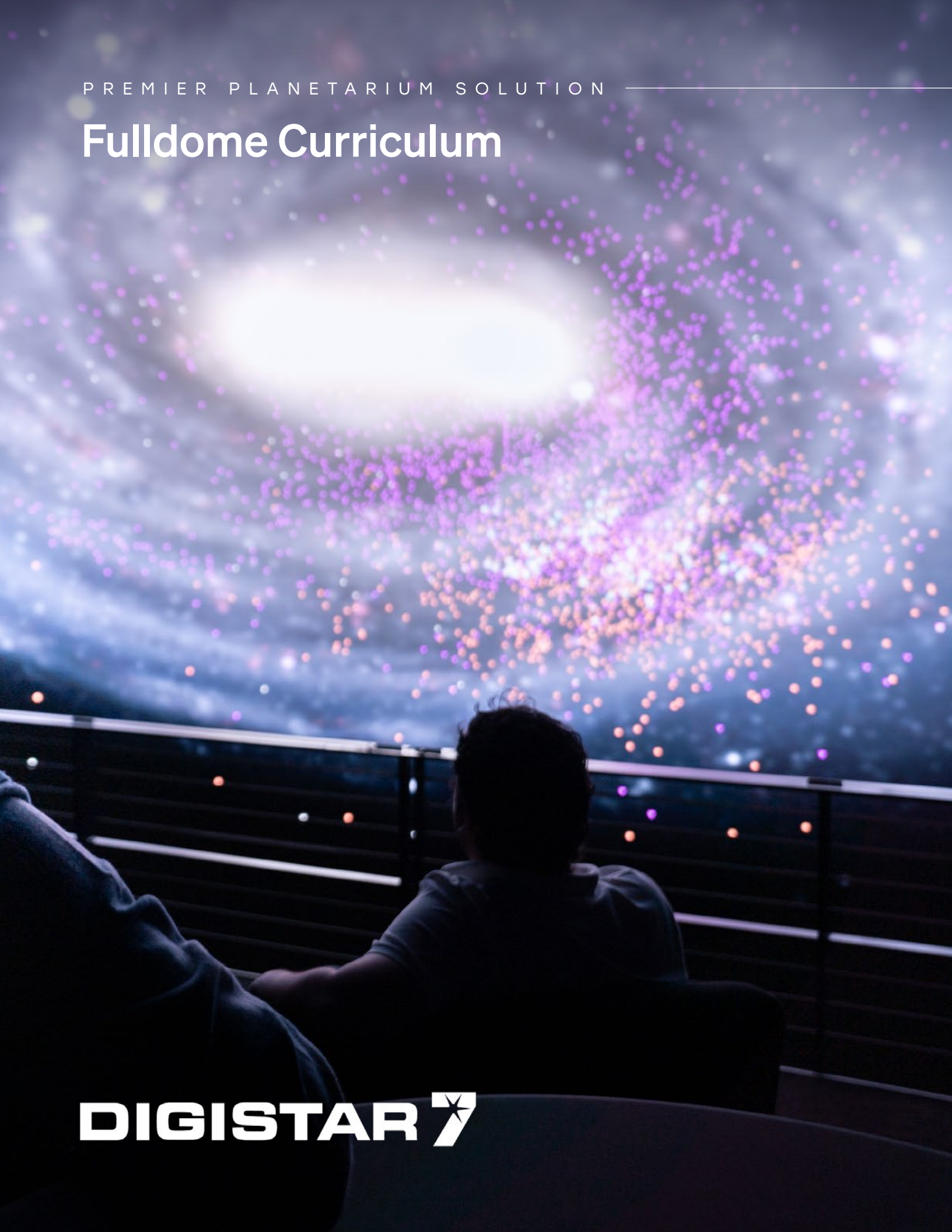
PREMIER PLANETARIUM SOLUTION

Fulldome Curriculum



DIGISTAR 7

Igniting Curiosity in the Universe

With a rich history spanning almost two decades, Dr. David Bradstreet's Fulldome Curriculum has evolved from a passion project into an extensive collection of over fifty captivating lessons. Designed specifically for planetariums, these lessons offer an unparalleled opportunity to explore and illuminate astronomical concepts in a truly remarkable manner. Originally crafted to enhance Dr. Bradstreet's astronomy courses at Eastern University in St. Davids, Pennsylvania, this curriculum harnesses the immersive potential of the planetarium, equipping presenters and educators with an exceptional array of tools for delivering impactful dome-based instruction.

1. MOON

This comprehensive overview of the Moon discusses its phases, patterns and motions, and the discrepancies between its near and far sides when looking at our satellite from Earth. This lesson also explores what the motion of Earth would look like from the near side of the Moon's surface, Moon risings, and more.

2. SEASONS

This lesson provides a comprehensive understanding of the Earth's seasons and related concepts. It demonstrates the causes of seasonal changes, the impact of Earth's axis, insolation, and the reasons for the variation in daylight hours at a single location and across different latitudes. By exploring these concepts, viewers will gain a deeper understanding of the intricate systems that govern our planet.

3. COORDINATE SYSTEMS

This lesson delves into the fundamentals of coordinate systems and how they came to fruition. It focuses on the concept of degrees, the origins of the sexagesimal system, the altitude-azimuth system, and why analogies to latitude and longitude are commonly used for celestial coordinate systems. This course explains why Right Ascension and Declination are effective in locating celestial objects at any time, whereas alt-azimuth is not. By studying these concepts, viewers will develop a firm grasp of the coordinate systems used in astronomy and understand their significance in navigating the universe's celestial objects.

4. 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 elements on light pollution, why the sky moves as it does, why Polaris does not move during the night, constellations, the Moon and phases, and how to find the ecliptic and hence planets. Providing a broad overview of astronomy, the course also describes the Milky Way and Earth's place within the galaxy and the universe.

5. PLANET LOCATIONS

This lesson provides a better understanding of why the planets appear in the sky as they do. It endeavors to teach how to plot the positions of planets in their orbits around the Sun by observing the planets' positions in the sky just after sunset. The time spent learning this skill is valuable as it relates to how people visualize the Solar System.

6. U.S. HISTORY BOSTON

This mini-lesson highlights several astronomical events during the Boston Massacre, the Boston Tea Party, and Paul Revere's Ride. Along with providing historical insights into the events that led to the American Revolution, this lesson answers intriguing questions like the accuracy of Paul Revere's woodcut of the Boston Massacre and the reason behind the low tide on the night of the Tea Party. It also explores how the almost full moon nearly doomed Paul Revere's ride before it even began.

Mini Lessons - Shorter, more specialized topics designed to be dropped into larger discussions. Some can be as short as 5 minutes or are just video representations of astronomical phenomena.

1. ANALEMMAS

This lesson focuses on analemmas and what we can learn from their shape. It covers the anatomy of an analemma and the factors that determine the height, width, and shape, as well as how the appearance would change if Earth's orbit were circular, or more eccentric, or had no tilt. The course also delves into the appearance of analemmas from other planets and moons, such as the moons of Neptune.

2. CIRCUMPOLAR CONSTELLATIONS

Explore circumpolar constellations and the factors that determine their visibility in the night sky. Examine the factors that influence which constellations are circumpolar and learn about the appearance of the circumpolar region at different latitudes, such as the equator, the North Pole, and the South Pole. The course additionally reveals how the visibility of circumpolar constellations changes with the observer's position on Earth.

3. DOG DAYS

Delve into the origin of the expression "The Dog Days of Summer" and the astronomical phenomenon that inspired it. It explores the science behind the helical rising of a star and covers the role of Canis Major and the Dog Star, Sirius.

4. ECLIPTIC SLIDES

This series of slides demonstrates the concept of the plane of Earth's orbit (the ecliptic) and teaches how to locate the ecliptic at any time of the year. This is one of the most crucial concepts taught in planetariums.

5. HALLEY 1910

This mini-lesson focuses on Halley's Comet and its various apparitions throughout history. The spectacular scene of the Earth passing through the trail of the comet on May 19, 1910 is presented, along with an explanation of why this contributed to the comet's heightened visibility. The 1986 apparition of Halley's Comet is contrasted with 1910s, and the reasons for its comparative lack of excitement are discussed. It also presents Comet McNaught's highly inclined orbit as an example of a visitor to the inner Solar System.

6. INSOLATION

This mini-lesson, which is also part of the Seasons class, explores the relationship between the angle of the Sun and the amount of radiation (insolation) received on the Earth's surface. It explains why the amount of radiation received on a given area of the Earth's surface depends on the angle at which the Sun's rays strike it, while also discussing the effect of the shape of the incident surface on the amount of insolation received.

7. KEPLER'S SECOND LAW

This straightforward series of slides illustrate the principles behind Kepler's Second Law and constructs the necessary elements in detail to help audiences understand the premise of the Law of Areas.

8. LINCOLN ALMANAC TRIAL

This mini-lesson examines the connection between Abraham Lincoln's most famous case as a trial lawyer and the position of the Moon. It highlights the research conducted by Dr. Don Olson, who demonstrated that the circumstances of the Moon on the night of a murder helped prove Lincoln's client was innocent. The lesson not only discusses the historical significance of the case, but also uses it as a platform to teach about the Moon's orbital characteristics, including the regression of nodes. Through this historical mystery, audiences also learn about astronomy in an engaging and entertaining way.

9. MAGIC EARTH

This lesson explores the movement of the Sun at the North and South Poles as well as examines the direction in which the Sun appears to move in the sky during the day at each pole and why there is a difference. It covers the concept of perspective and how viewing the Earth from different angles can affect perceptions of its rotation. This lesson is also part of the Coordinate Systems curriculum.

10. MARS HOAX

This lesson focuses on the topic of the 2003 opposition of Mars and the misconceptions surrounding it while exploring the factors that determine the size and appearance of Mars during an opposition and the concept of opposition itself. It covers reasons why some oppositions are more favorable than others and the time frame for the next favorable opposition comparable to 2003.

11. MERCURY'S ORBIT

The intriguing apparent retrograde of motion of the Sun when observed from the Caloris Basin on Mercury is explored in this lesson. It covers the factors that cause this peculiar motion and how it provides insights into the orbit and rotation of Mercury. It also delves into the length of the Mercury year and day, how they differ from those of Earth, and the unique apparent motion of the Sun and the explanation behind it.

12. MIMAS RESONANCE

This lesson covers the Cassini Division with Saturn's ring system, remarkable for its symmetrical absence of ring material. It explains why this exists and why it occurs precisely when it does, and explores the relationship between the orbital periods of a hypothetical particle at the edge of the Cassini Division and Mimas.

13. NORTH CELESTIAL POLE ALTITUDE

In this lesson, the relationship between the altitude of the North Celestial Pole (NCP) and the observer's latitude is explored. Including the unique characteristics of each location and how they affect the altitude of the celestial poles as seen from the North Pole, equator, and South Pole.

14. NORTH CELESTIAL POLE ALTITUDE SLIDES

In this lesson, the relationship between the altitude of the North Celestial Pole (NCP) and the observer's latitude is explored. This set of images breaks down the reason for this relationship and is also included in the North Celestial Pole Altitude mini-lesson

15. OPPOSITION OF MARS

Audiences will discover the meaning of "oppositions of Mars" and learn why some are more favorable for observing than others in this mini-lesson. The course explores this routine, which showcases oppositions of Mars from 1997 to 2020 and illustrates the varying distances between Earth and Mars, as well as the apparent size of Mars for each one. This routine is part of the Mars Hoax mini-lesson, providing fascinating insights into the red planet.

16. PLANET DEFINITION

This mini-lesson explores the reclassification of Pluto as a Dwarf Planet by the International Astronomical Union in August 2006. It explains the reasons for this reclassification and examines the new discoveries in the outer parts of the Solar System that led to it. The routine demonstrates how Pluto's orbit is more similar to the newly discovered Kuiper Belt objects than the classical planets, whose orbits lie close to the plane of the ecliptic.

17. POLARIS STATIONARY

This mini-lesson explains why Polaris appears to remain mostly stationary in the sky as the Earth rotates. It demonstrates the motions of the sky through the night and shows how the Earth's axial orientation to Polaris makes it the famous Pole Star.

18. PRECESSION

This mini-lesson showcases a fun and unique way to better understand the wobbling of Earth's axis, also known as precession. While the concept of the Celestial Poles circling the sky over a period of 26,000 years is easy to explain, this lesson takes it a step further by showing how the equinoxes also precess westward along the ecliptic due to this motion.

19. PRECESSION PART DEUX

This course features an animation that demonstrates why the precession of Earth's axis causes the equinoxes to regress and the pole star to change over time. Created by Steve Sanders, the animation is very effective in teaching this concept. This course is a slightly modified version of the Precession mini-lesson.

20. RETROGRADE OF MARS

This educational mini-lesson delves into the topic of retrograde planetary motion. It goes beyond the basics to explore why certain planets, such as Mars, exhibit slightly different shared retrograde paths. The lesson also explains the connection between retrograde motion and opposition. To help illustrate these concepts, two artificial Mars-like planets are used to provide a visual aid.

21. SATURN'S ASPECTS
In this mini-lesson, audiences will learn about Saturn's ring system and its 29-year sidereal period. With the help of visuals, it demonstrates how the tilt of the 25° Saturn's rotational axis affects the appearance of the ring system, and presents unexpected motions that students can solve.

22. SCORPIO'S CLAWS
This mini-lesson explores the mystery of why the weighing scales (Libra) is included in the zodiac, which literally means "zone of the animals." The course additionally covers why the two brightest stars in Libra are called the Northern and Southern Claws. By understanding the historical and cultural context behind these symbols, audiences can better understand the significance of these constellations and how they fit into the larger picture of the zodiac.

23. SIDEREAL DAYS
In this mini-lesson, Sidereal Day is explained and compared to Solar Day. The lesson also demonstrates the differences between the two in a planetarium setting.

24. SIDEREAL TIME
In this mini-lesson, Sidereal Time is defined and demonstrated, including its ability to locate objects based on their Right Ascension and Local Sidereal Time. The lesson provides two examples to help visualize this concept.

25. SOLAR SYSTEM SCALE
This mini-lesson offers a visually stunning demonstration of the relative sizes of the planets in the Solar System and the Sun. Learn how the planets stack up against each other, how many Earths can fit inside the Sun, and the relative size of the Sun compared to the planets. This demonstration shows the vast differences in size between celestial bodies in our Solar System.

26. LOCAL APPARENT SOLAR TIME
This mini-lesson introduces the concept of Local Apparent Solar time and provides clear examples to explain the definition of this time system.

27. LOCAL MEAN SOLAR TIME
This course demonstrates that the actual Sun is not an accurate clock and why. It introduces the analemma and explains that a more accurate clock could be obtained if Earth's orbit had no eccentricity and no axial inclination. The lesson guides understanding of the concept of the Mean Sun through this investigation.

28. TIME ZONES
The need for time zones and why they were introduced is discussed in this lesson. It contrasts the ideal solution with the human solution of wacky time zones. The International Date Line is also discussed, and the reason for its existence is carefully explained.

29. ECLIPSING BINARIES
This mini-lesson provides a comprehensive overview of eclipsing binary star systems and how they are important for our understanding of the universe. It explains the basics of these systems, including their light curves and orientations. It then delves into the importance of multiple star systems in astronomy, as they are the way to determine the masses of stars. To help visualize these concepts, the lesson uses unique three-dimensional rotating models created by Steve Sanders, which are accurate and to scale to showcase some of the most interesting types of eclipsing binary star systems.

30. HOUR ANGLE
The focus of this mini-lesson is hour angles and their significance in timekeeping and celestial object tracking. Hour angles are explained in detail, emphasizing their connection to Earth's rotation and the Sidereal Day. The role of the Greenwich Meridian in timekeeping and the development of time zones is also explained.

31. LUNAR LIBRATIONS

This mini-lesson is an effective tool for teaching the concept of Lunar Libration. It uses Digistar's ability to create artificial worlds to show the complex motions of the Moon clearly. The audience is encouraged to engage with the presentation and is taken on a step-by-step journey of observing and understanding the different factors that contribute to Lunar Libration, before gradually subtracting them out to arrive at a Moon with no librations at all.

32. MILKY WAY CROSS SECTION

This mini-lesson, originally part of the Boy Scout Astronomy Badge class, provides a visual and conceptual understanding of the structure of our galaxy. By starting with an animation showing the spiral shape, viewers can see the overall structure of the galaxy before diving into its detail. The flattened disk shape of the galaxy is introduced and demonstrates why we see the Milky Way as a band of stars in the night sky.

33. MILKY WAY ZOOM

This mini-lesson, also part of the Boy Scout Astronomy Badge class, is an excellent way to show scale and perspective in the universe. Using Digistar, the presentation begins from the Sun and gradually zooms out with distance spheres marking each level of magnification until the Milky Way galaxy is visible in all its glory. Viewers are taken on a journey around the galaxy and further beyond until the entire Digistar database is encompassed, giving viewers a sense of just how vast the universe is.

34. MOON PERIGEE AND APOGEE

This course explores the Moon's orbit and how it affects its apparent size in the sky. Through clear visualizations, the differences in the diameters of the perigee and apogee moons are shown, highlighting the significant impact of the Moon's distance from Earth on its appearance.

35. SPEED OF LIGHT

Utilizing Digistar's time variable solarsphere, this mini-lesson demonstrates the true speed of light. It provides a simple yet effective demonstration of the speed of light relative to the Moon's orbit and the size of the inner portion of the Solar System.

36. STELLAR SIZES

This presentation provides a clear visual representation of the different sizes of stars, ranging from white dwarfs to red supergiants. This can help viewers of all ages to better understand the incredible diversity of celestial objects in our universe.

37. STELLAR SIZES - 3D SPHERES

This mini-lesson uses the Distance Spheres capability of Digistar to create scale models of stars, taken from the Stellar Sizes mini-lesson, and compares them to the size of the Solar System, making it an excellent way to demonstrate the vast size differences between stars and planets. The lesson also depicts the supermassive black hole located at the center of the Milky Way to provide a sense of perspective and scale.

38. GALILEAN MOONS

This lesson explores Galileo's observation skills and the limitations of his primitive telescopes. By comparing his sketches in his book Sidereus Nuncius to computer-generated placements of Jupiter's four largest moons, audiences can see the accuracy of his observations. This comparison helps audiences understand the extent to which Galileo's observations were restricted by the limitations of his equipment and how skilled an observer he truly was.
perspective.

39. PLANET AXIS TILTS

Created by Steve Sanders, this video is a fantastic educational tool that illustrates the various planetary tilts and rotation rates found in the Solar System. It dynamically compares the axial tilts and rotations of the planets and is a great way to foster curiosity about the wonders of our Solar System.

40. QUASARS FULLDOME

This mini-lesson explores quasars and how they represent the great distances in the universe. It highlights the cosmological principle that the universe looks the same from any point, regardless of where you are in it. It additionally reveals that the Milky Way could appear like a quasar from the quasar's

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This presentation offers a clear explanation of how Copernicus discovered the sidereal orbits of planets around the Sun. It focuses specifically on his method for studying Jupiter, providing a simple yet compelling demonstration to understand the logic behind his discoveries.

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44. SYNODIC PERIOD OF VENUS
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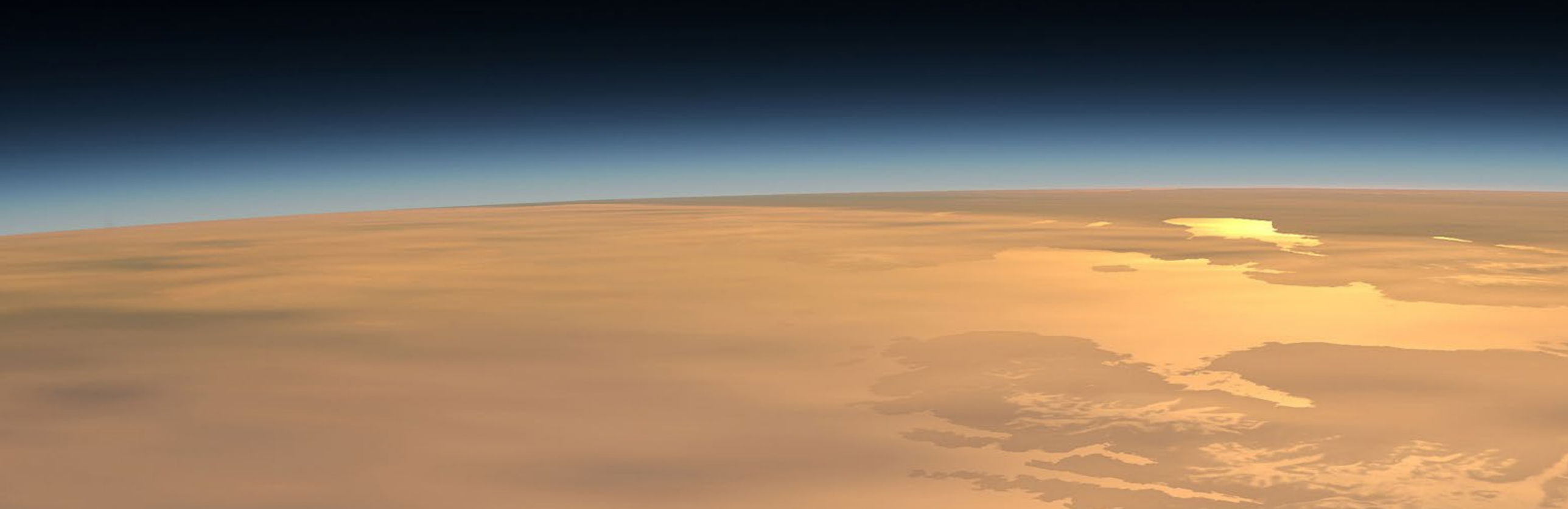
45. WATERY CONSTELLATIONS
This mini-lesson covers the history and mythology behind the constellations located in the region of the sky commonly referred to as “The Sea.” Through engaging storytelling, audiences will discover the fascinating reasons behind the association of these constellations with the sea.

46. HUBBLE TUNING FORK
This lesson discusses the Hubble Tuning Fork diagram and how it has been updated with a 21st-century twist. The original diagram was created by Edwin Hubble in 1926 and classified galaxies into ellipticals and spirals. However, the updated version reveals that galaxies mostly remain the same as the way they were born, with their shapes dependent on their initial angular momentum. This mini-lesson is especially useful in showing the planar nature of spiral galaxies compared to elliptical galaxies.

47. WINTER HEXAGON
This mini-lesson introduces the Winter Hexagon, a great asterism that highlights the most prominent and bright stars in the winter sky. Instructors can easily point out each segment of the hexagon, allowing audiences to become more familiar with the stars in the sky and improve their astronomical knowledge.

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