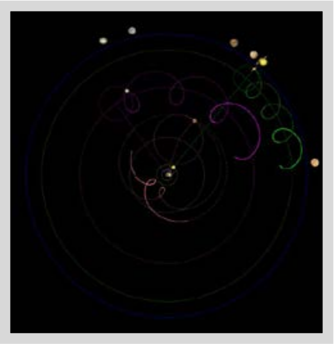
Minilessons

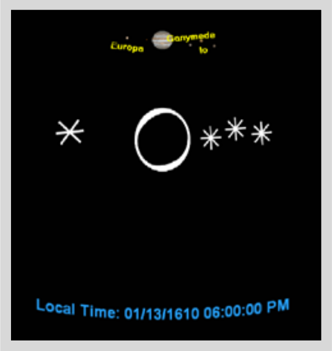


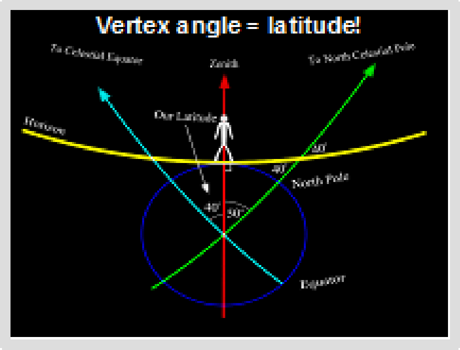
Epicycles*

The Ptolemaic geocentric system is a nightmare, but ingenious in attempting to save the model. What systematics inherent within this system should have been warning signals that the model assumed too much and couldn't explain the fundamentals of why Mercury and Venus hovered around the Sun. Why did the epicyclic radii of Mars, Jupiter and Saturn always parallel the line connecting the stationary Earth to the Sun? This interactive recreation of the basics of the Ptolemaic system allows students to discover for themselves the issues that this system should have flagged and hence teach them to question an authority whose only defense is ***"It has to be that way to make the model work!"***

Galilean Moons

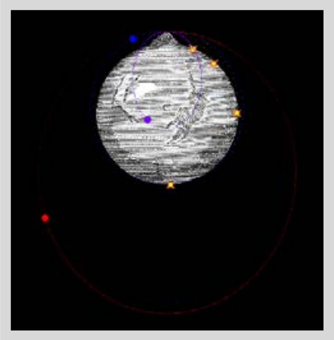
Was Galileo a good observer? How restricted was he by the poor optics of his primitive telescopes? By comparing the sketches from his popular book ***Sidereus Nuncius*** to computer generated placements of Jupiter's four largest moons, we can directly compare each night of his observations and through them see for ourselves just what limitations he was working under and what an excellent observer he actually was!





North Celestial Pole (NCP) Altitude

Why is the North Celestial Pole always at the altitude which is equal to the observer's latitude? When confronted with the diagram at left it seems like an impossible conundrum. But, by taking this diagram apart and placing the pieces step by step in a logical progression, the audience can actually see how this fantastic navigational asset actually makes sense.

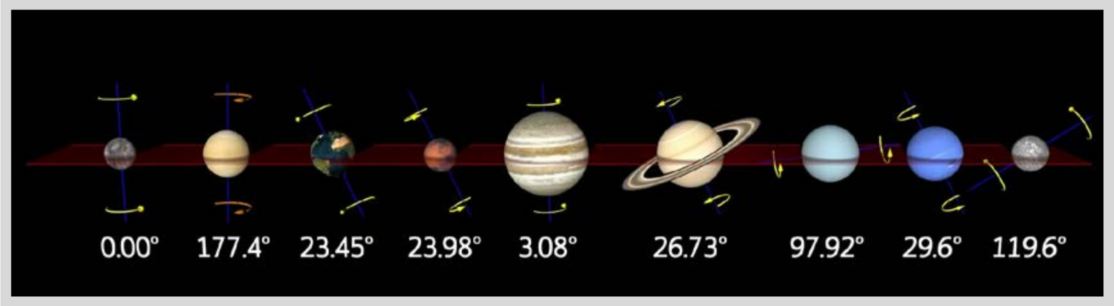


Newton's Mountain*

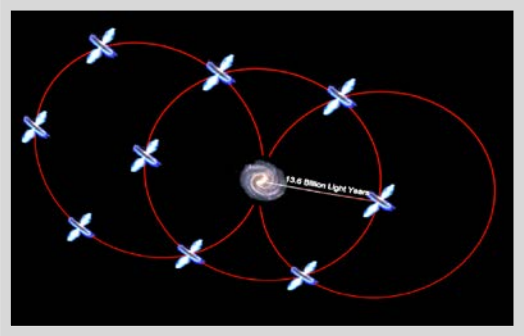
What actually is an orbit? How can the force of gravity cause things to orbit when in reality it always causes things to fall? Using Newton's original diagram of a cannon on top of a super high mountain, this interactive program allows the audience to experiment with different initial velocities to see just what it takes to make an object finally fall around the Earth. A unique feature of this program also demonstrates that the trajectories which strike the Earth's surface were actually just parts of ellipsoidal orbits trying to orbit the center of the Earth, but the Earth's surface got in the way!

Planetary Tilts

This fantastic video by Steve Sanders beautifully illustrates the various planetary tilts and rotation rates found in the Solar System. It dynamically compares the axial tilts and rotations and should prompt questions like "Why are four of the planets' tilts so close to 25 degrees?"



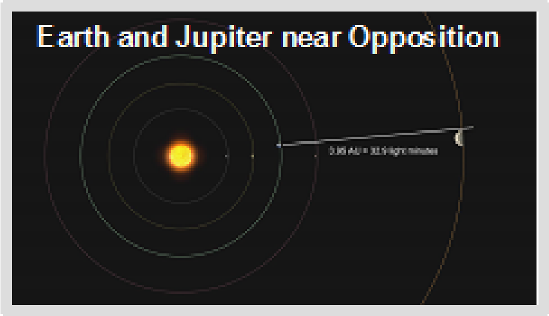
Quasars Fulldome

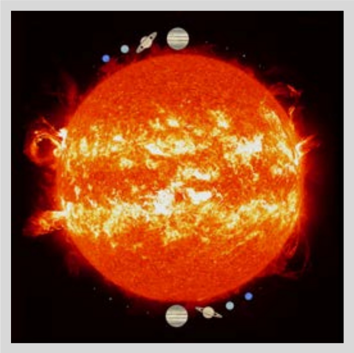


The awareness of what quasars actually represent and that their locations are only at ***great*** distances from the Milky Way are used to illustrate one of the great cosmological principles, namely that the universe looks the same no matter where you reside within it. I love to blow my audience's minds when they realize that the Milky Way probably looks like a quasar from the quasar's point of view!

Roemer's Method revised

Ole Roemer's estimate of the speed of light from the observations of Jupiter's moon Io remains one of the great discoveries in astronomy. We recreate his observations of Io emerging from the shadow of Io in 1676 and calculate an extremely accurate value for the speed of light from just a few measurements!



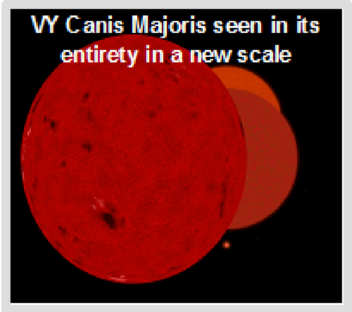


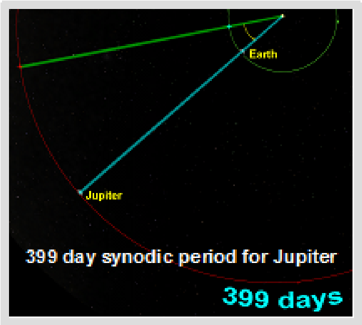
Solar System Scale revised

One of the most utilized minilessons in the Fulldome Curriculum, this classic comparison of Solar System bodies has been improved with higher resolution graphics and better images. We still always hear gasps of unbelief when the Sun is finally displayed compared to the planets!

Stellar Sizes revised

A new graphic has been added to the end of this classic minilesson which shows (arguably) the largest known star in the Milky Way in its entirety (VY CMa) to further emphasize how incredibly large it is compared to the other stars.



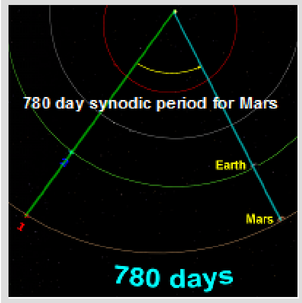


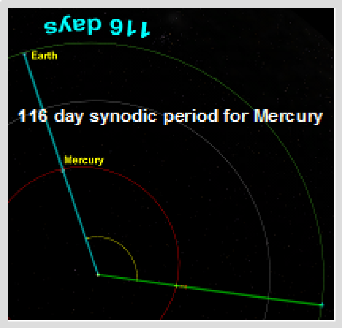
Synodic Period of Jupiter

Just how did Copernicus unravel the motions of the planets and discover for the first time their sidereal planets around the Sun? This minilesson clearly allows the audience to discover his method for the planet Jupiter and the one "confusing" realization is soon shown to be perfectly rational. But it took a Copernicus to see it!

Synodic Period of Mars

How did Copernicus unravel the motions of the planets and discover for the first time their sidereal planets around the Sun? This minilesson clearly allows the audience to discover his method for the planet Mars and the one "confusing" realization is soon shown to be perfectly rational. But it took a Copernicus to see it!



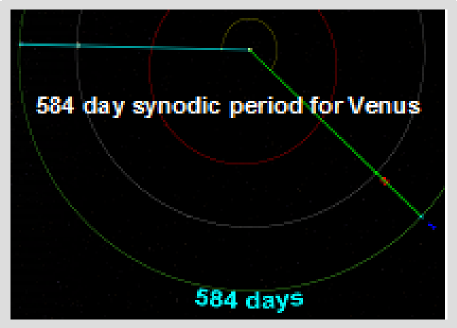


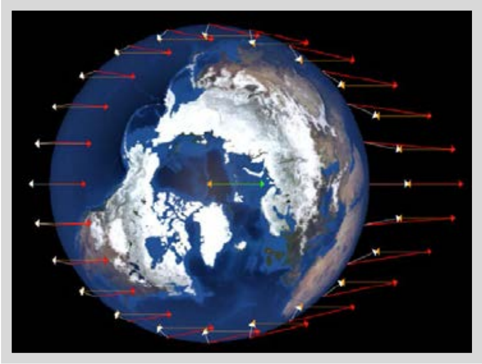
Synodic Period of Mercury

How did Copernicus unravel the motions of the planets and discover for the first time their sidereal planets around the Sun? This minilesson clearly allows the audience to discover his method for the planet Mercury and the one "confusing" realization is soon shown to be perfectly rational. But it took a Copernicus to see it! The contrast to determining the synodic periods of inferior planets as compared to superior planets will also be seen.

Synodic Period of Venus

How did Copernicus unravel the motions of the planets and discover for the first time their sidereal planets around the Sun? This minilesson clearly allows the audience to discover his method for the planet Venus and the one "confusing" realization is soon shown to be perfectly rational. But it took a Copernicus to see it! The contrast to determining the synodic periods of inferior planets as compared to superior planets will also be seen.



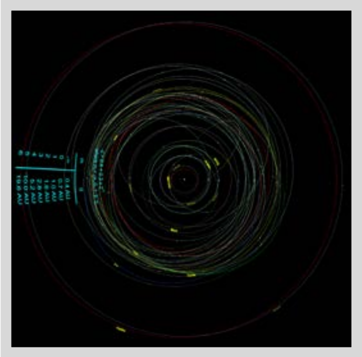


Tides*

One of the most difficult concepts to teach is how the Moon is the major cause of tides. This fact was known throughout antiquity, but the mechanism for it and especially why there were two high tides associated with the Moon's pull was not understood until Newton. This interactive program allows the audience to be taken step by step through what vectors are and then to graphically represent the differential gravitational force of the Moon on the Earth. Even the fact that the two high tides are <u>not</u> the same height is illustrated in this minilesson.

Titius Bode Rule

Why is there a seeming mathematical relationship between the sizes of the orbits within the Solar System as demonstrated by Titius and Bode? Is this geometrical oddity revealing some intrinsic resonance for the positioning of the planets and asteroid belt, or is it a coincidence? This minilesson attempts to succinctly lead the audience through the history of the Titius-Bode Rule so that they can decide for themselves.



Watery Constellations

Did you ever wonder why there are so many constellations in the part of the sky which has been sometimes been designated as "The Sea?" Is this a coincidence or was there a logical reason why the ancients associated this region with the seas? The reason will delight your audiences!

* - These programs require purchase because of the many years of work which went into their development and implementation. They can be ordered and downloaded for installation into your SciDome by going to the following link:

https://www.spitzinc.com/blog/astrophysics-apps-for-scidome/