

- planetquest.jpl.nasa.gov
"Planet Quest: The Search for Another Earth" is an amazing resource for those interested in how the search for new planets is done and allows students to track the discovery of extrasolar planets and the NASA missions that study them, including the Keck Interferometer, the Space Interferometry Mission and Terrestrial Planet finder.
- www.psi.edu/esp/process.html
This site explains how amateur astronomers can contribute in the quest to locate extrasolar planets.
- hubblesite.org/
This site allows students to track the location of NASA's orbiting Hubble Space Telescope, and includes a gallery of amazing images, as well as plans to make a scale model of the instrument.
- tpf.jpl.nasa.gov/whatis/whatis.html
This NASA site explains the goals of the TPF mission and the science and technology that have paved the way for such a mission.

Suggested Print Resources

- Kirshner, Robert. *The Extravagant Universe: Exploding Stars, Dark Energy, and the Accelerating Cosmos*. Princeton University Press, Princeton, NJ; 2002.
- Trefil, James & David H. Levy. *Other Worlds: Images of the Cosmos from Earth and Space*. National Geographic Society, Washington, D.C.; 1999.
- Voit, Mark. *Hubble Space Telescope: New Views of the Universe*. Harry Abrams Publishing, New York, NY; 2000.

TEACHER'S GUIDE

Paula J. Bense, M.Ed.

Curriculum Specialist, Schlessinger Media

COMPLETE LIST OF TITLES

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The Search for New Planets

Alien Planets: Anyone Home?

Grades 9–12

This series tells the stories behind the science of astronomy in an informative and entertaining way. Fast-paced and visually rich, viewers journey to exotic destinations within our solar system from moons and planets to comets and asteroids. Featuring advances in scientific investigation, this series investigates cosmic mysteries including the birth and death of stars, the structure of the universe, and the search for extraterrestrial life.

This guide provides a brief synopsis of the program, background on the science concepts presented in the show, discussion topics, activities, vocabulary and additional resources.



Program Summary

Some two hundred billion stars make up the cosmic whirlpool we call the Milky Way Galaxy. Is anybody out there? Is there any kind of life beyond the Earth? Many people think not. For decades, SETI (Search for ExtraTerrestrial Intelligence) researchers have aimed radio telescopes at “sunlike” stars hoping to hear signals from intelligent beings. In recent years, astronomers have discovered many “extrasolar planets” orbiting distant stars, but so far none seem anything like Earth.

Scientists have found that the diversity of other planetary systems is far greater than we ever imagined by looking at our own solar system. Our solar system consists of two groups of planets: terrestrial and gas planets. The first group is comprised of four small rocky worlds that lie fairly close to the sun — Mercury, Venus, Earth and Mars. The second group includes four much larger planets a lot farther away. Neptune is the farthest, followed by Uranus, Saturn, and Jupiter.

Learning about extrasolar planets is quite an achievement considering that most of the alien worlds are up to several hundred light years away — too distant for even our largest telescopes to see directly. However, astronomers have developed ingenious techniques for indirectly detecting the planets, employing huge telescopes and high-speed computers to detect worlds they can’t actually see. One way researchers seek out these invisible worlds is by observing something called “doppler shift.” This is when the small tug of a planet on its parent star causes a small variation in the velocity of the star. A second indirect planet-search technique looks for the positional wobble of a star induced by the presence of a planet.

More sensitive telescopes are being designed to seek out Earth-size worlds whose discovery is still beyond the reach of current technology. NASA’s Space Interferometry Mission, or SIM, will group together several telescopes to search for stars that harbor terrestrial-type planets. And the Terrestrial Planet Finder, or TPF, is a monster telescope array planned for launch within a few years. The TPF will employ spectroscopic analysis to look for traces of oxygen in the atmospheres of any planets it finds. Will the new orbiting telescopes detect water...and life? We might learn the answers to these questions sooner than you think.

Vocabulary

antenna — An instrument for receiving radio waves.

black hole — A dense, compact object whose gravitational pull is so strong that — within a certain distance of it — nothing can escape, not even light. Black holes are thought to result from the collapse of certain very massive stars at the ends of their evolution.

binary stars — Pairs of stars that orbit around their common center of mass.

Big Bang — The dominant scientific theory about the origin of the universe. According to the big bang, the universe was created sometime between 10 billion and 20 billion years ago from a cosmic explosion that hurled matter in all directions.

brown dwarf — An exceedingly dim object whose size falls somewhere between a planet and a star.

cosmology — The study of the origin and evolution of the universe.

Doppler effect — Phenomenon originally discovered by the Austrian mathematician and physicist Christian Doppler (1803-53), in which the frequency of light or sound coming from a moving object is different when it is received compared to when it was emitted.

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galaxy — A group of hundreds of millions of stars, other objects, gas and dust that is held together in space by gravity. Telescopes such as the HST have revealed billions of galaxies other than our own.

Hubble Space Telescope — The first large optical telescope launched above the Earth’s atmosphere carrying instruments sensitive to visible and ultraviolet light. The telescope was built by NASA with major contributions from the European Space Agency, and was launched in 1990.

infrared — Radiation with slightly longer wavelengths and slightly lower frequencies than those of visible light.

interferometer — A type of telescope in which signals from two or more small telescopes are combined to produce an image with the resolution of a much larger telescope.

Keck Observatory — Home of the largest optical telescopes in the world, located in Mauna Kea in Hawaii.

NASA — Acronym for the National Aeronautics and Space Administration, a U.S. government agency formed in 1958 with the goal of making space exploration possible.

nebula — An interstellar cloud of gas and dust.

optical interferometer — An instrument in which light collected from a chain of telescopes is electronically blended to form an image. In a sense, the mirrors are added together to produce the light-gathering power of one gigantic telescope. These monstrous, yet fragile telescopes will have to be assembled and operated far above the Earth’s atmosphere.

photometers — Electronic light detectors that can measure changes in the frequency of a star’s light.

SETI Institute — (“Search for ExtraTerrestrial Intelligence”) A scientific research organization with a mission to explore, understand and explain the origin, nature and prevalence of life in the universe.

SIM — (Space Interferometry Mission) A space-based observatory designed to take a census of the planets.

spectrograph — An instrument that breaks up light for analysis.

spectroscopy — The study of the way in which atoms absorb and emit electromagnetic radiation. Spectroscopy allows astronomers to determine the chemical composition of stars.

TPF — (Terrestrial Planet Finder) An orbiting observatory planned for launch in 2012, designed specifically to seek out terrestrial planets like Earth.

Activities & Discussion

- How can scientists look for planets without seeing them?
- What is the “Cosmic Billiard Ball Theory”?
- Do you think we are alone in the universe? Why or why not?

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- cfa-www.harvard.edu/seuforum/teachers/tchres.htm
Cosmos in the Classroom is a pilot lesson plan designed to launch students into a discussion of size and scale as well as the history of the universe.

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