A Brief Overview of the Curriculum - Volume 2

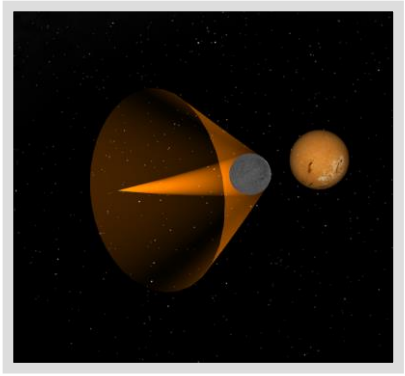
Classes

Boy Scout Astronomy Badge

This comprehensive show includes coverage of a significant portion of the requirements for the Boy Scout Astronomy Merit Badge. Approximately 75-minutes in length, it contains many elements which we present at Eastern University to the majority of our visiting school groups. From light pollution, why the sky moves as it does, why Polaris doesn't move, constellations, the Moon and phases, how to find the ecliptic and hence planets, and finally, describing the Milky Way and our place within it and its place within the universe, this class almost does everything required for an astronomy overview. There are many sections of this class that you may want to use in your own presentations.

Eclipses

This class teaches the fundamentals of eclipse shadows and then proceeds to illustrate why we don't have eclipses every month (really every two weeks!). It then concludes with examples of a solar eclipse observed from in the path of totality and just outside of it, an annular eclipse and finally a total lunar eclipse. It assumes that the very basics of the conditions required for eclipses have been covered before coming to the planetarium, namely, that in order to have eclipses the Moon must be New for a solar eclipse and Full for a lunar eclipse. Beyond that nearly everything else is covered in depth in this class.

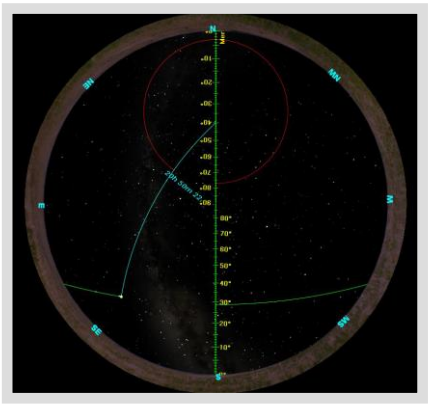


Planet Locations

This particular class is one that excites me tremendously because my students achieve a profoundly better understanding of why the planets appear in the sky as they do. This class endeavors to teach how, by simply observing the positions of the planets in the sky just after sunset, to plot their positions in their orbits around the Sun. The time spent in learning this skill is, in my opinion, truly life changing as it relates to how people visualize the Solar System!

Time and Timekeeping

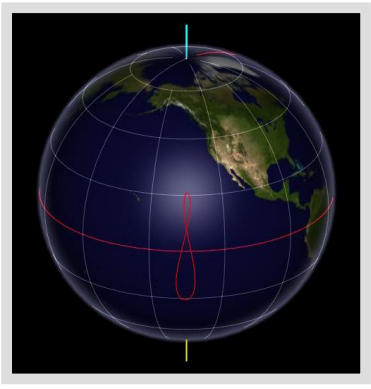
This comprehensive class actually is comprised of a "main" program (cue file) which calls six subprogram minilessons in a logical teaching order. This class consists of presenting the following minilessons: Sidereal Days, Hour Angle, Sidereal Time, Time LAST (Local Apparent Solar Time), Time LMST (Local Mean Solar Time) and Time Zones and the International Date Line. These concepts are typically not understood by many and my hope is that by carefully working through these minilessons that people will thoroughly understand how we determine time and the ***many*** complications that arise because of our relying on the position of the Sun as our time standard!

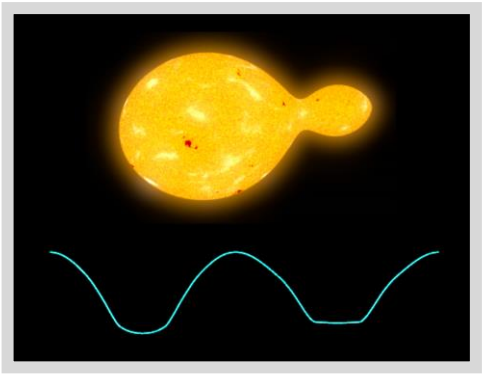


Minilessons

Analemmas – Part Deux

Starry Night has the unique ability to project accurate and to scale analemmas on the planets in the Solar System. This minilesson presents all the planets that have solar days less than their sidereal year and attempts to explain what each pattern means relative to the planet's axial tilt and orbital eccentricity. The old Earth globe makers would be proud!





Eclipsing Binaries

As a binary star astronomer, I love eclipsing binaries, and now you will too! This minilesson thoroughly explores the mysteries of these systems, their light curves and peculiar orientations, and then gives unique three-dimensional (accurate and to scale!) rotating models (thanks to Steve Sanders) of some of the most interesting types! Since more than 50% of all stars in the skies are multiple star systems and they're the only way that we can determine masses for stars, eclipsing binaries are of paramount importance in astronomy!

Ecliptic Slides

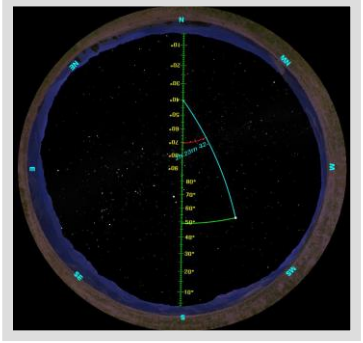
The concept of the plane of the Earth's orbit (the Ecliptic) is one of the most crucial concepts that we teach in the planetarium. This series of slides clearly demonstrates one way of helping your audience to locate the ecliptic at any time of the year! You just have to be able to find Draco and have a pair or arms… ☺

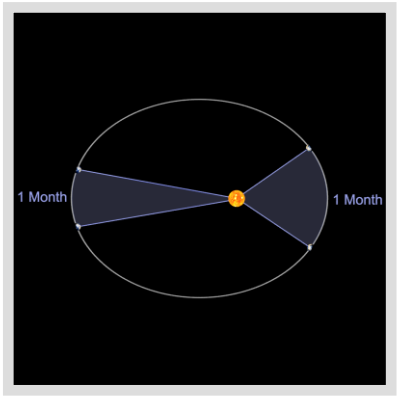
Halley 1910 Ride Through the Inner Solar System

As we taught Volume 1 of the Curriculum, the Earth actually passed through Halley's Comet's tail in 1910. In this minilesson, we watch the comet's movement through the solar system from the perspective of Halley itself – as if we're "riding" with it on its Journey around the sun. A comet visualization shows the slowly rotating and "spitting" nucleus as it winds its way into our neighborhood. The visualization was inspired by Keith Johnson (Rowan University). Eastern University's Steve Sanders created a realistic comet nucleus animation to enhance the ***Starry Night*** simulation.

Hour Angle

One unique teaching tool of Starry Night is its ability to project hour angles for any celestial object. Hour angles are the basis for all of our time systems, and the thrust of this minilesson it to clearly understand exactly what an hour angle is. This presentation lays the groundwork for all the subsequent lessons on Time and Timekeeping.

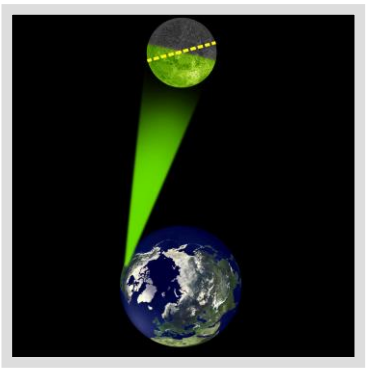




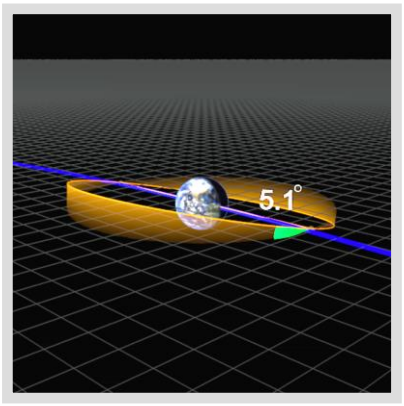
Kepler's Second Law

This straightforward series of slides illustrates the principles behind Kepler's Second Law. It constructs, piece by piece, the necessary elements to help your audience understand what's going on with the Law of Areas.

Lunar Librations



Using ***Starry Night's*** ability to create artificial worlds, this minilesson carefully investigates the commonly misunderstood phenomenon of Lunar Libration. Each contributor to libration is carefully observed and then, with help from the audience, subtracted out of the Moon's motions until we end up with a Moon with no librations at all! This straightforward presentation really helps to demystify a topic which goes largely untaught simply because it has been difficult to present…until now.

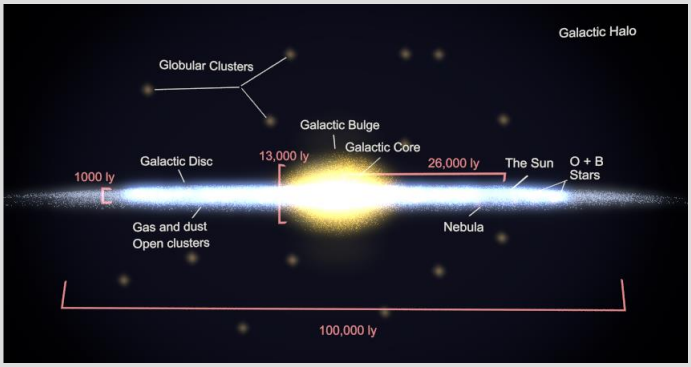


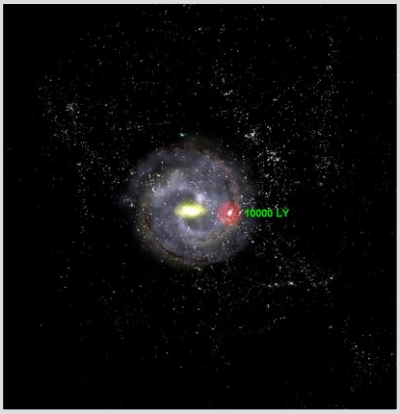
Lincoln Almanac Trial

This is one of my most popular planetarium presentations! Based upon the research of Dr. Don Olson, this lesson carefully outlines how Lincoln's most famous case as a trial lawyer was based upon the position of the Moon and how its extraordinary circumstances for the night of a murder were only recently shown that proved Lincoln was telling the truth in the defense of his client! In the process of this mystery your audience will be fooled into actually learning all kinds of great information about the Moon and its orbital characteristics. Who ever thought the regression of nodes could be such an understandable and intriguing phenomenon?

Milky Way cross section

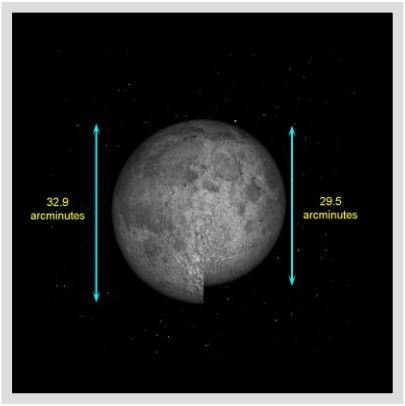
This minilesson, originally part of the Boy Scout Astronomy Badge class, is an excellent way to present the structure and shape of our galaxy. Beginning with an animation to show its spiral shape, it then presents itself as a flattened disk which finally leads to several overlays depicting it major features.





Milky Way zoom

Also part of the Boy Scout presentation, this cool routine starts from the Sun and zooms out, distance spheres marking your way, until you can see the Milky Way in all its glory! After flying around it, the zoom continues until it encompasses the entire Starry Night database out to 1 billion light years.

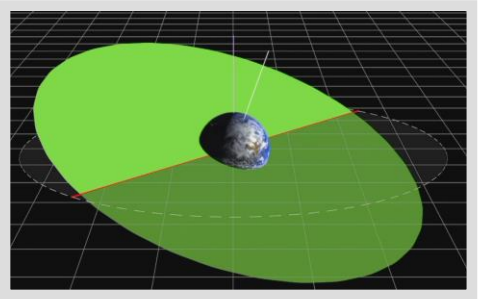


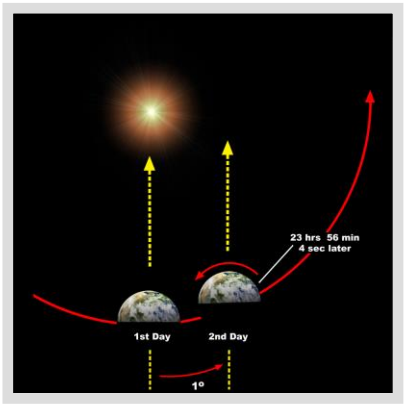
Perigee and Apogee of the Moon

This minilesson demonstrates how the Moon's orbit differs from a circle and then shows how the different distances from Earth affect its apparent size in the sky. It includes a clear visualization showing the diameters of the perigee and apogee moons, artificially superimposed as a single slide, presenting a clear difference in their apparent sizes.

Precession Part Deux

This slightly modified version of Volume 1's Precession minilesson features Steve Sanders' fantastic animation which, taken by itself, clearly demonstrates why the precession of the Earth's axis causes both the equinoxes to regress as well as the pole star to change through the ages. This concept was always lost on my college students until they saw this animation!



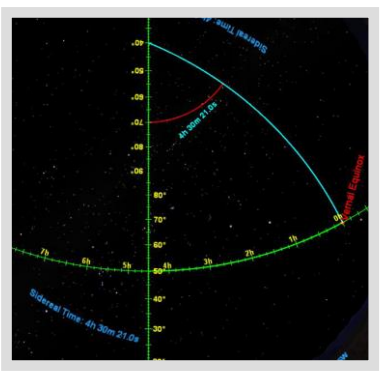


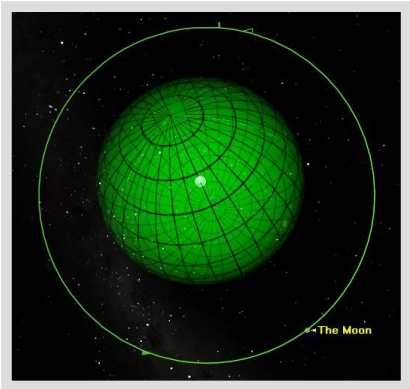
Sidereal Days

The Sidereal Day is carefully defined and contrasted to the Solar Day and then these differences are clearly demonstrated in the planetarium.

Sidereal Time

Sidereal Time is defined and demonstrated. The ability to locate objects based upon their Right Ascension and the Local Sidereal Time is then explained and two examples are shown.



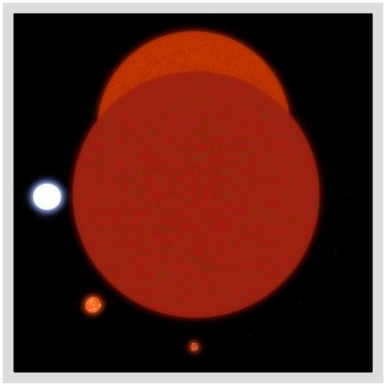


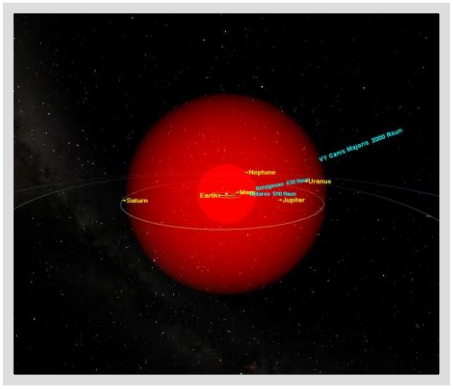
Speed of Light

Using ***Starry Night's*** time-variable Radio Sphere, a simple but effective demonstration of the true speed of light is shown, first relative to the Moon's orbit and then to the size of the inner portion of the Solar System.

Stellar Sizes

I use this minilesson in almost <u>all</u> of my school presentations, from 4-years olds through adults. It graphically depicts the sizes of stars from white dwarfs to red supergiants.



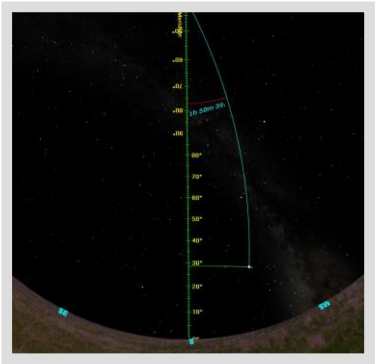


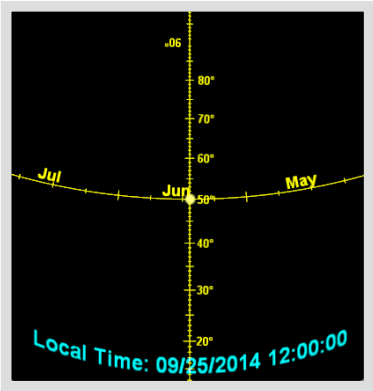
Stellar Sizes – 3D Spheres

A compelling way to use the Distance Spheres capability of Starry Night is to create scale models of stars and compare them to the size of the Solar System. This minilesson takes the same stars from the regular Stellar Sizes minilesson and creates them with Distance Spheres. This way your audience can compare planetary orbits with the stars. The size of the supermassive black hole located at the center of the Milky Way is also depicted (just to freak people out).

Time – Local Apparent Solar Time

The definition of Local Apparent Solar time is carefully introduced and then several examples are shown.



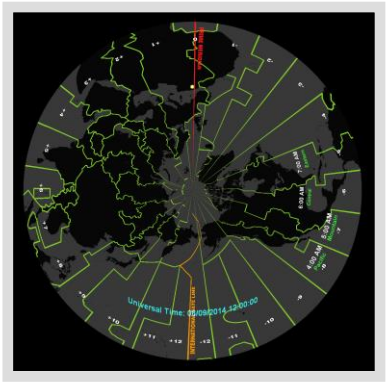


Time – Local Mean Solar Time

The actual Sun is shown to be an inaccurate clock and why it's inaccurate is carefully demonstrated. In this analysis, which makes use of the analemma, the audience is coached into understanding that a "better" Sun could be had if the Earth's orbit had no eccentricity and the Earth had no axial inclination. Through these investigations the Mean (or Average) Sun is discovered.

Time Zones

The last minilesson in the Time series, the need for time zones is presented and the perfect solution is then contrasted with the human solution of wacky time zones! The rationale for the International Date Line is also presented and its reason for being is carefully explained.



US History – Boston

Based on the superlative work of Dr. Don Olson from South Texas University, this minilesson discusses some of the astronomical occurrences during the Boston Massacre, the Boston Tea Party, and Paul Revere's Ride. In addition to teaching some of the history of the events which led to the American Revolution, this presentation helps to answer some of the intriguing questions like "Was Paul Revere's woodcut of the Boston Massacre really accurate or just propaganda?", "Why was the tide so low on the night of the Tea Party?" and "How did the nearly full Moon nearly doom Paul Revere's ride before it even got started?"