SUGGESTED REFERENCES

- *National Aeronautics and Space Administration: Hubble Space Telescope*
  http://hubble.gsfc.nasa.gov/
- *Hubble Site:*
  http://hubblesite.org/
- *The Big Bang*
  http://www.umich.edu/~gs265/bigbang.htm

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5 - 8

Physical Science
Transfer of energy
Motions and Forces

Grades K - 4

Life Science
Objects in the sky
Changes in the earth and sky

Science and Technology
Understanding about science and technology

**Source: National Science Education Standards, 1996, National Academy Press*

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SCIENCE SCREEN REPORT FOR KIDS

VOLUME 16 ISSUE 3

ORIGINS OF THE UNIVERSE EXPLORED

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SYNOPSIS

The Big Bang theory is currently the most popular scientific theory for the origin of the universe. It describes how the universe emerged from an enormously dense and hot state about 13.7 billion years ago and how the universe is still expanding from that point. This theory helps scientists explain the formation of all the galaxies, stars, and planets.

This edition of Science Screen Report for Kids demonstrates how the big bang is thought to have begun, and it examines what scientists have learned to support this theory, including information from the Hubble Space Telescope and radio telescopes.

CURRICULUM UNITS	RUNNING TIME
■ CHEMISTRY	14:45
■ EARTH AND SPACE SCIENCE	
■ ENVIRONMENTAL SCIENCE	
■ PHYSICAL SCIENCE	
■ PHYSICS	

BACKGROUND

Our universe is filled with billions of galaxies, each containing hundreds of billions of stars. The size of the universe is unimaginably vast. In any direction away from earth there are galaxies as far as the most powerful telescopes can see. Many scientists have tried to understand how a universe of this size has formed. Some scientists use a theory that was proposed in 1948.

This theory is called the big bang, proposed by George Gamow and Ralph Alpher. They determined that the universe was created in a gigantic expansion from a single point outside space and time as we see them today. This expansion consisted of energy and infinitely hot and dense simple matter. As the expansion continued, the space around it would rapidly cool; and within minutes, matter would begin to form. Because of the temperature and density, this matter would fuse into elements.

Other evidence that supports the big bang theory is cosmic radiation, first detected in 1965 when two scientists were trying to eliminate all sources of interference from their radio telescopes. No matter what they did, there was always some radiation that they could not account for that interfered with their signal. They realized this was left over from the big bang, and provided a record of the event. Similar to a fossil, the background radiation provides evidence for the big bang theory.

Analysis of light coming from galaxies tells us that all galaxies are moving away from ours at very high speeds. The farther away a galaxy is, the faster it is moving. The farther away a galaxy is from the Milky Way, the further back in time it was formed. As light travels towards us, it takes time to reach earth. The light we see from a galaxy one billion light years away was made one billion years ago. The observation allows us to use instruments like the Hubble Space Telescope to peer back into both space and time to look for evidence of the beginning of the universe.

The big bang theory also helps to explain how stars are formed. The video shows nebulas, immense clouds of gas and dust, which are literally "stellar nurseries". The gas and dust are compressed together by gravity until the pressure increases so much that fusion reactions occur and the beginnings of a star are formed.

ADVANCED ORGANIZERS

Prior to showing this video students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press, which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 3: The Nature of Technology
Section A - Technology and Science
Know by the end of 5th grade
- Technology enables scientists and others to observe things that are too small or too far away to be seen without them and to study the motion of objects that is moving very rapidly or is hardly moving at all.

Section C - Issues in Technology
Know by the end of 5th Grade
- Any invention is likely to lead to other inventions. Once an invention exists, people are likely to think up ways of using it that where never imagined at first.

Benchmark 4: The Physical Setting
Section A - The Universe
Know by the end of 2nd grade
- There are more stars in the sky than anyone can easily count, but they are not scattered evenly, and they are not all the same in brightness or color.

Section E - Energy Transformations
Know by the end of 5th grade
- Things that give off light also give off heat.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

CRITICAL THINKING EXERCISES

After viewing the program:

1. Develop background information and students' prior knowledge about the beginning of the universe. Conduct an open discussion or create a KWL chart.
2. Read a book aloud to the class about the big bang. An example is, The Big Bang, a Tale of a Speck that became Spectacular, by Carolyn Decristofano.
3. Using balloons explain and show students how the universe is constantly expanding.
4. Working in cooperative groups, have students create a story book about the beginning of our universe, the big bang theory. After books are proofread, illustrated and published, they can read them aloud to the class or even arrange to read aloud to another class.
5. What is the Hubble Space Telescope? How does this telescopic satellite help scientists in learning about space?
6. Research the Hubble Telescope and other space-based telescopes which may be planned for the future and how they are going to be used.
7. Draw a diagram of our galaxy including our solar system. Label the planets.

VOCABULARY

Atom	A unit of matter, the smallest unit of an element
Big Bang Theory	A scientific theory that the universe originated from an explosion of very small matter of extremely high density and temperature.
Cosmologist	The study of the physical universe considered as a totality of phenomena in time and space.
Electromagnetic spectrum	The entire range of radiation in order of decreasing frequency, cosmic-ray photons, gamma rays, x-rays, ultraviolet radiation, visible light, infrared radiation, microwaves, and radio waves.
Gravity	The natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body.
Hubble Space Telescope	Telescopic satellite orbiting around earth while taking photographic images of space.
Molecules	A small particle; a tiny bit.
Nebula	A diffuse mass of interstellar dust or gas, or both
Orbit	The path of a celestial body or an artificial satellite as it revolves around another body
Protostar	Any early stage in the formation of a star when an interstellar cloud of gas and dust starts to collapse but before nuclear synthesis has begun at its core
Radiation	Energy radiated or transmitted as rays, waves, in the form of particles.
Theory	Explains a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted, and can be used to make predictions about natural phenomena.

CAREER POSSIBILITIES

- ASTRONOMER
- CHEMIST
- ENGINEER
- PHYSICIST