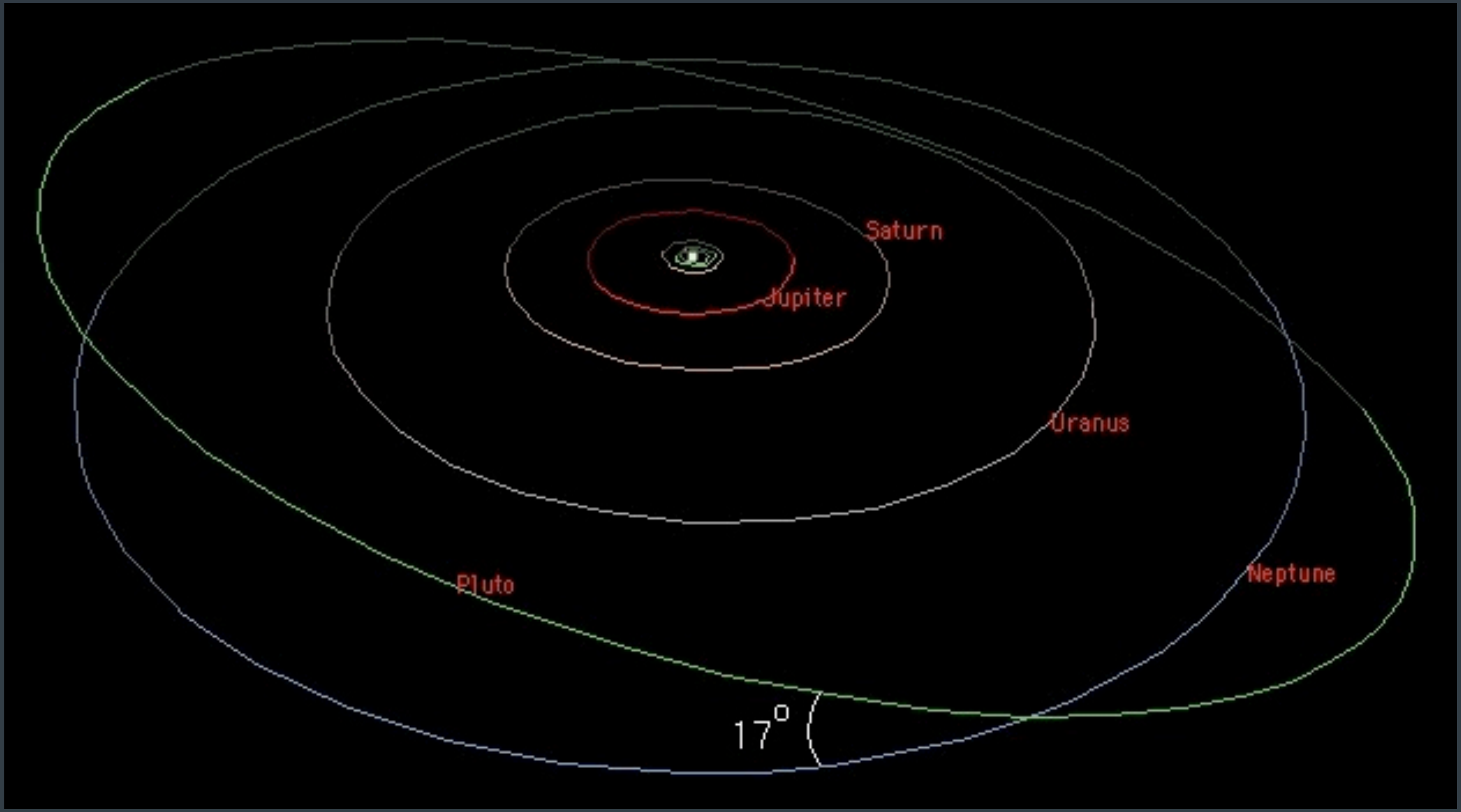
ASTR 1010

Lab 3: Planetary Orbits

Kepler's 1st Law: Elliptical Orbits

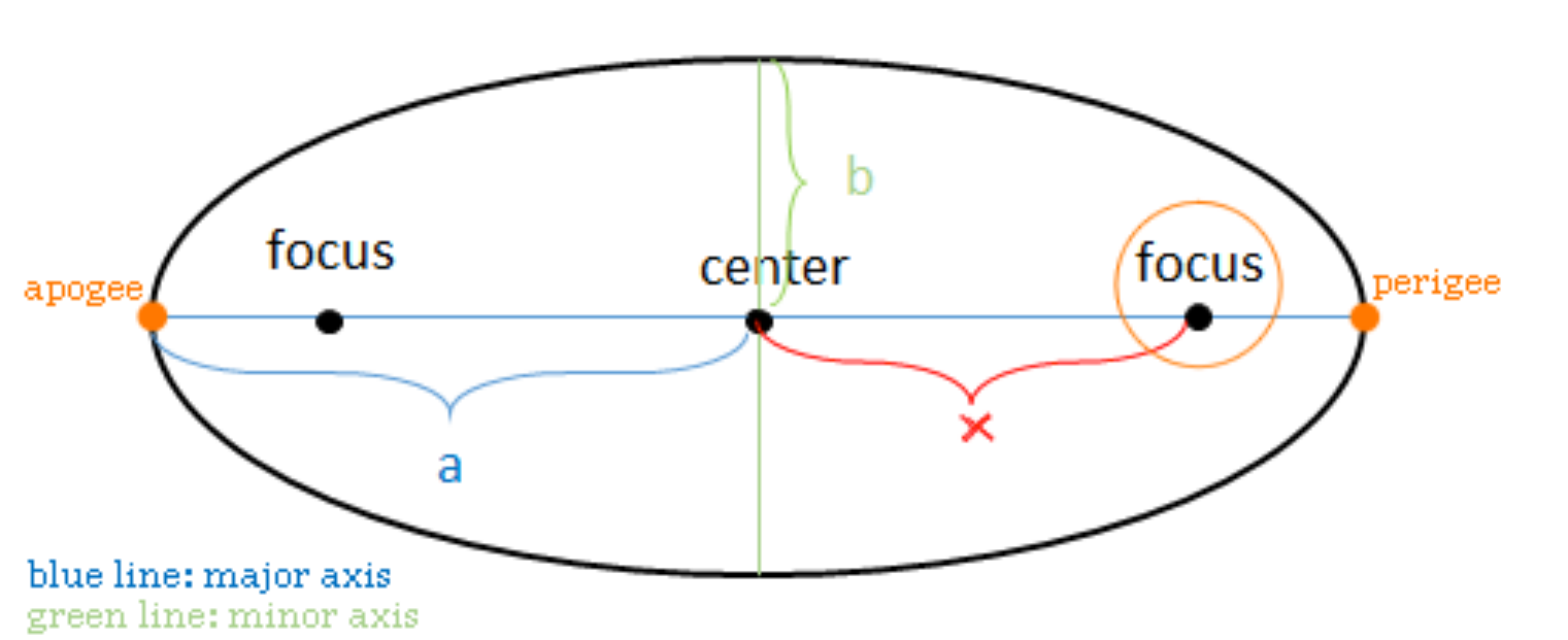
All planets and moons have elliptical orbits.



Parts of an Ellipse

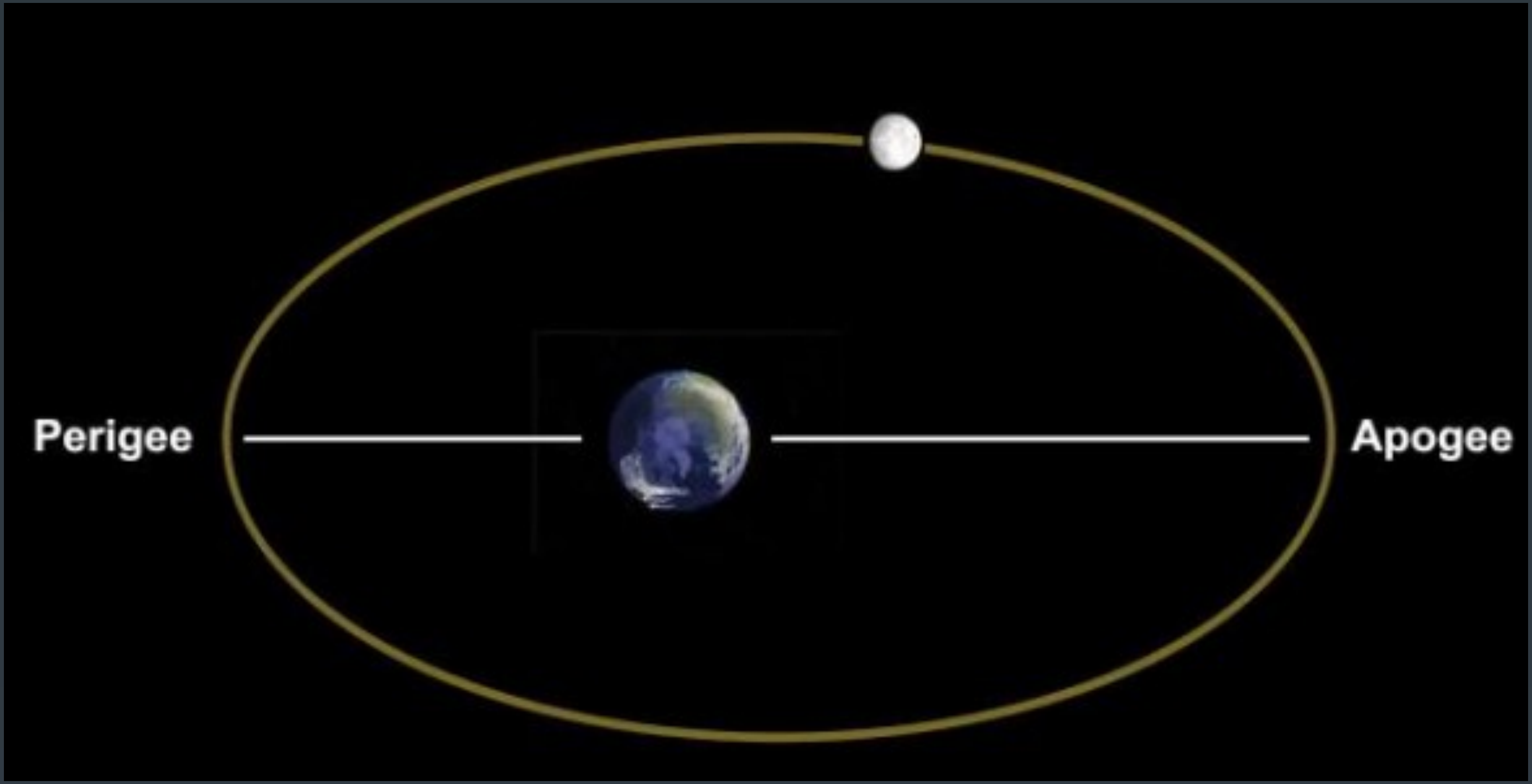
An ellipse looks like a squished circle. The long “diameter” is the major axis, and the short “diameter” is the minor axis. On either side of the center is a focus. The farther the foci are from the center, more squished, or eccentric, the ellipse is. The eccentricity of the ellipse is **e = x/a.**

If we pick one focus, we can define a **perigee** as the ellipse’s nearest position to the focus, and **apogee** as the ellipse’s farthest position from the focus.



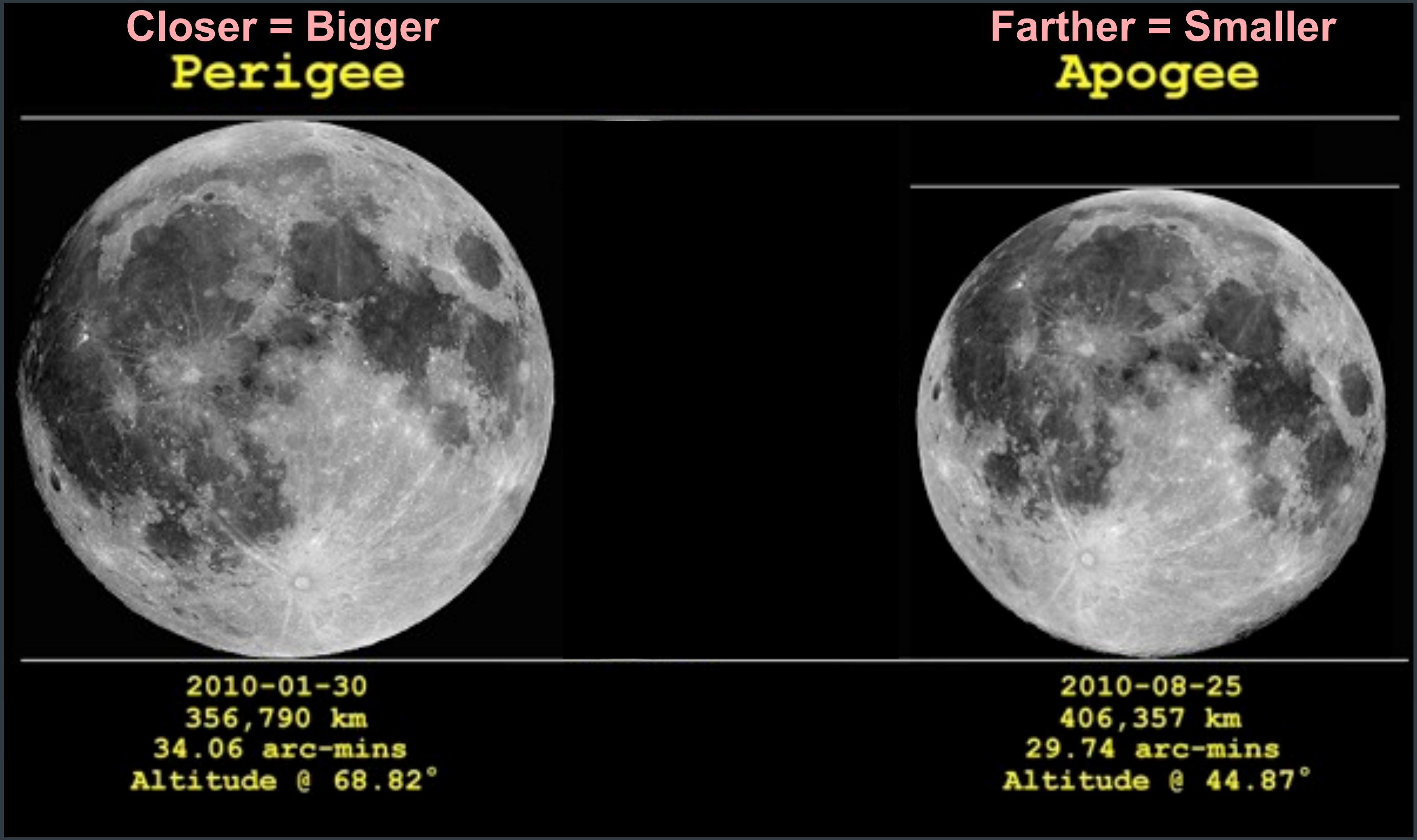
Moon's Elliptical Orbit

Let's apply our knowledge of ellipses to the Moon's orbit. The Earth is at a focus. When the Moon is closest, it's at perigee. When the Moon is farthest, it's at apogee. There's nothing at the center of the Moon's orbit, but the distance between the center of the Moon's orbit and Earth defines the eccentricity e = x/a.



How We Trace Moon's Orbit

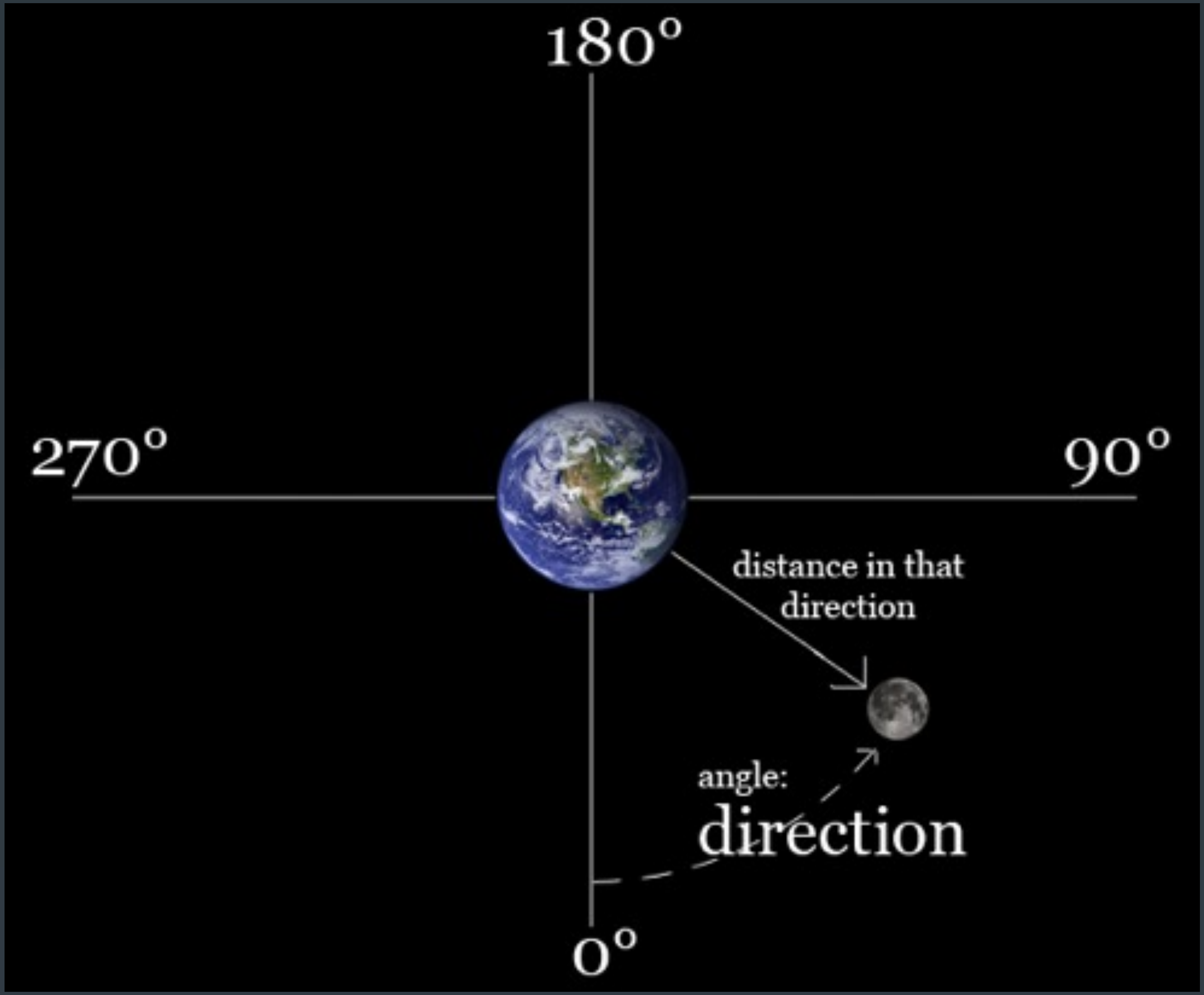
We know from the previous lab that from the Moon's phase, we can deduce the Moon's elongation angle (position relative to Earth along Moon's orbit). From the observed size of the Moon, we can tell when the Moon is closer or farther. It's not a big difference visually, but it IS measurable.



NOTE: Phase during perigee and apogee won't necessarily be full.

Polar Plot

From the position angle of the Moon in its orbit and its distance from you on Earth, you will plot the Moon's orbit around the Earth. You will then apply all the parts of an ellipse to the Moon's orbit. Notice it's not quite perfectly circular!



Fin