M T W T F S DATE:

Methods to measur the age of the Universe:

- Based on scientific observations and calculations, the universe is believed to be 13.7 billion years old by a majority of the scientific community.
- There are two methods scientists rely on for calculating the age of the universe which are the following;

1. Calculating the expansion rate of the universe – the time that has passed since the Big Bang:

- According to scientists, the universe is approximately 13.7 billion years old. It is the age of the universe that is estimated from the Big Bang. According to this method, we assume that the universe is expanding at a constant rate by using Hubble's constant (H_0).

i. Mathematical Expression:

- Hubble noted that the distance of a galaxy is directly proportional to its speed, and means the further the galaxy was, it was moving away.

As we know that

speed = distance / time

To find time, multiply time both sides.

M T W T F S

DATE:

$$v \times t = \frac{d}{t} \times t$$

$$vt = d$$

Now divide speed both sides

$$\frac{vt}{v} = \frac{d}{v}$$

$$t = d/v \rightarrow (i)$$

According to Hubble Law: $v = H_0 d$

Now put v in eq (i).

eq (i) $\Rightarrow$

$$t = d/v$$

$$t = d/H_0 d$$

$$t = 1/H_0$$

$$\boxed{t = 1/H_0}$$

v = velocity of a galaxy in km/s

H_0 = Hubble constant, measured in km/s/mpc

d = distance of a galaxy, in Mpc (megaparsecs).

ii. To estimate the age of the Universe using Hubble's Constant:

- The value of 13.7 billion years for the age of the universe has been estimated by using a Hubble's Constant H_0 of approximately 71 km/s/Mpc, and plugging it into the following equation.

$$\text{Age of universe} = 1/H_0$$

- Hence, scientists were able to use the Hubble constant to estimate the age of the universe,

M T W T F S DATE:

specifically. by observing the velocity with which distant galaxies are moving away from the earth.

2. The age of Universe can also be measured by determining the age of the oldest stars:

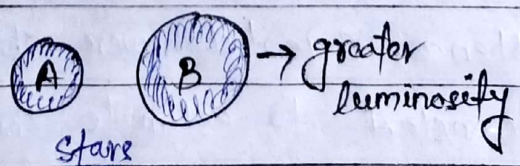
This method is based on observations of globular clusters. A globular cluster is essentially a group of a large number of stars (approximately one million stars!) huddled close together in space. Scientists determine the age of the universe from the following;

i. Spectrum of a Star:

The star's spectrum helps determine the age of stars because blue stars tend to die faster than red stars.

ii. Luminosity of a Star:

A brighter star will exhaust its energy faster than a less bright star. Therefore, the star with less luminous intensity intensify exists for a longer time than with a more luminous intensity.



M T W T F S DATE:

iii. **Star's Mass helps to measure the age of the Universe:**

- The amount of a stars mass also helps in finding the life of a star. If a star is dense, it tends to die quickly as compared to a less dense star. Thus, the density factor also helps calculate a star's life.

iv. **Age of the Universe can also be measure by finding the speed of a star:**

- The brighter star tends to have more energy; in turn, its speed will be greater than the comparatively less luminous star. Eventually, the brighter star will consume its energy quickly & die before the other less bright star, thus, will have a short life and vice versa.

Conclusion:

The stars in the oldest globular clusters are less than 0.7 solar masses, which puts their age (& the age of the universe) b/w 11 & 18 billion year. But the most widely & accepted age of the universe is 13.7 billion years.