

The Milky Way

AGE OF THE MILKY WAY

The Milky Way arches high overhead this evening. This subtle band of light is the combined glow of millions of stars, which outline the flat disk of our Milky Way Galaxy.

Everything about the Milky Way is gigantic. Its disk spans 100,000 light-years, and contains hundreds of billions of stars. And according to a team led by University of Texas astronomer Chris Sneden, it's about 14 billion years old, give or take a few billion.

Astronomers arrived at this age by measuring the age of a single star. The galaxy can't be any YOUNGER than its oldest stars, so this technique yields a MINIMUM age for the Milky Way.

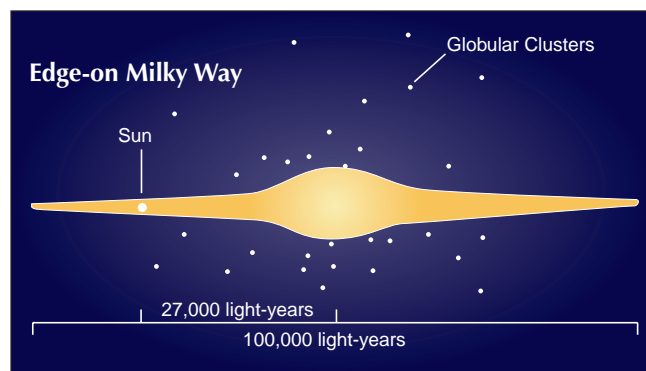
Astronomers determined the star's age by measuring its chemistry. They found that it contains only minute traces of anything heavier than hydrogen and helium, the two lightest elements. That alone shows that the star must have formed early in the history of the Milky Way, since heavier elements were forged inside stars, then expelled into space, where they could be incorporated into NEW stars.

One of the most important tracers of the star's age is a radioactive element called thorium. The star contains only about half as much thorium as expected. Thorium has a half-life of 14 billion years. In other words, in 14 billion years, half the star's thorium should have turned into other elements. Since half of the thorium has disappeared, astronomers deduce that the star is about 14 billion years old — and so is the Milky Way.

Stretching across the dark night sky, not easily visible when the Moon is in the sky, is a faint irregular glowing strip of light. For thousands of years peoples of various cultures tried to explain what they saw, sometimes using stories. Here are some examples:

Chinese

The seventh Princess of Heaven fell in love with a poor herdsman and ran away to marry him. When her mother sent soldiers to bring her home, the herdsman chased them away. Seeing her daughter's husband running, the mother dropped a silver pin to make a silver stream to separate the lovers forever. Eventually, her father allowed her to have an annual reunion with her husband — black birds escorted her across the stream. The Milky Way is that silver stream. The young lovers are the stars Vega and Altair on either side of it.



Navajo

When the world was created, the people gathered around Black God to place stars in the sky. Coyote was frustrated by how long it was taking. He threw the bag of stars over his head, forming the Milky Way.

Egyptian

The goddess Isis spread large quantities of wheat across the sky. We see this bounty as the Milky Way.

African Bushmen

The Milky Way is made of the ashes of campfires.

Polynesian

The Milky Way is a long, blue, cloud-eating shark.

Greek

The Milky Way is along the circular path where the Sun once moved across the sky. It looks different than the rest of the sky because the Sun scorched it.

ACTIVITY 1

Show students a picture of the Milky Way. Read several of the selections above. Tell them to work in groups to make up a story and picture that explains how someone living thousands of years ago in their location might have explained it. When the pictures are done, have each group present its report. For a link to Social Studies, have them choose a civilization to research to discover what important elements of their culture are reflected in these stories.

BACKGROUND

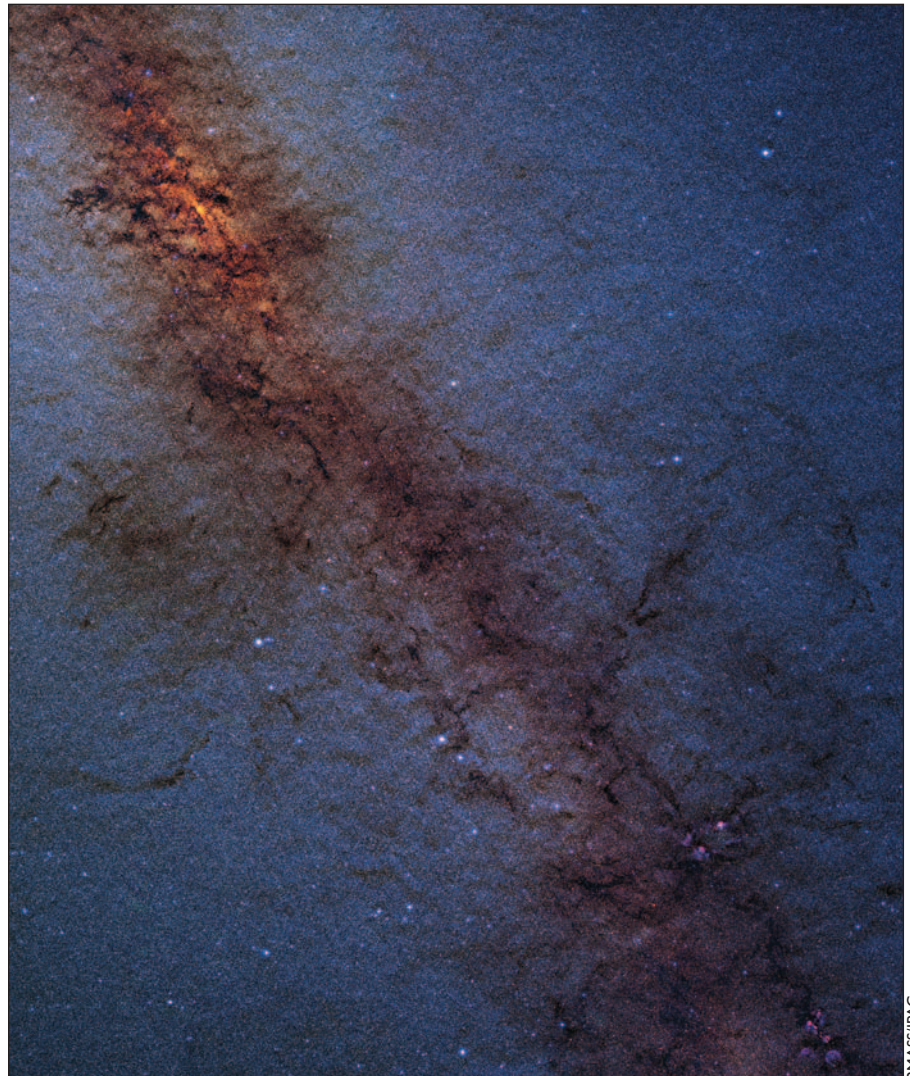
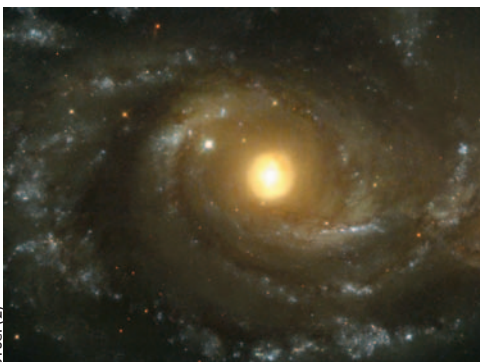
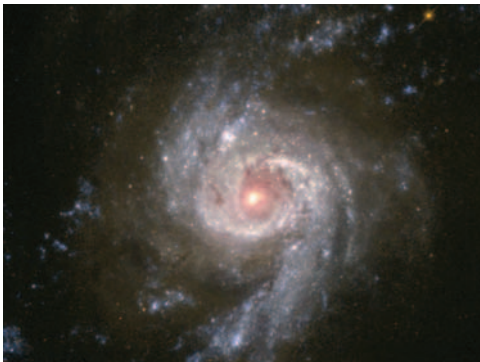
Galileo, the first person to look at the sky with a telescope, discovered that the Milky Way is actually made up of countless faint stars. Other astronomers discovered it also had many star clusters and nebulae (clouds of gas and dust). In the 20th century, astronomers put together clues from many types of observations to deduce that we live at the edge of a spiral arm in the Milky Way galaxy. Because we are in the arm, we look at the rest of the galaxy edge-on and don't easily see its structure. If we could take a picture of the Milky Way from a vast distance, we would see it as a majestic cosmic pinwheel. The Sun is just one of hundreds of billions of stars in the Milky Way galaxy. The stars in the arms are young, and many of them are hot and blue. The stars in the core and between the spiral arms are mostly older and redder.

NATIONAL SCIENCE EDUCATION STANDARDS

- Content Standard in 9-12 Science as Inquiry (Abilities necessary to do scientific inquiry)
- Content Standard in 9-12 History and Nature of Science (Science as a human endeavor, Historical perspectives)

ACTIVITY 2

Examine color pictures of spiral galaxies. Using them as examples, take yellow and red fluorescent poster paint to make a nucleus-shape in the center of a piece of black paper. Add blue spiral arms swirling out from the center. Within the arms, glue small pieces of cotton balls to indicate the gaseous nebulae. Add a flag attached to a toothpick saying "You are here" to indicate the Sun's position about two-thirds of the way from the center, on the edge of a spiral arm.



2MASS/IPAC

Seen from a distance, our Milky Way galaxy would look something like the two majestic spirals at left. From our earthly vantage point, infrared telescopes can peer through the intervening dust into the heart of the Milky Way (above, in red), 27,000 light-years away.

STScl (2)

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Texas Essential Knowledge and Skills

Science, grade 8:

§112.20.(b)-8(A) describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification.

§112.20.(b)-8(B) recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star.

Astronomy, grades 9-12:

§112.33.(c)-4(A) research and describe the use of astronomy in ancient civilizations such as the Egyptians, Mayans, Aztecs, Europeans, and the native Americans.

§112.33.(c)-4(B) research and describe the contributions of scientists to our changing understanding of astronomy, including Ptolemy, Copernicus, Tycho Brahe, Kepler, Galileo, Newton, Einstein, and Hubble, and the contribution of women astronomers, including Maria Mitchell and Henrietta Swan Leavitt.

§112.33.(c)-6(C) examine the scale, size, and distance of the stars, Milky Way, and other galaxies through the use of data and modeling.

§112.33.(c)-12(B) recognize the type, structure, and components of our Milky Way galaxy and location of our solar system within it.