



**HOW HAVE THEORIES OF THE
FORMATION AND STRUCTURE OF
THE UNIVERSE CHANGED?**

**A Scientific Theory is an
explanation or model
backed by results
obtained from many tests
or experiments.**

WHY DO THEORIES CHANGE?

- Scientific theories change when scientists discover new information
- New technology, new tools, and/or new observations can provide new information.

Greater telescopes and imaging technology

THEORY CHALLENGE ACTIVITY

For centuries, there have been a variety of theories to explain the formation and structure of the universe.

We will examine some of these theories and identify the most widely accepted theory today.

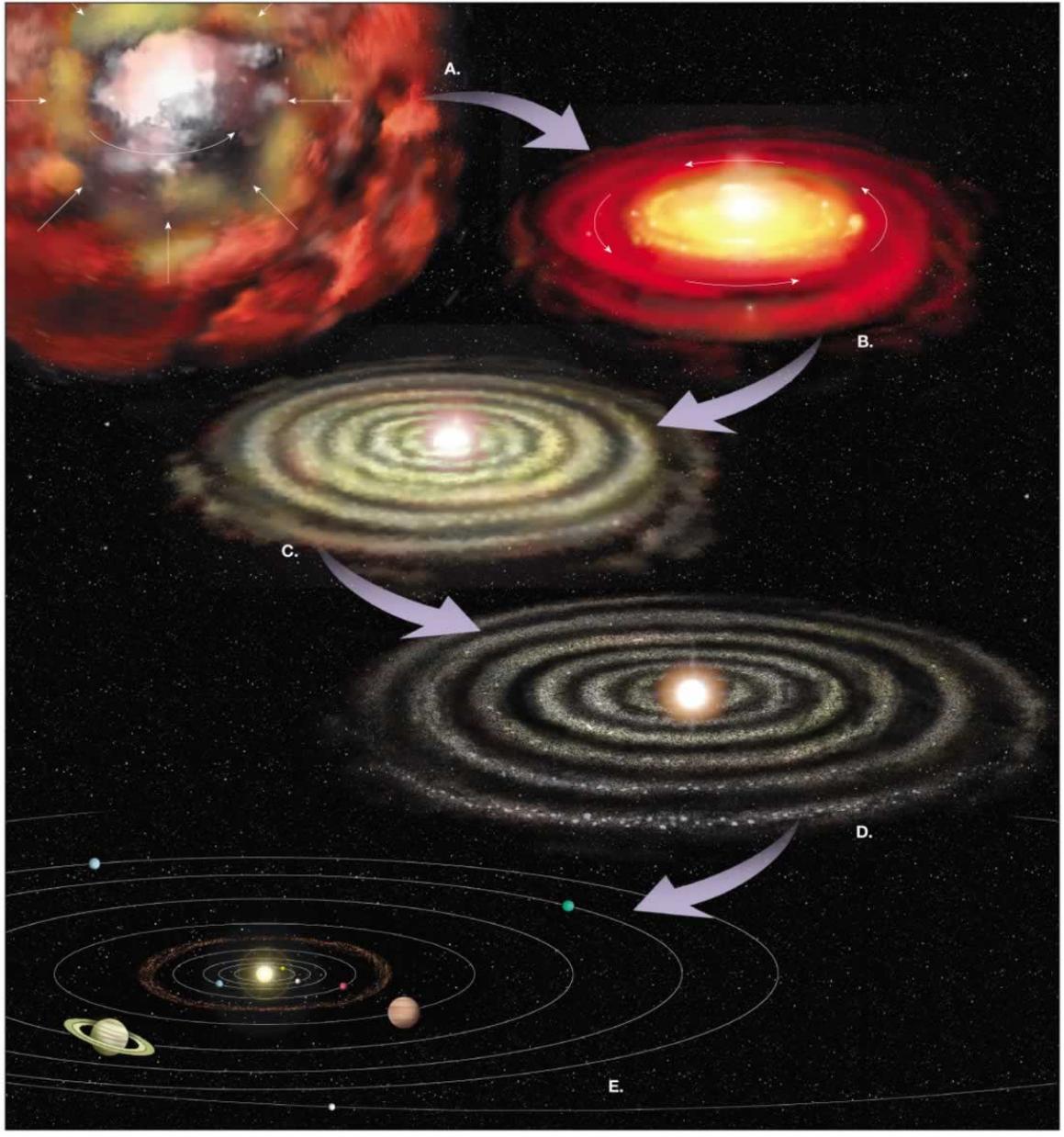
How and when did the universe begin? No one was around when the universe began, so who can say what really happened?

The best that scientists can do is work out the most foolproof theory, backed up by observations of the universe.

THE BIG BANG THEORY

The most commonly accepted theory today of the formation of the universe is the Big Bang Theory.

The theory states that the universe originated sometime between 10 billion and 20 billion years ago from an enormous explosion of a small volume of matter at extremely high density and temperature.



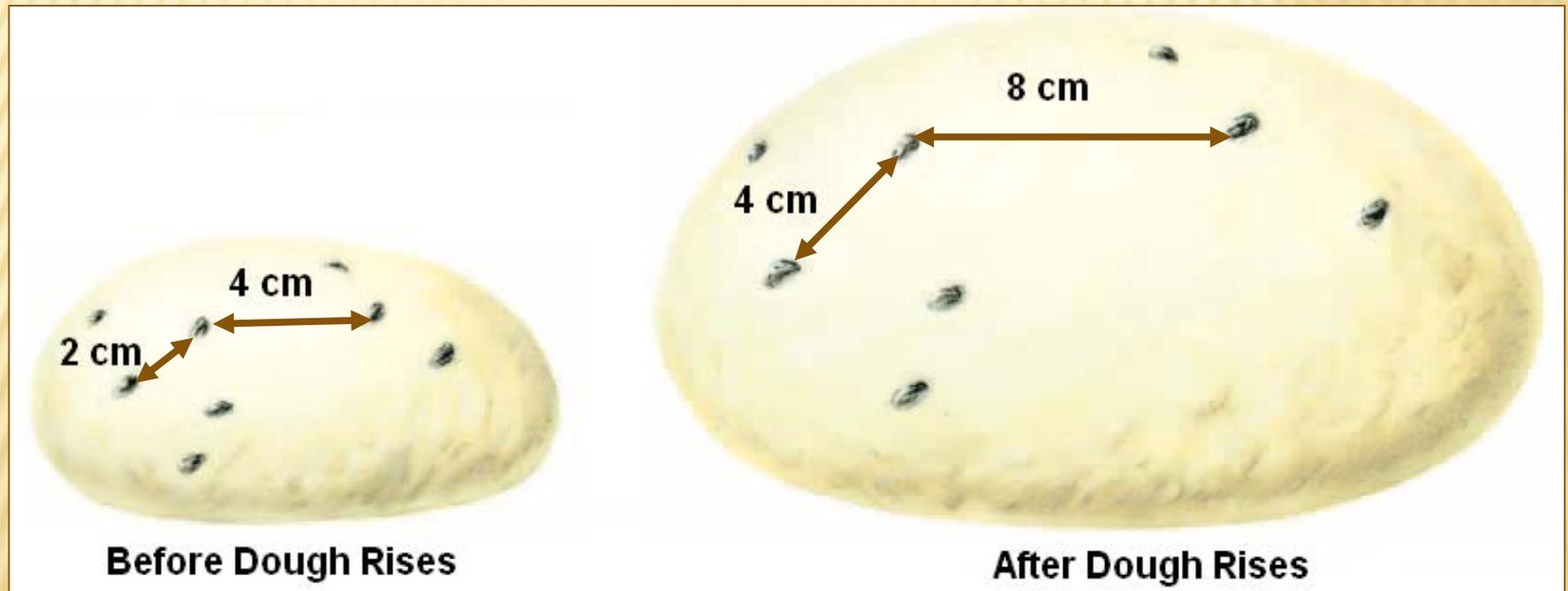
In spite of its problems, the Big Bang is still considered by most astronomers to be the best theory we have.

As with any scientific hypothesis, however, more observation and experimentation are needed to determine its credibility.

EVIDENCE TO SUPPORT THE BIG BANG

- Big Bang theorists claim that all of the galaxies, stars, and planets still hold the explosive motion of the moment of creation and are moving away from each other at great speed.
- In 1929, astronomer Edwin Hubble announced that all of the galaxies he had observed were moving back from us, and from each other, at speeds of up to several thousand miles per second.
- Since the Big Bang explosion, they reason, the universe has been expanding. This is the expansion theory.

Astronomers use the analogy of cooking raisin bread to demonstrate the expanding universe



Expanding the Universe on a Balloon Demo

THE UNIVERSE AFTER ITS BIG BANG...

- **The Universe includes living things, planets, stars, galaxies, dust clouds, light, and even time.**
- **The Universe contains billions of galaxies, each containing millions or billions of stars. The space between the stars and galaxies is largely empty.**
- **So, if the universe supposedly was formed by the Big Bang, how did these other objects form?**

THE UNIVERSE AFTER ITS BIG BANG...

As millions of years passed, the dense areas of the universe pulled in material because they had more gravity. Finally, about 100 million years after the Big Bang, the gas became hot and dense enough for the first stars to form. Large clusters of stars soon became the first galaxies.



Further away from the center of this mass where the star was forming, there were smaller clumps of dust and gas that were also collapsing.

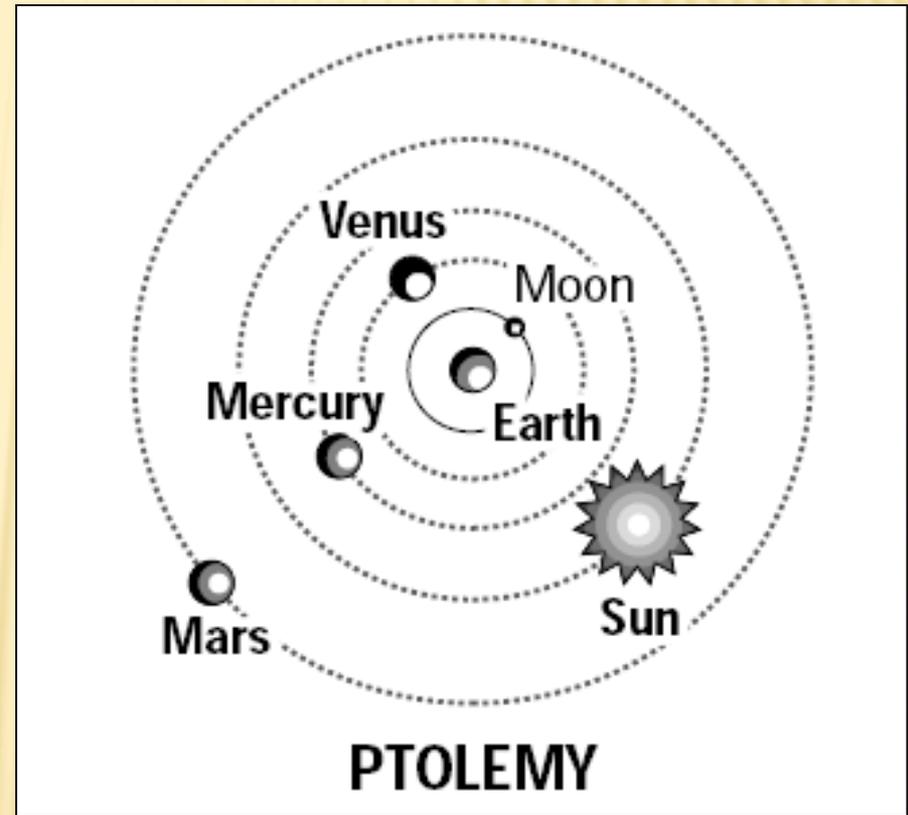
The star in the center eventually ignited forming our Sun, while the smaller clumps became the planets, minor planets, moons, comets, and asteroids.

In short, after the Big Bang, dense clouds of gas and dust from the “bang” either collapsed or stuck together to form the parts of the universe we know today.

**ANOTHER THEORY WHICH HAS
CHANGED OVER CENTURIES IS
THE SCIENTIFIC MODEL OF OUR
SOLAR SYSTEM**

PTOLEMY'S MODEL OF THE SOLAR SYSTEM

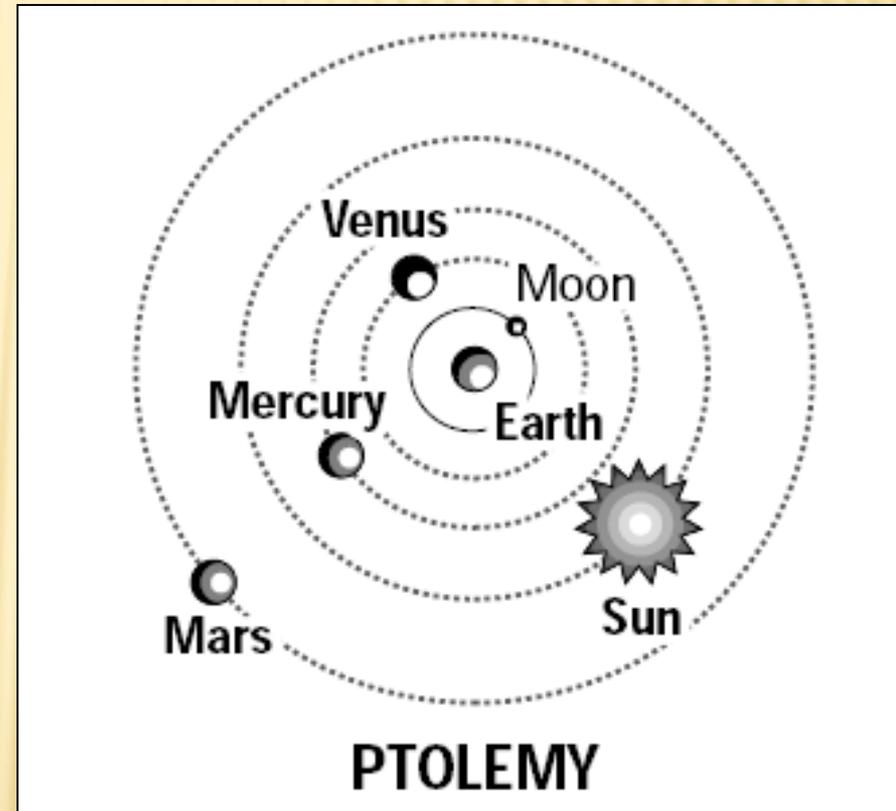
- Ptolemy's theory is known as the Geocentric Model because he thought the Earth was the center of the universe
- In Greek, "Geo" means earth



PTOLEMY'S MODEL OF THE SOLAR SYSTEM

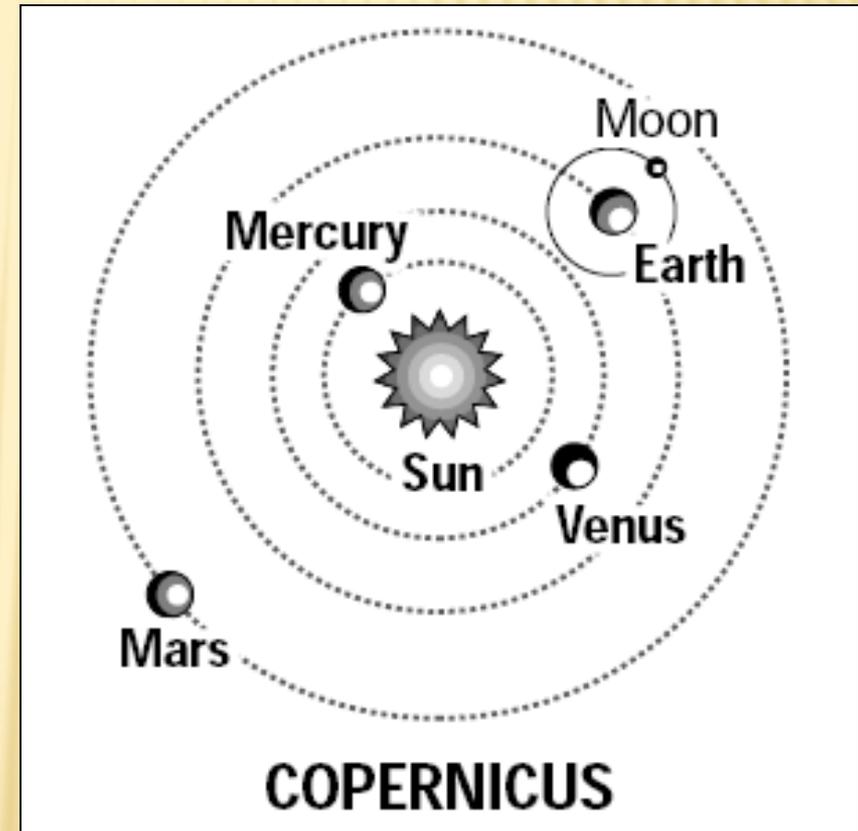
He believed his theory for several reasons

- Gravity of all objects were attracted to the earth, which suggested to him that the earth must be the center.
- He thought the Earth did not move because objects fell in the same place if thrown up in the air. He thought if the earth moved, objects would fall in a different place.



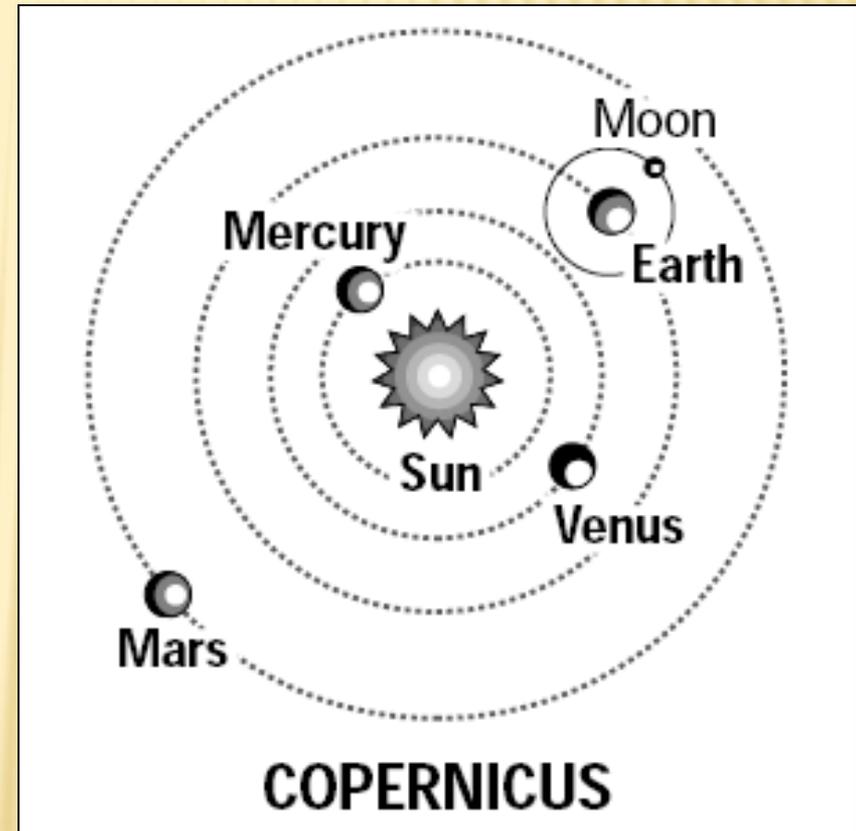
COPERNICUS' MODEL OF THE SOLAR SYSTEM

- Copernicus' theory is called the Heliocentric Theory because he thought the sun was the center of the universe.
- In Greek, “helios” means sun



COPERNICUS' MODEL OF THE SOLAR SYSTEM

- Galileo made additional observations using a telescope which supported the heliocentric theory.
- Kepler also supported the Heliocentric model through mathematics. He also discovered that the orbits of the planets were elliptical not circular.



THREE THEORIES OF THE SOLAR SYSTEM ACTIVITY SHEET

**WHY WAS THE GEOCENTRIC
MODEL OF THE SOLAR
SYSTEM REPLACED BY THE
HELIOCENTRIC?**

SUMMARIZING STRATEGY

- 3 - Identify three people who have contributed to the models of our solar system**
- 2 - Describe two models that were debated for hundreds of years**
- 1 - Name of the theory that explains the formation of the universe**