Visions of the Universe

Four Centuries of Discovery

Introduction to the Supplemental Materials
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In turning his telescope to the heavens in 1609, Galileo embarked upon a journey that would revolutionize science and culture alike, profoundly changing our view of our place in the universe. Our views of the universe, and how they have evolved over time, are portrayed in the images and text of the “Visions of the Universe: Four Centuries of Discovery” exhibit.

In recognition of the International Year of Astronomy, this exhibit includes six two-sided panels that feature key astronomical discoveries from the past 400 years. The exhibit also highlights the technological advancements that made these discoveries possible. Exhibit topics range from celestial objects within our own “cosmic backyard” to those beyond the realm of our solar system. Featured objects include the Sun, the Moon, Saturn, Mars, comets, stars, nebulae, and galaxies. Images are accompanied by captions that highlight relevant, historical discoveries.

The “Visions of the Universe: Four Centuries of Discovery” exhibit is supported by supplemental resource documents available online, in PDF format, for each panel. These twelve documents include science background information in the form of Q&As, related science misconceptions, a glossary, and links to additional resources on NASA’s Amazing Space Web site. In addition, each exhibit panel is available as a downloadable, poster-size file. These materials are available from: http://amazing-space.stsci.edu/visions

The “Visions of the Universe: Four Centuries of Discovery” exhibit was produced in December 2008 by the Space Telescope Science Institute, the American Library Association, and the Smithsonian Astrophysical Observatory, through funding from the National Aeronautics and Space Administration.
Q1: Who was Galileo?

ANSWER: Galileo Galilei (1564–1642) was an Italian physicist, mathematician, astronomer, and philosopher who played a major role in the scientific revolution. His achievements include improving the telescope, recording astronomical observations, and supporting the idea that Earth travels around the Sun as described by the Copernican model. His contributions to observational astronomy include the telescopic confirmation of the phases of Venus; the discovery of the four largest satellites of Jupiter, which were named the Galilean moons in his honor; and the observation and analysis of sunspots. Galileo also observed the Moon, reporting the existence of craters and mountains based on the patterns of light and shadows on the Moon's surface.

Q2: Why is the image of Jupiter's moons included on this panel?

ANSWER: Galileo discovered the four largest moons of Jupiter: Io, Europa, Ganymede, and Callisto. When first observed, Galileo believed the objects to be fixed stars near Jupiter. He continued to observe these objects for several months and concluded that they were not fixed stars, but were in fact orbiting Jupiter. In 1610 Galileo published an account of his observations of the moons of Jupiter, using the observations to argue in favor of the Sun-centered, Copernican view of the universe. The prevailing view of his time was the Earth-centered Ptolemaic model. The next year Galileo visited Rome to demonstrate his telescope to the influential philosophers and mathematicians, and to let them see with their own eyes the reality of the four moons of Jupiter. This visit is depicted in the first image on the panel as a fresco painted by Giuseppi Bertini in Villa Ponti in the city of Varese, Italy.

Q3: Are Jupiter's moons arranged as shown in the image?

ANSWER: The image of Jupiter’s Red Spot and its four largest moons is a composite designed to show the relative sizes of the spot and the moons. NASA's Galileo spacecraft took the images of the Great Red Spot and the moons. The moon closest to Jupiter is yellow-orange–colored Io, which is known for its volcanic activity (top, right). Icy Europa is the gray- and rust-colored moon that might hide an ocean under its frozen surface. Ganymede, larger than the planet Mercury, is Jupiter's largest moon, characterized by bright and dark patches. Note that the rim of this moon is in shadow, making it appear to be flattened on one side. Dark Callisto (bottom, left), with its bright impact craters, is the most distant of the Galilean satellites.

Continued …
Q4: What was NASA’s Galileo Mission

ANSWER: The purpose of NASA’s *Galileo Mission* was to study Jupiter and its moons in more detail than any previous spacecraft. The spacecraft was named in honor of the first modern astronomer — Galileo Galilei. Galileo was launched from the cargo bay of Space Shuttle Atlantis in 1989 and ended its mission in 2003 when the spacecraft plunged into Jupiter’s atmosphere. The exciting list of discoveries started even before Galileo got a glimpse of Jupiter. As the asteroid Gaspra crossed the asteroid belt, Galileo took the first-ever close-up images of an asteroid, and later revealed that the asteroid Ida had its own little “moon,” Dactyl. The highly successful mission discovered giant thunderstorms in Jupiter’s atmosphere, studied the intense volcanic activity on the moon Io, found that sub-surface oceans might exist on the three other large moons, and determined that dust blasted off of the small inner moons is the source of Jupiter’s rings. ✜
**Myth:**
Telescopes have always been powerful tools that astronomers use to look at objects very far away.

**Fact:** Telescopes began as simple “spyglasses” and have evolved into powerful tools.
Copernican model

The view of the universe put forth by Copernicus that was contrary to the prevailing belief that Earth was the center of the universe. Copernicus thought the planets orbited the Sun, and the Moon orbited Earth. Copernicus also thought the Sun, in the center of the universe, did not move, nor did the stars. Copernicus was correct about some things, but wrong about others. The planets travel around the Sun, but the Sun is not in the center of the universe.

Model

A representation of some aspect of nature that can be used to explain and predict real phenomena without involving myth, magic, or the supernatural.

NASA’s Galileo Mission

The purpose of NASA’s Galileo Mission was to study Jupiter and its moons in more detail than any previous spacecraft. The spacecraft was named in honor of Galileo Galilei, who discovered the four largest moons of Jupiter.

Ptolemaic model

The view of the universe put forth by Ptolemy and Aristotle. Ptolemy thought that all celestial objects — including the planets, Sun, Moon, and stars — orbited Earth. Earth, in the center of the universe, did not move at all.
Online Explorations

“Online Explorations” are fun, interactive activities for exploring various space science topics.

• Telescopes From the Ground Up
  “Telescopes From the Ground Up” traces the 400 years of telescope development from Galileo’s refractor to NASA’s Great Observatories. The overview for this activity can be found at:
  http://amazing-space.stsci.edu/eds/overviews/explorations/telehistory.php
  Specific sections of “Telescopes From the Ground Up” related to this exhibit panel include:
  • “Era of Galileo’s Refractor,” which describes how Galileo improved the recently invented spyglass, pointed it toward the heavens, and gave birth to modern astronomy.
  • “Galileo’s Refractor,” which describes how Galileo improved upon the spyglass.
  • “Biography: Galileo,” which offers information about the man who revolutionized science.
    http://amazing-space.stsci.edu/resources/explorations/groundup/lesson/bios/galileo
  • “Views of the universe: Ptolemy vs. Copernicus,” which compares Ptolemy’s Earth-centered model with Copernicus’ Sun-centered one.
    http://amazing-space.stsci.edu/resources/explorations/groundup/lesson/basics/g37

Graphic Organizers

This is a collection of T-charts and Venn diagrams that compare and contrast various celestial objects and phenomena. The downloadable organizers are available in teacher versions (full chart) and student versions (blank organizer with images).

Comparison of refractors and reflectors

This T-chart shows the similarities and differences between refracting telescopes and reflecting telescopes.

http://amazing-space.stsci.edu/eds/overviews/organizers/refractreflect.php