## BEYOND THE SOLAR SYSTEM: DVD OUTLINE

**Introduction** (4:18)

### SCIENCE CONTENT STRAND

**Key Concepts:**

- Our universe is made of galaxies (3:02)
- Galaxies are moving apart (2:04)
- Looking out into space is looking back in time (3:36)
- We can see light from the big bang (2:55)
- Our early universe was simple (3:10)
- Gravity formed structures in our universe (2:02)
- Einstein's model predicts the big bang (3:47)

**Evidence:**

About our universe...How do we know:

- What stars and galaxies are made of? (2:09)
- The distances to stars and galaxies? (2:04)
- The speed of galaxies? (2:10)
- The age of our universe? (3:12)

**Researchers:**

- Marcelo Gleiser–Big Questions (3:38)
- Hiranya Peiris–Big Bang (3:41)
- Kim McLeod–Black Holes (2:37)
- Robert Kirshner–Dark Energy (5:01)
- David Charbonneau–Other Solar Systems (4:59)

### TEACHING AND LEARNING STRAND

**Student Ideas:**

- Introduction (4:23)
- Travis–Where are the stars? (3:33)
- Katrina–How far out do stars go? (4:38)
- Martin–What is a galaxy? (4:10)
- Gregory–How are galaxies arranged? (4:26)
- Zocrates and Friends–What was the big bang? (4:55)

**Classrooms:**

- Modeling the universe (12:24)
- The nature of models (8:16)
- Exploring with telescopes (9:26)
- Measuring with telescopes (9:12)
- Cosmic timeline (9:45)

**Resources:**

- Introductory materials (4 PDF documents)
- Curriculum materials (19 PDF documents)
- Visual resources (4 video clips; 4 PDF documents)
- Science education standards (3 PDF documents)
- Web resources

*Beyond the Solar System* was produced for NASA by the Universe Education Forum and the Science Media Group at the Harvard-Smithsonian Center for Astrophysics.


www.universeforum.org/btss

HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS

UNIVERSEFORUM

# BEYOND THE SOLAR SYSTEM

## Expanding the Universe in the Classroom

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WELCOME TO

# BEYOND THE SOLAR SYSTEM
## Expanding the Universe in the Classroom

Get ready to explore some of the biggest questions about our place in space and time. This DVD draws on the latest scientific and educational research to help teachers in grades 8–12 deepen their own and their students' understanding of both our universe and the nature of science. Produced by the Harvard-Smithsonian Center for Astrophysics in association with NASA, *Beyond the Solar System* is filled with video, print, and online resources. It is perfect for Earth and space science educators, for physical science educators, for professional development providers, and for classroom use.

The *National Science Education Standards* includes the topic of origin and evolution of the universe as part of the essential content of Earth and space science understanding. Yet providing concrete, inquiry-based experiences for students to learn these concepts can be a challenge for teachers. *Beyond the Solar System* has been designed to help.

This DVD contains more than two hours of video, organized into two modular strands of material—science content, and teaching and learning resources. These are intended to promote greater understanding of the scientific concepts through discussion and reflection, activities, and application of the ideas to teaching. Also included are lesson plans, student guides, assessments, content background, summaries of relevant standards, and links to further resources. These instructional materials are provided in PDF format and can be printed from a computer.

## SCIENCE CONTENT STRAND

### Key Concepts
This series of short video clips explains the conceptual chain of observations, evidence, and logical reasoning that support the standard Big Bang model for the origin and evolution of our universe.

### Evidence
Without direct experience, how can we know what stars and galaxies are made of, or how old the universe is? This segment illustrates some of the practical and conceptual tools used by astronomers.

### Researchers
We have learned a lot about the structure and evolution of our universe, but many big questions are yet to be answered. These interviews with scientists highlight some of the fascinating space science research topics currently under investigation.

## TEACHING AND LEARNING STRAND

### Student Ideas
What kinds of mental models of the universe do students bring to the classroom? These interviews illustrate common student ideas that can serve as barriers—or building blocks—to deeper conceptual understanding of our universe.

### Classrooms
These real classroom vignettes show students and teachers exploring the universe using *Beyond the Solar System* instructional materials. View them to reflect on your own strategies for supporting student thinking and learning.


### Resources
An extensive set of print and web resources are available when you access the DVD on a computer. PDF format instructional materials feature inquiry-based classroom activities and assessments. Several supplemental video science visualizations are also provided.