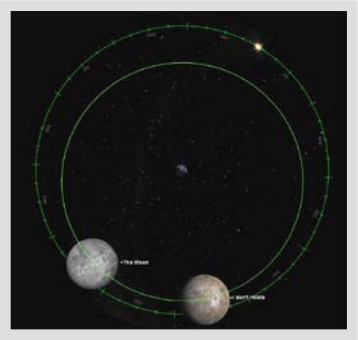
Classes

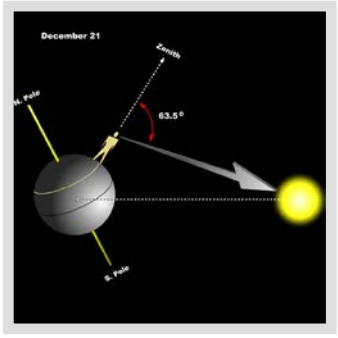


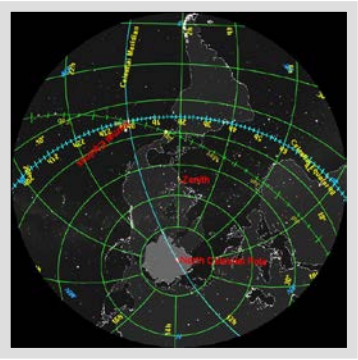
Moon

Why does the Moon phase? What time does New Moon set? What time does Full Moon rise? Does the Moon rotate? What would it look like if it didn't? Is the far side of the Moon the same as the near side? Why are they so different? What would the motion of the Earth look like from the near side of the Moon's surface?

Seasons

Why does the Earth experience seasons? What's the tilt of the Earth's axis got to do with anything? What is it tilted with respect to? Why does the Sun appear at different altitudes at different times of the year? What is insolation? What do the apparent daytime paths of the Sun look like at the solstices and equinox at 40° N latitude? At the equator? At the North Pole? At the Arctic Circle? At the South Pole? Why does the amount of daylight vary through the year at one location? Why do different latitudes experience different amounts of daylight?

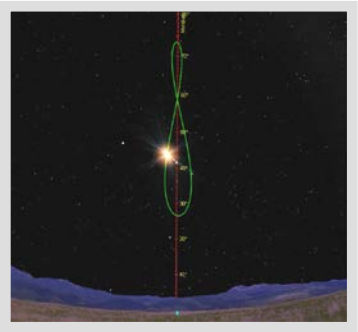




Coordinate Systems

What are coordinate systems, and why do we need them? What are degrees and where does that goofy sexagesimal system come from? Why use analogies to latitude and longitude for celestial coordinate systems? What is the altitude-azimuth system and what are its strengths and limitations? What are right ascension and declination and where do they originate? Why do RA and Dec work where alt-az does not for locating celestial objects at any time?

Mini Lessons

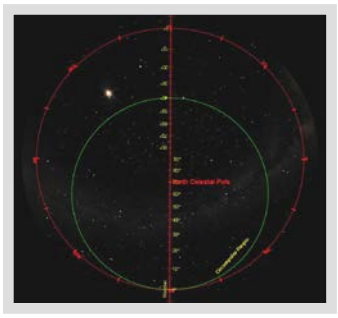


Analemmas

What is an analemma? What does it show, and what can we learn from its shape? (It turns out a ***very*** great deal!) What does its height, width and shape depend upon? What would it look like if the Earth's orbit were circular? More eccentric? What if the Earth had no tilt? What if it had no tilt and no eccentricity? What would analemmas look like from the other planets? What would they look like from other moons, say the moons of Neptune?

Circumpolar Constellations

Why are certain constellations circumpolar? What does it depend upon? What would the circumpolar region look like at different latitudes, say the equator? What about the North Pole or South Pole?

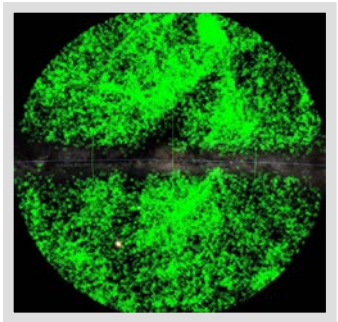


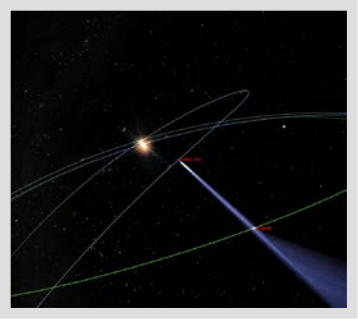
Dog Days

Where does the expression "Dogs Days of summer" come from? What is a helical rising of a star? This little scene comes in handy when discussing Canis Major and the Dog Star, Sirius.

Galactic Distribution

What can we determine from the galactic distribution of objects in the sky relative to the plane of the Milky Way? It turns out that different types of celestial objects are distributed differently within the Milky Way, and these positions give us vital clues as to their nature, age and composition. Associations, open clusters, emission nebulae, planetary nebulae, supernovae remnants, eclipsing binaries, globular clusters, galaxies and quasars are all illustrated.



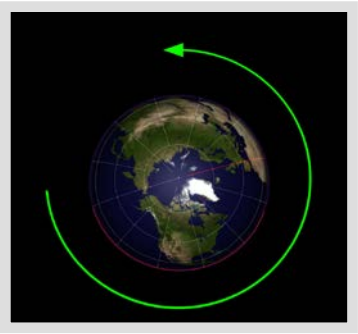


Halley 1910

Why was the apparition of Halley's Comet in 1910 so spectacular? This scene shows the Earth passing through the tail of the comet (killing all of its inhabitants) on May 19, 1910. Halley's 1986 apparition is contrasted to show why it was not nearly as exciting, and finally Comet McNaught (2006) is shown as an example of a highly inclined orbital visitor to the interior of the Solar System.

Insolation

Why does the angle of the Sun determine how much radiation the Earth's surface receives (insolation)? What else does the insolation depend upon (the shape of the incident surface)? This minilesson is also part of the Seasons class, but is included as a separate routine because of its usefulness in other contexts.

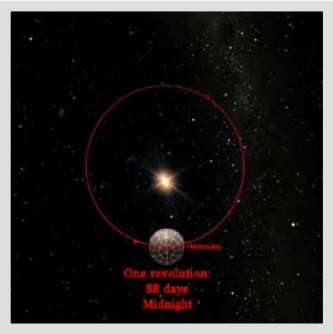


Magic Earth

At the North Pole, in what direction does the Sun appear to move in the sky during the day (CCW)? At the South Pole, in what direction does the Sun appear to move in the sky during the day (CW)? Why is there a difference? This minilesson shows how looking at the Earth from different views (above the NP compared to above the SP) makes the Earth appear to rotate either CCW or CW. This routine is also part of the Coordinate Systems lesson.

Mars Hoax

Did Mars appear as large as the Moon at that famous opposition of August 28, 2003? Why or why not? What exactly is an opposition, and why are some more favorable than others? Do we really have to wait 60,000 years for the next favorable opposition comparable to 2003? Exactly how large did Mars appear in 2003? Are you sick and tired of people asking you these questions that were triggered from the Internet?? This minilesson attempts to turn their interest into a learning experience.

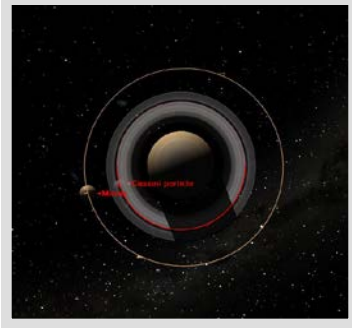


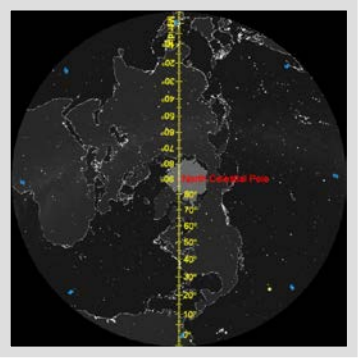
Mercury's Orbit

When watching the Sun's apparent motion from the Caloris Basin on Mercury, you notice that the Sun exhibits peculiar retrograde motion near the meridian. Why? What can this tell us about the orbit and rotation of Mercury? How long is the Mercury year? How long is a Mercury "day?" How can this unique apparent motion of the Sun be explained? You'll find out…

Mimas Resonance

The Cassini Division within Saturn's ring system is one of its most striking features. Why does this symmetrical paucity of ring material exist, and why does it occur exactly where it does? The relationship of the orbital periods of a hypothetical particle at the edge of the Cassini Division and Mimas tell the story.



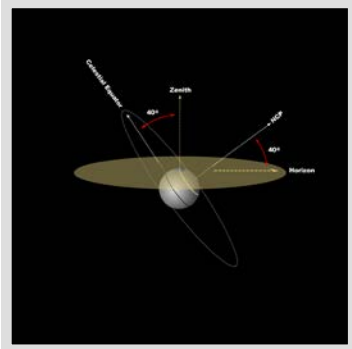


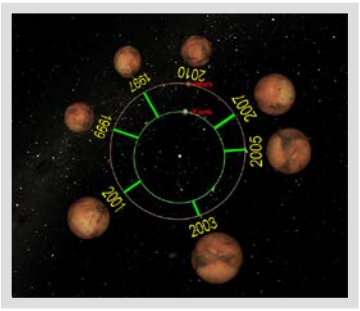
North Celestial Pole Altitude

What is the relationship between the altitude of the North Celestial Pole (NCP) and the observer's latitude? Why does this relationship exist? This minilesson carefully explains the reason and then investigates the altitude of the celestial poles as seen from the North Pole, equator and South Pole. Lots of fun!

North Celestial Pole Altitude Slides

What is the relationship between the altitude of the North Celestial Pole (NCP) and the observer's latitude? Why does this relationship exist? This set of images clearly breaks down the reason for this relationship. This set of graphics is also included within the North Celestial Pole Altitude minilesson, but is included separately for your convenience (in case you want to use it independently).



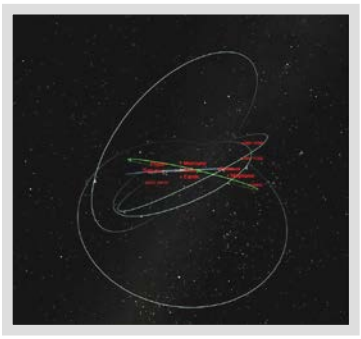


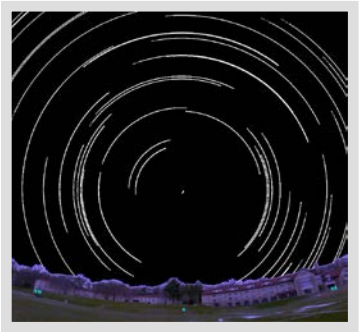
Opposition of Mars

What is meant by oppositions of Mars? Why are some more favorable for observing than others? This routine (included within the Mars Hoax minilesson as well) clearly demonstrates oppositions of Mars from 1997 to 2020 and indicates the varying distances between the Earth and Mars and the apparent size of Mars for each one.

Planet Definition

In August 2006 the International Astronomical Union voted to reclassify Pluto as a Dwarf Planet. Why was this done? What new discoveries in the outer parts of the Solar System in recent years led to this reclassification? This minilesson tries to show how the plane of Pluto's orbit is much more like the newly discovered Kuiper Belt object than the classical planets whose orbits lie close to the plane of the ecliptic.



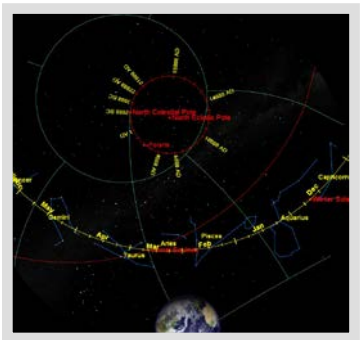


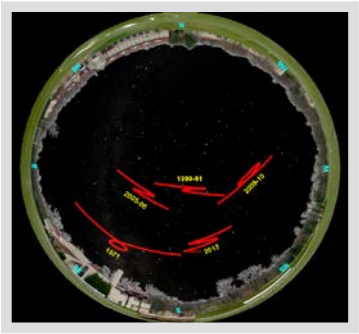
Polaris Stationary

Why does Polaris appear to remain mostly stationary in the sky as the Earth rotates? This minilesson demonstrates the motions of the sky through the night and then shows how the Earth's axial orientation to Polaris makes it the famous Pole Star.

Precession

Demonstrating that the Earth wobbles like a top is called precession and that the Earth's poles will describe circles in the sky with a period of ~26,000 years is straightforward. But can you easily demonstrate to your classes why the equinoxes also precess along the ecliptic because of this motion? I couldn't either, so I developed this very cool scene which clearly illustrates what's going on.



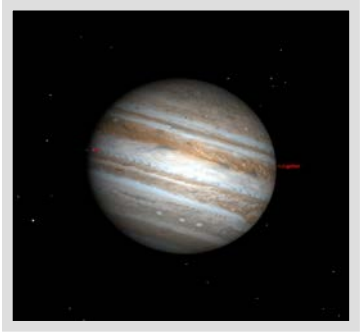


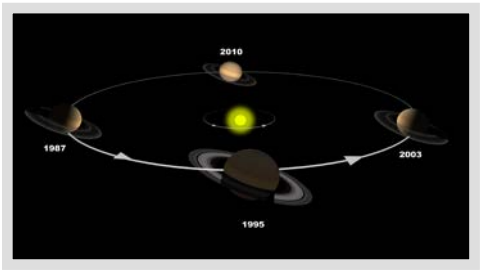
Retrograde of Mars

Teaching the retrograde of planets is standard fare in nearly all planetariums. But why, for example, does Mars exhibit several different shaped retrograde paths? And what does opposition have to do with it? The various shapes are explored in detail with the help of two artificial Mars-like planets.

Roemer's Method

Surely the first determination of the speed of light (and also the first evidence that it had one!) deserves some attention, especially since it was done astronomically. Ole Roemer's method of explaining the varying eclipse timings of Jupiter's moon Io is clearly demonstrated in this high school/college level minilesson, and a very precise measurement of the speed of light can be determined.





Saturn's Aspects

Because of the 25° tilt of Saturn's rotational axis, we see differing aspects of its ring system in its 29-year sidereal period. This minilesson shows this graphically, but introduces some unexpected motions which the students are encouraged to figure out.

Scorpio's Claws

If the term "zodiac" literally means "zone of the animals," then what is a weighing scales (Libra) doing in it? And why are the two brightest stars in Libra called the Northern and Southern Claws? This minilesson helps you explain this mystery so that your audience can sleep better at night.

Solar System Scale

In nearly every live planetarium presentation I use this short but very effective demonstration of the relative sizes of the planets to each other and the Sun. I guarantee that your audiences will gasp when the Sun comes on, no matter how smart they are.

Stonehenge

It's always fun to show the Sun rising over the Heel Stone in Stonehenge on December 21, the winter solstice for the Northern Hemisphere. This scene has everything all set for this event, with the Sun placed exactly over the Heel Stone. (But can you explain why precession doesn't affect the azimuthal rising of the Sun through the ages?)