Astronomy Unit 2 - How Big?

Content Area: **Science**
Course(s): **Astronomy**
Time Period: **Full Year**
Length: **18 days**
Status: **Published**

NJSLS - Science

HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science and Engineering Practices

Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1)

Using Mathematical and Computational Thinking

Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)

Constructing Explanations and Designing Solutions

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS1-2)

Obtaining, Evaluating, and Communicating Information

Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars

The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1)

The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3)

The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2)

Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3)

ESS1.B: Earth and the Solar System

Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with other objects in the solar system. (HS-ESS1-4)

PS3.D: Energy in Chemical Processes and Everyday Life

Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1)

PS4.B: Electromagnetic Radiation

Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)

Crosscutting Concepts

Patterns

Empirical evidence is needed to identify patterns. (HS-ESS1-5)

Scale, Proportion, and Quantity

The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1)

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-ESS1-4)

Energy and Matter

Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. (HS-ESS1-2)

In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3)

Rationale and Transfer Goals

Technology allows us to update our scientific knowledge; scale models used for objects too big, too small, or too far away to observe directly must be carefully constructed and mathematically valid.

Enduring Understandings

Best current science tells us the universe is expanding.

Will the universe continue to expand, will it contract, or will it reach a steady state?

Galaxies are clusters of stars, gases and other celestial debris and exist in various forms. Galaxies are grouped in clusters.

Our limits on knowing the size of the universe arise from the limits of our technology.

Essential Questions

How big is the universe?

Does the universe have a size?

Is the size of the universe changing?

How do we measure the size of the universe?

Content - What will students know?

- Definitions of planet, solar system, galaxy, cluster, local group, local supercluster, universe.

Skills - What will students be able to do?

- Describe our Galactic Address (Astro)
- Describe how large the Milky Way galaxy is and its properties.
- Compare and contrast the three main types of galaxies: spiral, elliptical, and irregular (including groups and clusters).
- Quantitative data collection and analysis

Activities - How will we teach the content and skills?

- Size and Scale of the Universe, start with salt grain for Earth.
- 2 Powerpoints, collect student data.
- Classifying galaxies/ Hubble sky survey picture (Astro).
- Imagine the Universe: The Hidden Lives of Galaxies
- Milky Way Galaxy - quarter, birdseed, North America map, football field.
- Balloon Expanding Universe (Astro).
- Voyager Recorded Music (Astro).

Evidence/Assessments - How will we know what students have learned?

- **Assessments can be reviewed for each course in this folder.**
- Analysis questions after making and using models
- Quizzes
- Tests
- Astronomy Benchmark #1

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Review planets in our solar system • Cross multiplying proportions/ratios		Practice page with ratio problems (interactive website)

Key Resources

Project Astro https://www.astrosociety.org/education/hands-on-astronomy-activities/

https://www.funderstanding.com/educators/astronomy-lesson-plan-how-big-is-the-solar-system/

https://www.astro.princeton.edu/~dns/teachersguide/website.pdf

website cross multiplication: http://www.aaamath.com/rat-prop-crossx.htm

21st Century Life and Careers

9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.

Career Readiness, Life Literacies, & Key Skills

9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).

9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

Interdisciplinary Connections/Companion Standards

