

# The Dawn of the Universe



According to Science:

EVERYTHING...space, matter, energy...that now constitutes the UNIVERSE came into existence with a violent, cataclysmic explosion of an extremely small, dense body of Matter about 13.7 Billion Years Ago

Known as The BIG BANG

\* Only a Theory constructed by scientists to fit the available evidence we find as we observe and measure the Universe

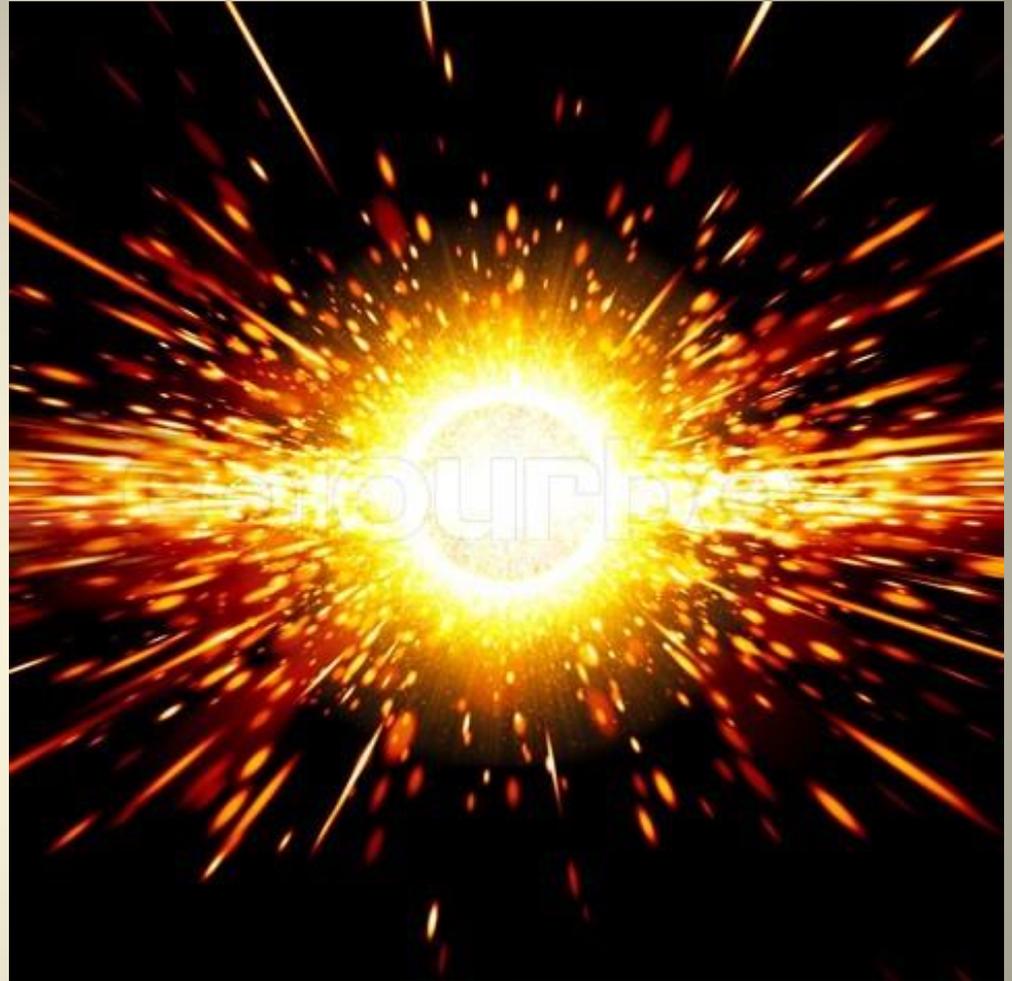


A Dense region of energy  
Unbelievably hot  
Smaller than a Pin Prick

An instant after the explosion: point expanded  
at an astonishing fast rate

**Within 1<sup>st</sup> second:**  
**Gravity was**  
**formed**

**Tiny elementary**  
**particles (quarks)**  
**clumped together**  
**to form protons**  
**and neutrons,**  
**which make up**  
**the atomic nuclei**  
**in most of the**  
**matter that exists**  
**today**



As the Universe Expanded it Cooled:

When it **cooled enough, to @ 3000 ° C** subatomic particles slowed down enough to be captured by atomic nuclei (mutual forces of attraction cause particles to come together) and form neutral atoms

**Large expanses of space opened up between atoms and photons, light energy/radiation, could travel across the universe**

Universe went from opaque to transparent : TODAY we can detect this remnant light, left over from the BIG BANG explosion

How? Frequency of this background radiation can be detected with radio antenna : called **COSMIC MICROWAVE BACKGROUND RADIATION or CMB**

**\*\* CMB is now the most studied phenomenon in astrophysics**

1978 Nobel Prize in Physics : Arno Penzias and Robert Wilson

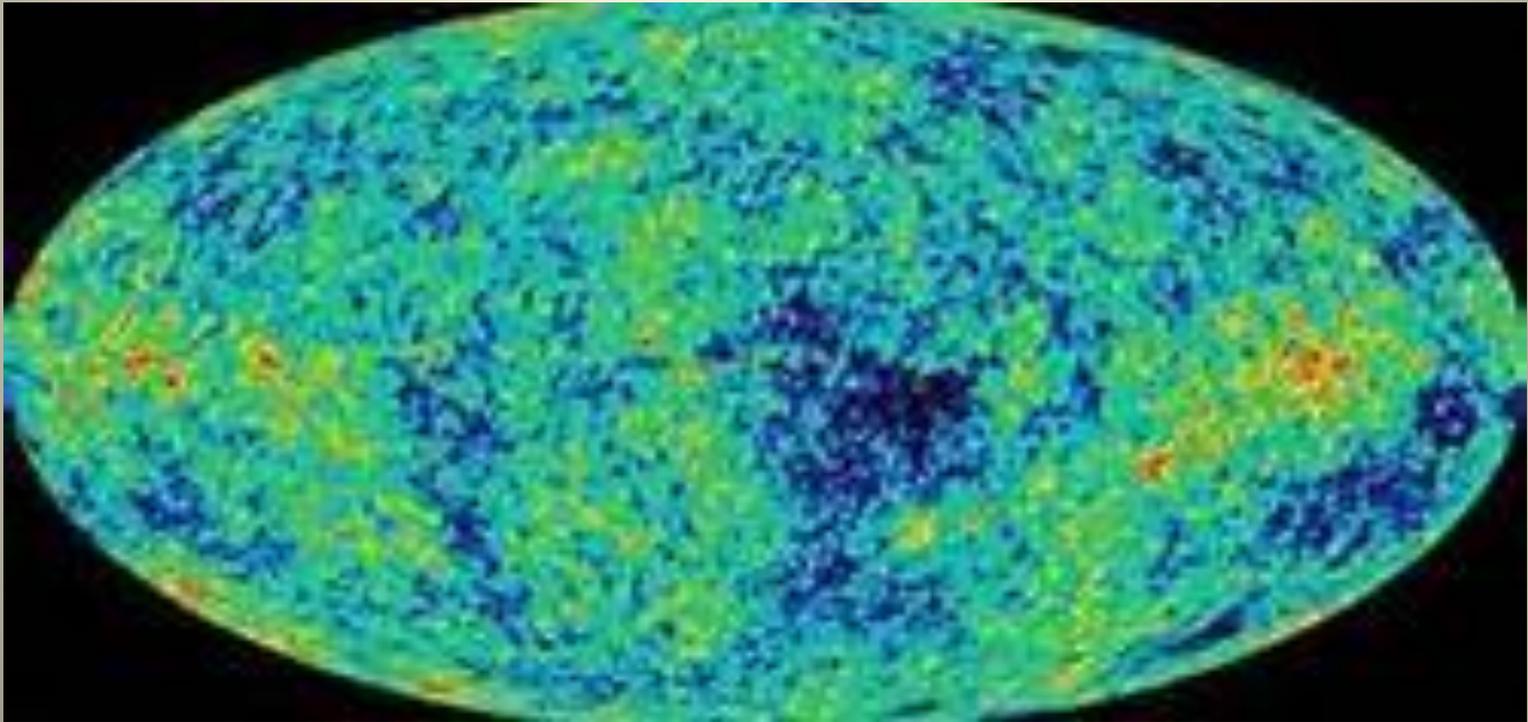
1989 NASA launched COBE – Cosmic Background Radiation Explorer Satellite

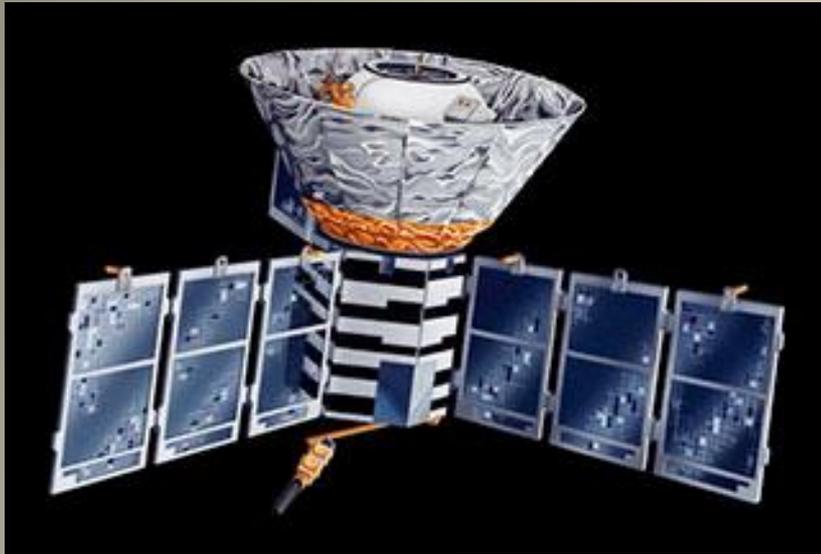
2001 launched WMAP – Wilkinson Microwave Anisotropy Probe to map CMB

CMB : the Oldest Light in the Universe!

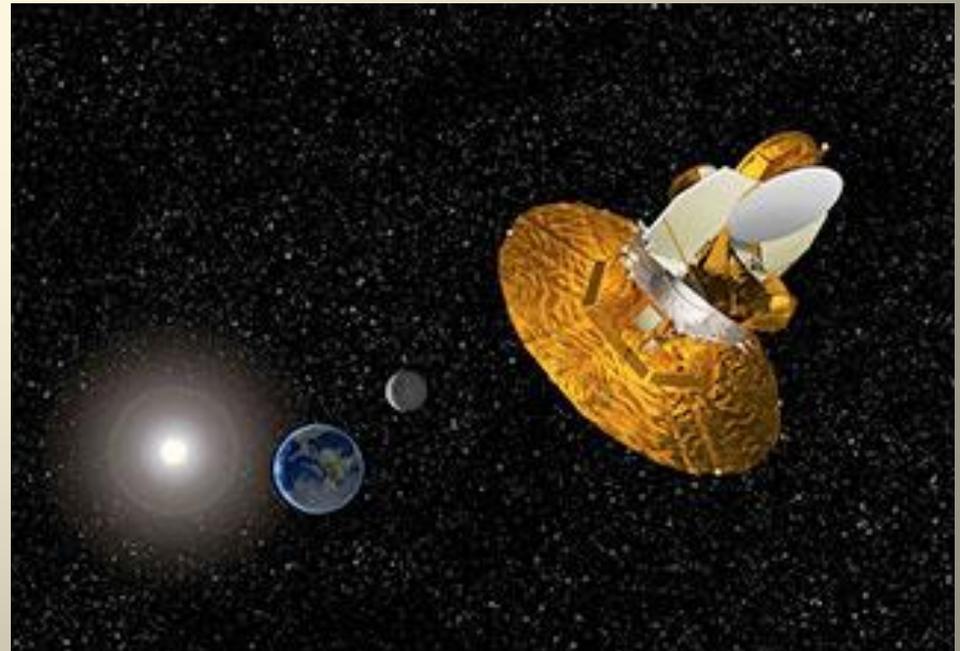
Considered one of the strongest pieces of evidence in support of the Big Bang Theory

\*\* All sky picture of our “infant universe” created from 9 years of data from WMAP probe  
Reveals temperature fluctuations that correspond to the “seeds” that grew into existing galaxies





# WMAP Probe



<https://www.youtube.com/watch?v=PVOAClykxQI>