NASA/NSTA Symposium:
Discover the Universe – From Galileo to Today
Friday, December 5, 2008

8:00 AM – 8:25 AM
Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA
Flavio Mendez, NSTA Learning Center Senior Director, NSTA

- About NSTA Symposia
- Agenda/Goals
- Forms/Logistics/Introductions

Lindsay Bartolone, Master Educator, Adler Planetarium & Astronomy Museum
Mary Dussault, Senior Science Education Specialist, Harvard-Smithsonian Center for Astrophysics
Dr. Denise Smith, Special Projects Manager, Space Telescope Science Institute
Dr. Simon Steel, Astronomer and Education Specialist, Harvard-Smithsonian Center for Astrophysics
Dr. Frank Summers, Astrophysicist, Space Telescope Science Institute

8:25 AM – 8:40 AM
NASA, You, and the International Year of Astronomy (IYA)

Dr. Denise Smith, Space Telescope Science Institute
Mary Dussault, Harvard-Smithsonian Center for Astrophysics

Learning Outcomes:

After participating in the presentation,

- Participants will identify the vision and rationale for IYA.
- Participants will compile examples of astronomical learning that exemplify the vision of IYA.

8:40 AM – 10:10 AM
Modeling the Universe, Then and Now (and in the Future)

8:40 – 9:25 Part I: An activity for assessment and discussion
Mary Dussault, Harvard-Smithsonian Center for Astrophysics
Lindsay Bartolone, Adler Planetarium & Astronomy Museum

9:25 – 10:10 Part II: An interactive content presentation
Dr. Simon Steel, Harvard-Smithsonian Center for Astrophysics

Learning Outcomes:

After participating in the activity and presentation,

- Participants will summarize in writing how their own mental model of the universe has changed.
- Participants will list at least 2 common student misconceptions about Earth's place in the Solar System and Universe.
- Participants will identify several ways in which Galileo's model of the universe was both similar to and different from the modern scientific model of the universe.
- Participants will identify several ways in which the activities and discoveries of Galileo illustrate the nature of scientific inquiry.
- Participants will describe at least one true-scale representation comparing the size of objects in the universe.
- Participants will list at least 2 new strategies or resources that they can use in the classroom to identify and improve students' mental models about Earth's place in the Universe.

10:10 AM – 10:25 AM
Break

10:25 AM – 11:55 AM
Exploring the Universe with Telescopes and Light

Dr. Frank Summers, Space Telescope Science Institute

Part I: How Telescopes Changed Astronomy (content presentation)
Part II: Build a Refracting Telescope (activity)
Part III: Exploring with Light and Color (activity)
Part IV: The Universe Beyond Your Eyes (content presentation)

Learning Outcomes:

After participating in the presentations and activities,

- Participants will describe how technology, such as telescopes, is essential to scientific progress.
- Participants will identify at least one resource for familiarizing students with the basic optics of a refracting telescope.
- Participants will identify one technique to illustrate that visible light can be separated into component colors.
- Participants will observe and record emission spectra for different gases/elements.
- Participants will describe at least one example of electromagnetic radiation that exists beyond what we can see with our eyes.
- Participants will describe the significance of the electromagnetic spectrum to astronomy.

11:55 AM – 12:10 PM
Exploring Further: The Universe is Yours to Discover

Dr. Denise Smith, Space Telescope Science Institute

Learning Outcomes:

After participating in the activity,

- Participants will identify at least two resources or programs related to the IYA that support STEM curricula.
- Participants will identify at least one strategy for incorporating astronomy-themed resources or activities into their curriculum.
- Participants will identify at least one step that they can take to help students discover the universe for themselves during the IYA.

12:10 PM – 12:30 PM
Final Words

Flavio Mendez, NSTA

- Post-assessment form
- Evaluation form/Survey/Credit info
- NSTA Web Seminars
- Drawing of door prizes

National Science Education Standards Addressed:
Content Standards, 5-8 and 9-12

Content Standard A:
Science as Inquiry
As a result of their activities in grades 5-8, all students should develop

- Understandings about Scientific Inquiry
  - Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.
  - Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifiying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.
  - Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data. All of these results can lead to new investigations.

As a result of their activities in grades 9-12, all students should develop

- Understandings about Scientific Inquiry
  - Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.

Content Standard D:
Earth and Space Science
As a result of their activities in grades 5-8, all students should develop an understanding of

- Earth in the Solar System
  - The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.
  - Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

Content Standard E:
Science and Technology
As a result of their activities in grades 5-8, all students should develop

- Understandings about Science and Technology
  - Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigation, inquiry, and analysis.

Content Standard G:
History and Nature of Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Nature of Science
  - Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.
- History of Science
  - Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.

AAAS Project 2061 Benchmarks Addressed:
Benchmarks for Science Literacy, 6-8 and 9-12

Benchmark 4A: The Physical Setting
<u>The Universe</u>
By the end of 8th grade, students should know that

- The sun is a medium-sized star located near the edge of a disk-shaped galaxy of stars, part of which can be seen as a glowing band of light that spans the sky on a very clear night. The universe contains many billions of galaxies, and each galaxy contains many billions of stars. To the naked eye, even the closest of these galaxies is no more than a dim, fuzzy spot.
- The sun is many thousands of times closer to the earth than any other star. Light from the sun takes a few minutes to reach the earth, but light from the next nearest star takes a few years to arrive. The trip to that star would take the fastest rocket thousands of years. Some distant galaxies are so far away that their light takes several billion years to reach the earth. People on earth, therefore, see them as they were that long ago in the past.

Benchmark 4A: The Physical Setting
<u>The Universe</u>
By the end of 12th grade, students should know that

- Increasingly sophisticated technology is used to learn about the universe. Visual, radio, and x-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle an avalanche of data and increasingly complicated computations to interpret them; space probes send back data and materials from the remote parts of the solar system; and accelerators give subatomic particles energies that simulate conditions in the stars and in the early history of the universe before stars formed.