic (solar) day? How do they differ from other ways of telling time? (animation) (explanation) This topic links to the next topic if you want to work as a pair, or as a 3-person group to include the analemma.
7. [*tough topic*] What is the equation of time as it relates to solar motion? (article text) Find the person working on analemma (next topic) and explain how the equation of time is related to the analemma. (link)

**Earth and Sun**

8. [*tough topic*] What is an analemma? (link) Why does it have the shape it has? Why does it look slightly different from different latitudes? What does the analemma look like on Mars? (link) (how to see analemma using Stellarium)
9. [*tough topic*] Why does the sun rise and set in different locations throughout the year? Does it change position more drastically at different latitudes? If so, why? What happens to our shadow over the course of a year? (helpful animation, scroll to the sungraph and compare cities at different latitudes)
10. [*geom topic*] What is a parsec? (article video)) How many light years is it? 3.26 How many kilometers is it? How many parsecs is the length of Oahu?
11. Why don't we have eclipses every month? (link) When will we have the last solar eclipse and why will they end?
12. Why do we have tides? (animation video) What is the difference between spring and neap tides? What has a stronger force on tides, the sun or the moon? Why aren't the tides at the same time every day?

**Earth, Sun and Planets**

13. Why is it (almost) impossible to see Venus at midnight (text)? What other planet cannot be seen at midnight? Do planets have phases like the moon? (animation)
14. What is retrograde motion? (animation animation) What planets show retrograde motion? What is the difference in the retrograde motion of different planets?
15. Where is the barycenter for our solar system? (animation) How does it change? What is a barycenter?
16. (*helps to know about angular momentum*) Why is our solar system flat? (video) What other systems or objects are flat due to the same reasons? Is the entire solar system flat or are there areas where it's different? (article)

**Constellations**

17. Why are the zodiac constellations special? (article) How are they related to the motion of the sun (animation)?
18. How different are the constellations now from when they were formed? (article) Why have they changed? (article) (animation animation) What will be the next north star?
19. Are all stars in a constellation near each other? (animation) What would we see from a different star system?
20. [*tough topic - helps to know calculus and physics*] Why don't the constellations stay the same - what is precession? (video video) What is nutation (text)?
21. How long is the sun in a particular constellation? (use Stellarium to check) How long is Mercury in a particular constellation? How long is Neptune in a particular constellation? Why is there a difference?
22. Are there constellations that are always visible in Hawaii or other locations - every night, all year? (link) If so, are they always visible everywhere else? Does every part of the Earth have sections of the sky that always stay the same? Do any areas on Earth have completely non-changing skies? (link) -
23. How do the constellations appear to change position night after night? If you see a constellation setting at 9pm tonight, will it set earlier or later tomorrow night? Is that time the same for all constellations? What about month after month, will it rise or set later or earlier? What makes the difference? (article)

**Galaxy**

24. What is a galactic year? How many have we had? How do we move relative to the galactic plane (video)? Where are we in our current cycle - above or below the plane? (article) What is the new holiday: Galactic Tick Day? (text)
25. Where are we in the Milky Way - on what spiral arm? (link) How many arms are there? What is the approximate radius of the distance to the stars we can see with the naked eye? How much of the Milky Way is that?