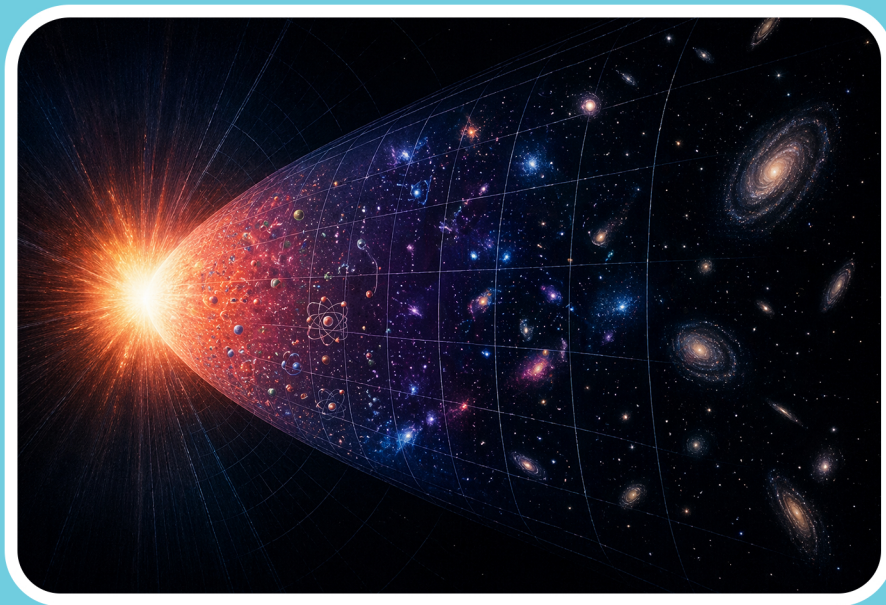


Big Bang



Big Bang

**Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.**

Scientists believe the universe began approximately 13.8 billion years ago in an event called the Big Bang. Take the following brief quiz to see how much you already know about the history of our universe. See the bottom of page 4 to check your answers.

1. About how large do scientists believe the universe was at the instant before the Big Bang occurred?
 - a. smaller than one atom
 - b. about the size of Earth
 - c. about the size of the Sun
 - d. about the size of the Milky Way Galaxy
2. What was the universe like in the first few moments after this event?
 - a. extremely cold and filled with ice
 - b. exactly as it looks today with stars and planets
 - c. incredibly hot, dense, and rapidly expanding
 - d. a silent, empty void with no energy
3. Elements that make up our bodies, like the iron in your blood and the calcium in your bones, did not exist at the beginning of the universe. Where were these heavier elements created?
 - a. inside the cooling center of the Earth
 - b. in the dark spaces between galaxies
 - c. inside the cores of stars and during supernova explosions
 - d. they were frozen inside comets from other universes
4. The "Cosmic Microwave Background" (CMB) is a very important piece of evidence for scientists. What is CMB?
 - a. leftover heat/radiation from the early Big Bang
 - b. signals being sent by distant alien civilizations
 - c. the sound of stars exploding in nearby galaxies
 - d. radio waves produced by modern kitchen appliances
5. For the first 380,000 years after the Big Bang, the universe was so hot that light could not travel through it, making it look like a thick "fog." What changed to allow light to finally shine through?
 - a. the first stars turned on like flashlights
 - b. the universe cooled down enough for atoms to form
 - c. a giant black hole swallowed all the smoke
 - d. the universe stopped expanding



Modeling the Universe's "Stretch"

Step into the role of a cosmologist to witness the birth of space! In this activity, you'll use a balloon to model the "fabric" of the universe. By tracking "galaxies" as the balloon inflates, you'll discover the startling reality: the universe isn't just growing—it's stretching everything along with it.

Materials

- 1-large round, light colored balloon
- 1- permanent marker
- 1- 30-cm piece of string
- 1 metric ruler

Procedure

1. Partially blow up the balloon until it is about the size of an orange (do not tie it yet).
2. Use the marker to draw 4–5 small dots scattered across the balloon. Label one dot "Home" and the others A, B, C, and D. make sure that each lettered dot is a different distance from the Home dot. These letters represent different galaxies.
3. While your partner holds the balloon neck closed, use the string and ruler to measure the distance from Home to each of the other galaxies. Measure along the curved surface of the balloon. Record in Table 1 these distances.

Table 1. Balloon Distances

Measurements	Initial Distance (cm)	Final Distance (cm)	Expansion Distance (cm)
Home to A			
Home to B			
Home to C			
Home to D			

4. Blow into the balloon until it has roughly doubled in size. This represents billions of years of cosmic expansion.
5. Without letting air out, measure the new distances from Home to galaxies A, B, C, and D. Record in Table 1 these distances.
6. Subtract the first measurement from the second. This shows how much "distance" was added over the expansion.

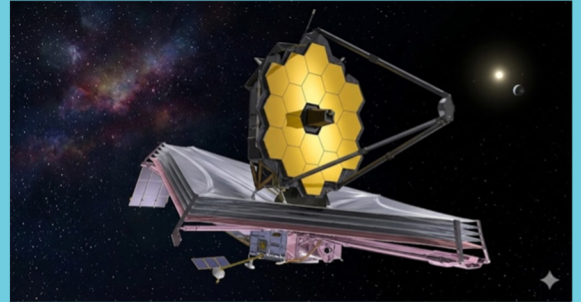
Questions

1. Did the galaxies that started farther from "Home" move a greater or smaller distance than the ones that started closer?
2. If you had picked Galaxy "B" as your "Home" instead, would the other galaxies still look like they were moving away from you?

Big Bang

Was the Early Universe a Quiet Place?

One of the most groundbreaking discoveries in recent astronomy has completely upended our understanding of how quickly the universe "grew up." Since the **James Webb Space Telescope (JWST)** began sending back data, it has identified a growing number of galaxies—such as the recently confirmed **MoM-z14**—that existed just 280 million years after the Big Bang.



Before these findings, scientists believed the early universe was a dark, relatively quiet place where the first stars and galaxies took a long time to slowly assemble. However, MoM-z14 and others like it are surprisingly bright, massive, and "chemically mature." They contain heavy elements like nitrogen and oxygen, which can only be forged inside stars. Finding these elements so early suggests that the first generations of stars lived and died much faster than our current models predicted.



Even more startling is the discovery of "JWST's Quintet," a group of five galaxies seen merging just 800 million years after the Big Bang. This indicates that the early universe was a violent, crowded place where massive structures were crashing together and forming at an incredible pace. These findings have created what astronomers call a "chasm" between theory and observation.

It appears the universe was in a massive hurry to evolve, forming complex galaxies and even **supermassive black holes** much sooner than anyone thought possible. These "Little Red Dots"—as astronomers call these early, dense objects—are forcing us to rewrite the timeline of cosmic history and reconsider what was happening during the very first moments of the "Cosmic Dawn."

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Answers: Page 2 Answers: 1) a, 2) c, 3) c, 4) a, 5) b. **Page 3 Answers:** Modeling the Universe's "Stretch" 1) The galaxies farther away moved a greater distance. 2) The galaxies would still have moved farther away from each other if B was the Home.

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