



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

S6E1a. Relate the Nature of Science to the progression of basic historical scientific models (geocentric, heliocentric) as they describe our solar system, and the Big Bang as it describes the formation of the universe.

**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.
- Think back to the Theory Challenge Activity. What new technology and/or tool was mentioned?

Greater telescopes and imaging technology

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?

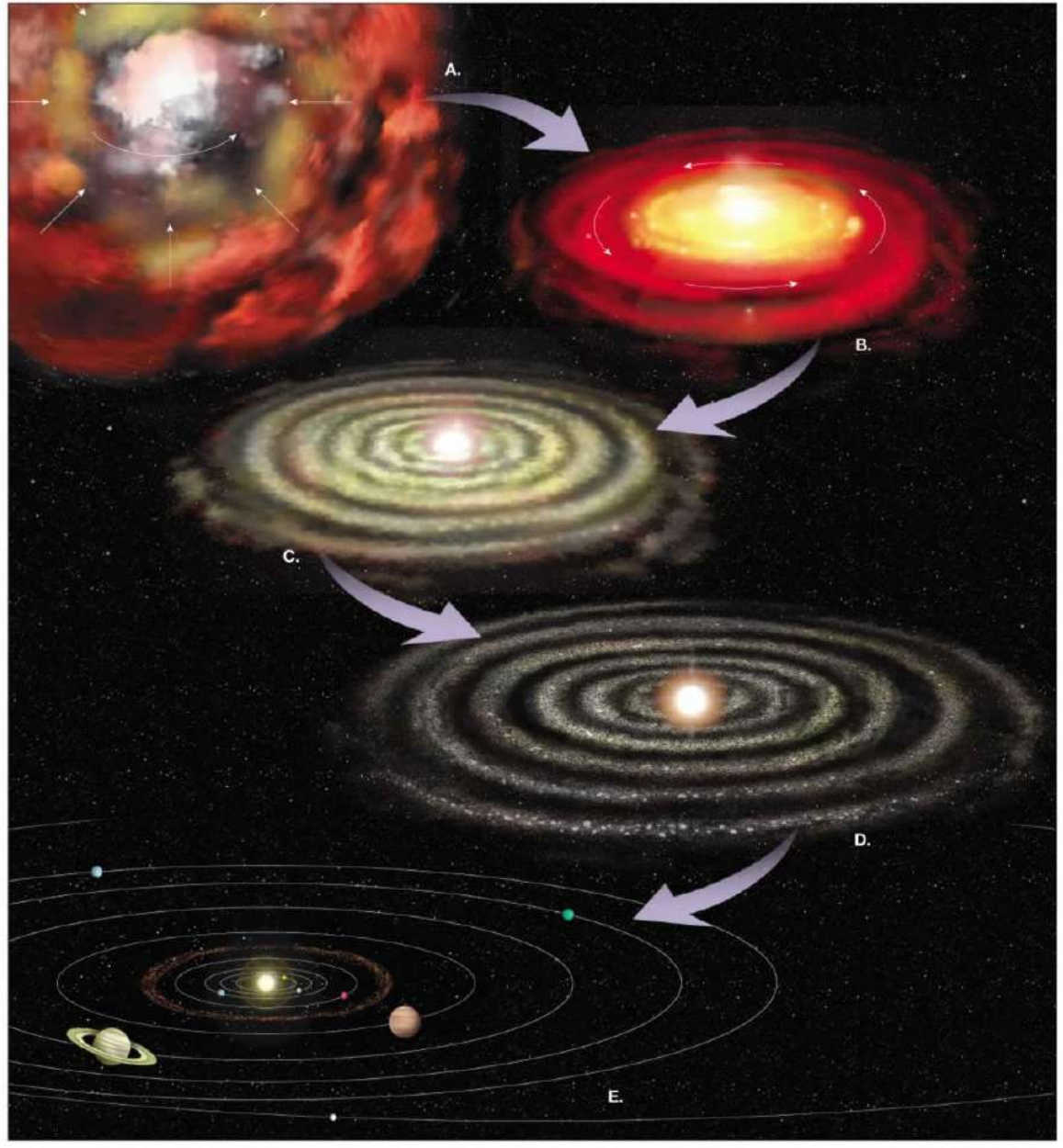
After all, no one was around when the universe began, so who can say what really happened?

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.



VISUALIZATION OF THE BIG BANG

http://www.classzone.com/books/earth_science/terc/content/visualizations/es0401/es0401page01.cfm?chapter_no=visualization

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.

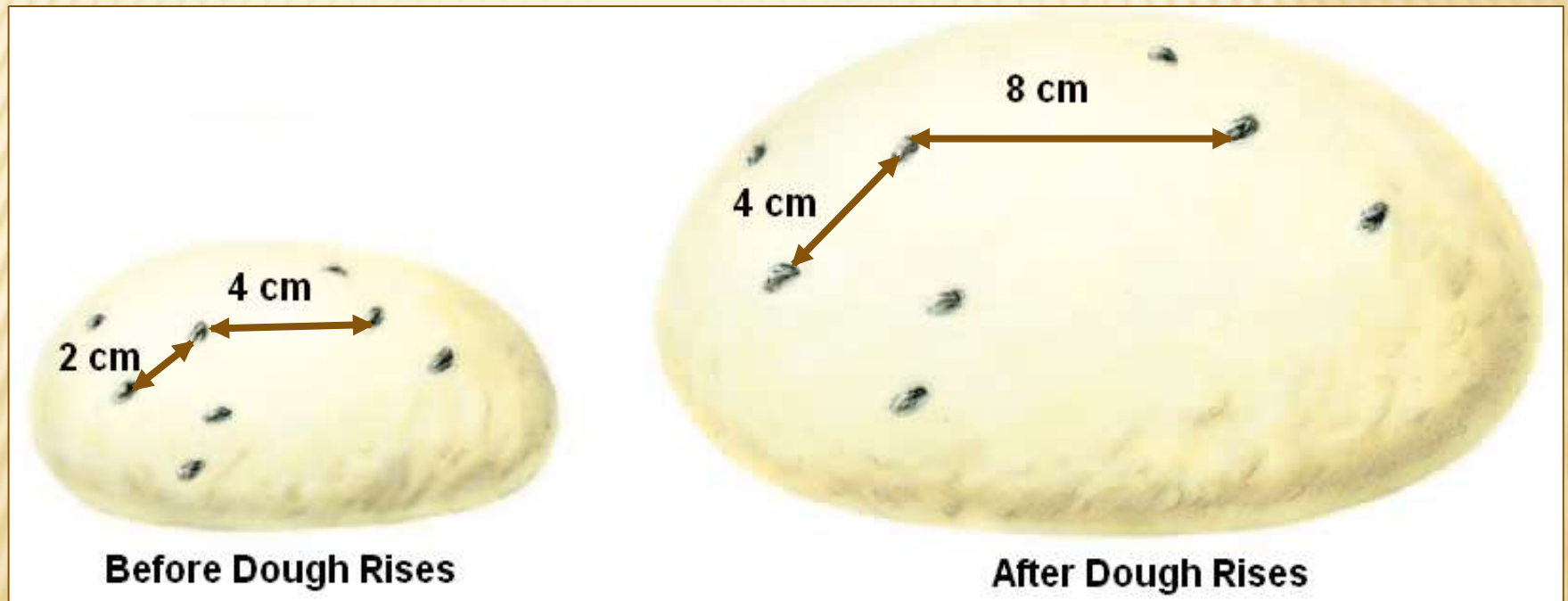
DISTRIBUTED SUMMARIZING

Turn to a partner and describe the Big Bang Theory and why it is called a Theory.

ANOTHER THEORY ABOUT THE UNIVERSE...

- 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.

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



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.**

THE UNIVERSE AFTER ITS BIG BANG...

- ✖ At the center of this spinning cloud, a small star began to form. This star grew larger and larger as it collected more and more of the dust and gas that collapsed into it.**

THE UNIVERSE AFTER ITS BIG BANG...

- ✖ 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.**

THE UNIVERSE AFTER ITS BIG BANG...

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.

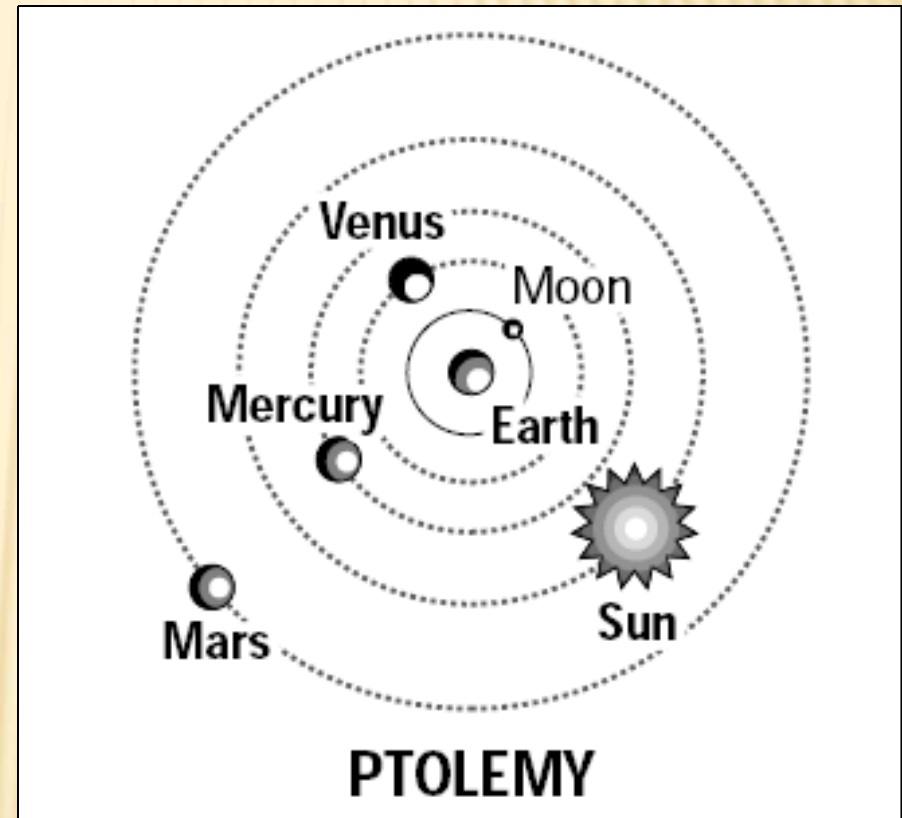
✖ Scientists believe that Solar Systems formed in similar ways. Giant clouds of dust and gas began to collapse under the weight of its own gravity. As it did so, the matter contained within it began to move in a giant circle, much like the water in a drain moves around the center of the drain in a circle.

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

**THE GREAT DEBATE! MODELS OF
THE SOLAR SYSTEM ACTIVITY
[SEE RESOURCES]**

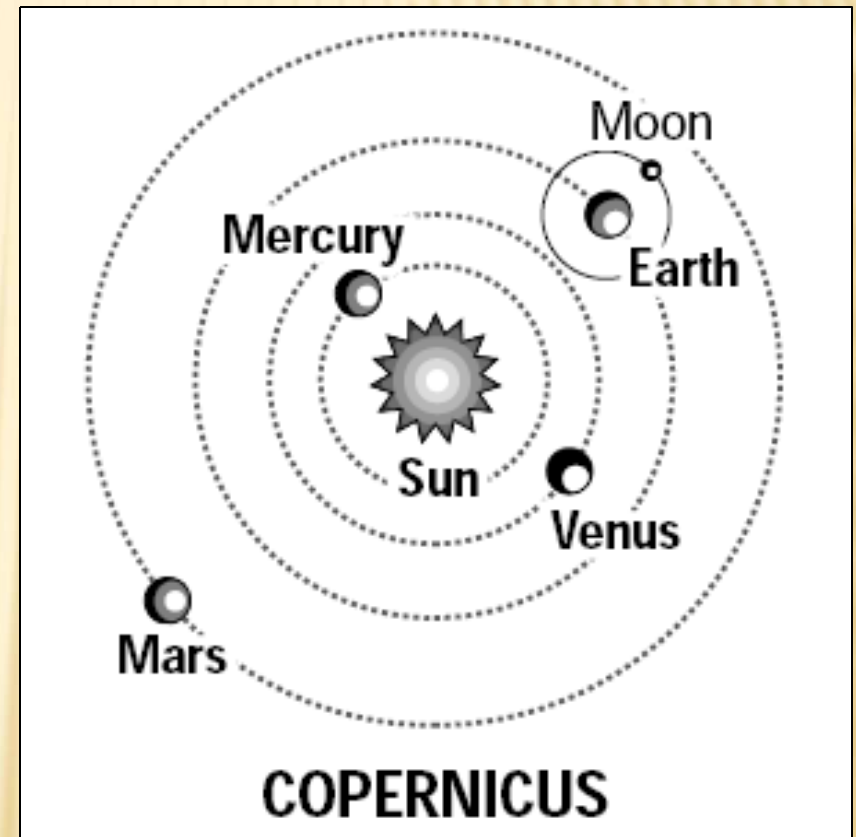
PTOLEMY'S MODEL OF THE SOLAR SYSTEM

- 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
- 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
- Galileo made additional observations using a telescope which supported the heliocentric theory.
 - Galileo observed that Venus went through a full cycle of phase's like the Moon. This could only be explained if Venus were orbiting the Sun.



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

MODELS OF THE SOLAR SYSTEM

- Video Clip of Models:
http://www.youtube.com/watch?v=GmwAr54L_pM
- Animation of the Geocentric Model:
<http://bcs.whfreeman.com/universe7e/content/ch04/0403001.html>
- Animation of Heliocentric Model
<http://astro.unl.edu/naap/ssm/heliocentric.html>

DISTRIBUTED SUMMARIZING:

You are Galileo, write a letter to Copernicus' ghost to tell him how Galileo has saved his name – be sure to include Galileo's findings, how he fixed Copernicus' reputation, and what the solar system has been proven to actually look like (which solar system model). The letter must be a minimum of 5 sentences.

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**