

# The Origin of the Universe

Week 26

# What is the universe?

- The observable universe is a sphere about 90 billion light years in diameter
- The sphere is centred on the observer
- The edge of the sphere is where the most distant light has had time to reach us since the universe began.
- This sphere is known as the 'Hubble volume'

# The Big Bang

- The universe is expanding from a dense, hot state that happened some time ago
- The first H and He atoms were created in this early state
- There is cosmic microwave background radiation (CMBR) present in the universe which is the remnants of the big bang

# CMBR

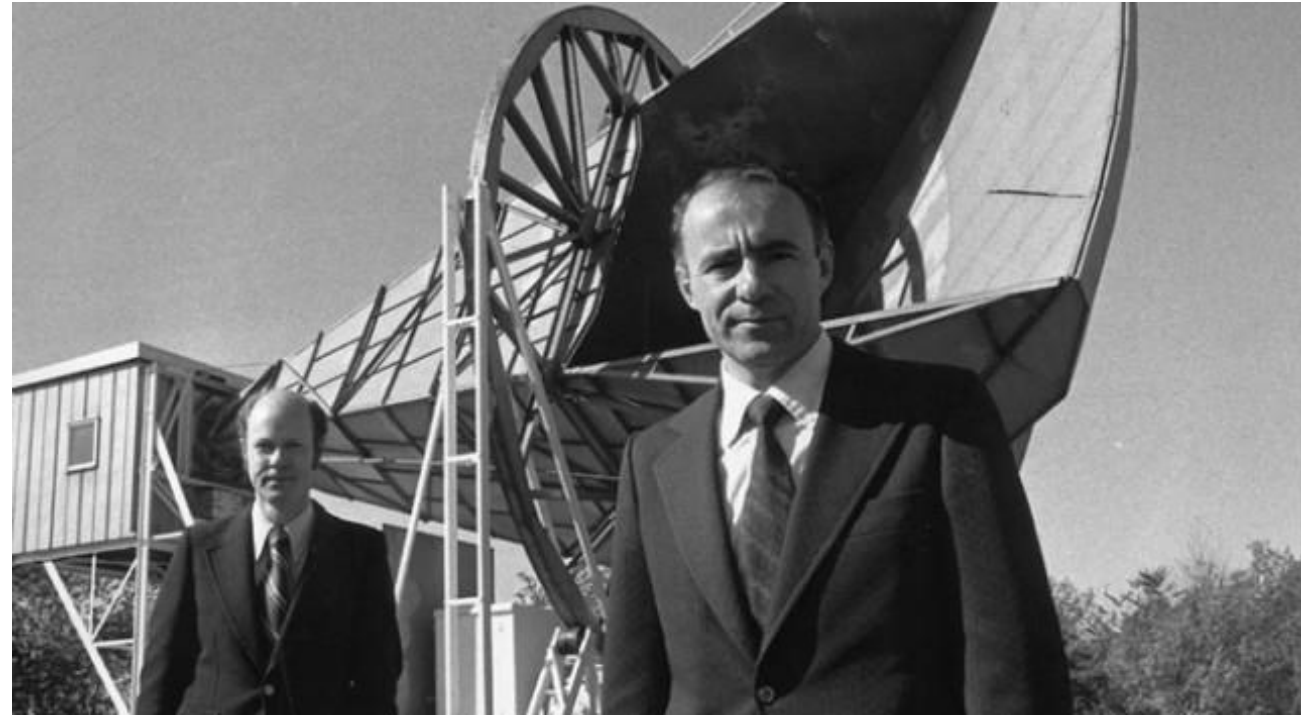
- The Russian scientist George Gamow predicted that the hot, dense universe of the big bang would have now had to have cooled to a few degrees above absolute zero.
- CMBR was later discovered to be at a temperature of 2.7K

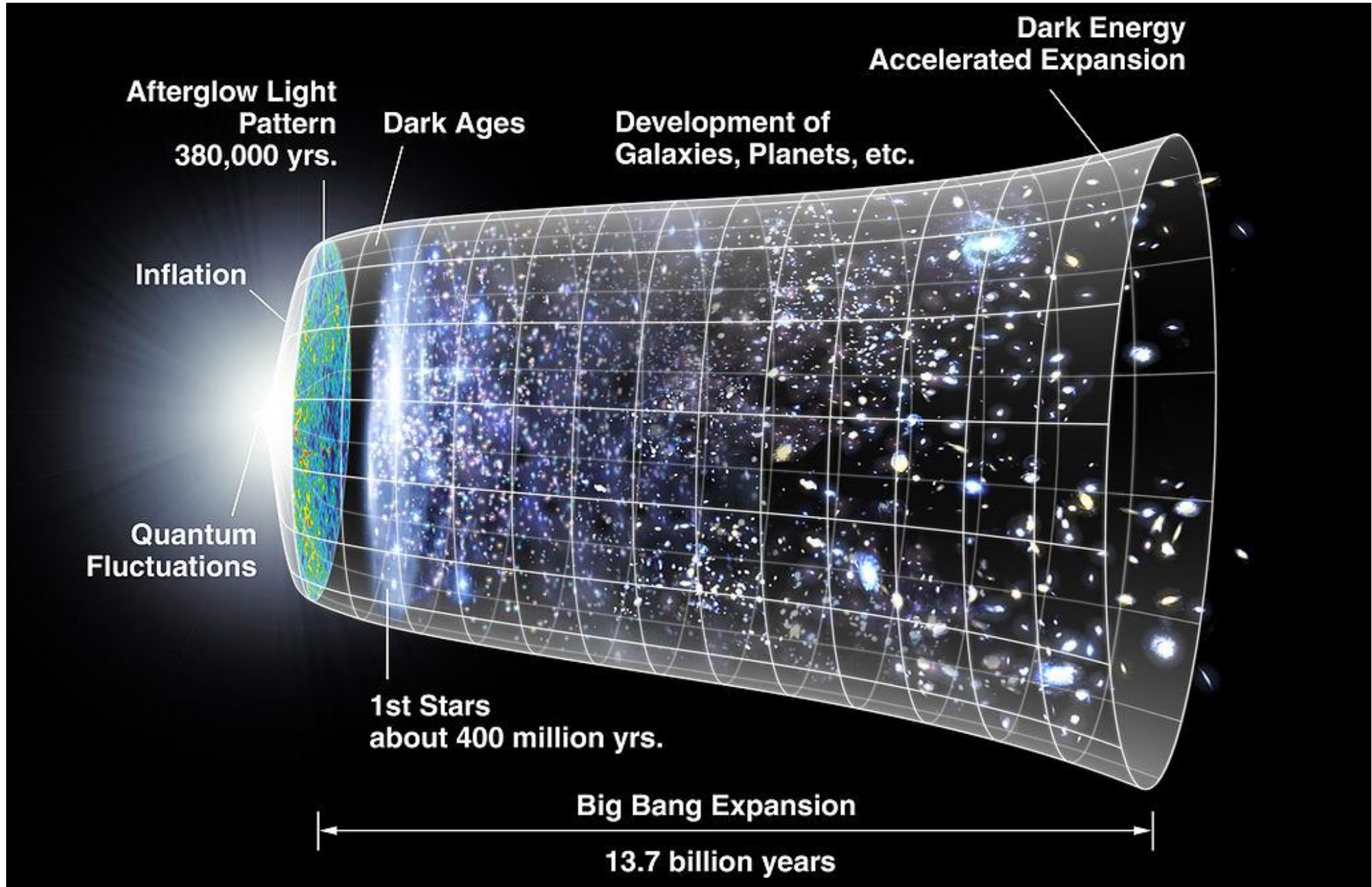


- A number of universities set out to find the existence of CMBR as predicted by Gamow.

- CMBR was discovered in 1965 by Arno Penzias and Robert Wilson. The discovery was accidental

- They were attempting to track radio signals from satellites but found 'noise interference' from every part of the sky, day and night.





# Strange effects...

- Strange behaviour of matter
- Gravitational lensing
- Strange effects on galaxies
- Odd effects in the CMBR

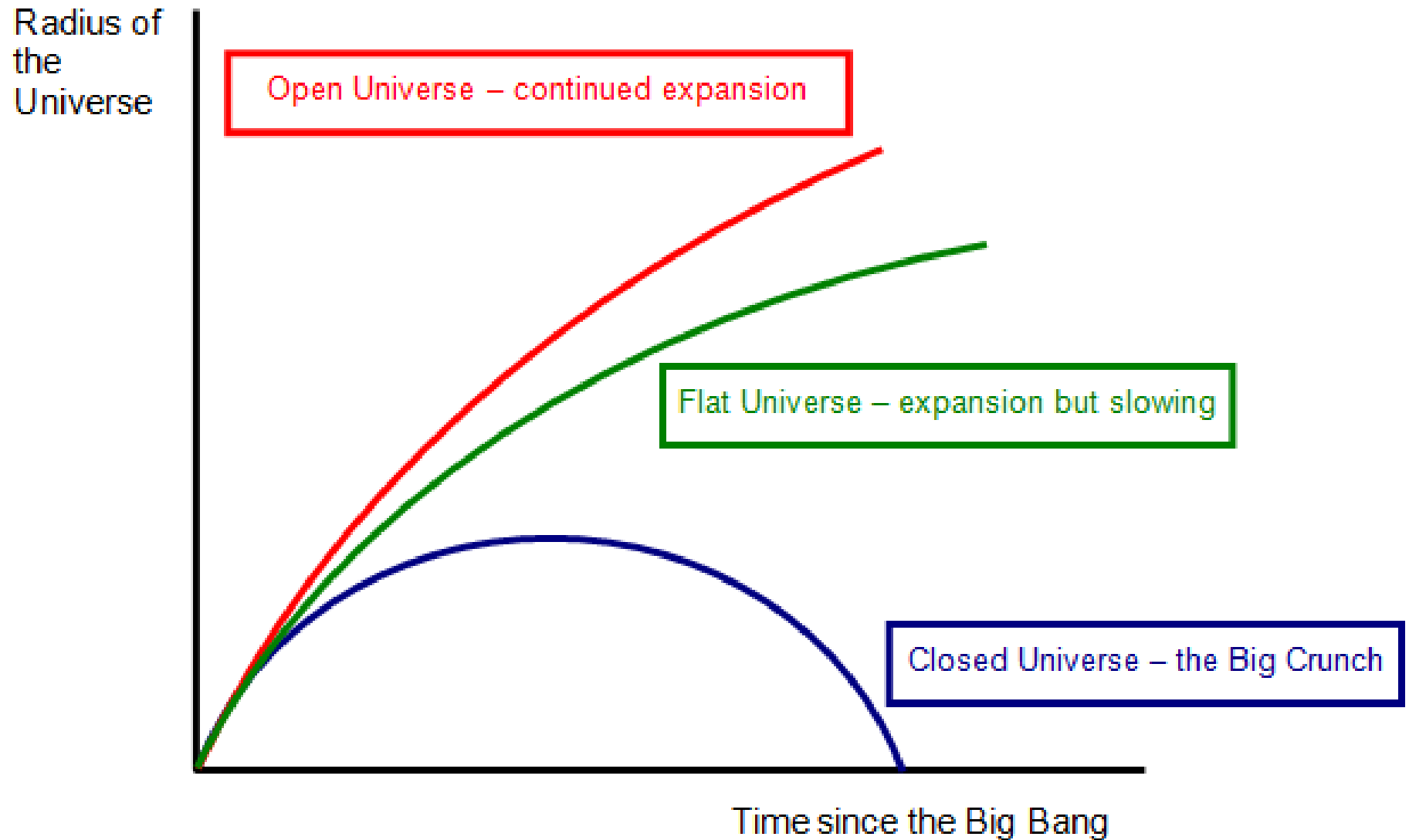
So we infer that there must be something else there...

- In fact matter is only 4.9% of the total make-up of the universe
- The rest can't be measured because it doesn't interact with electromagnetic radiation (light etc.)
- We can only assume it is there because it explains the strange effects.



- It's called dark matter and dark energy
- The universe is 4.9% matter, 26.8% dark matter and 68.3% dark energy

# 3 ideas about the fate of the universe



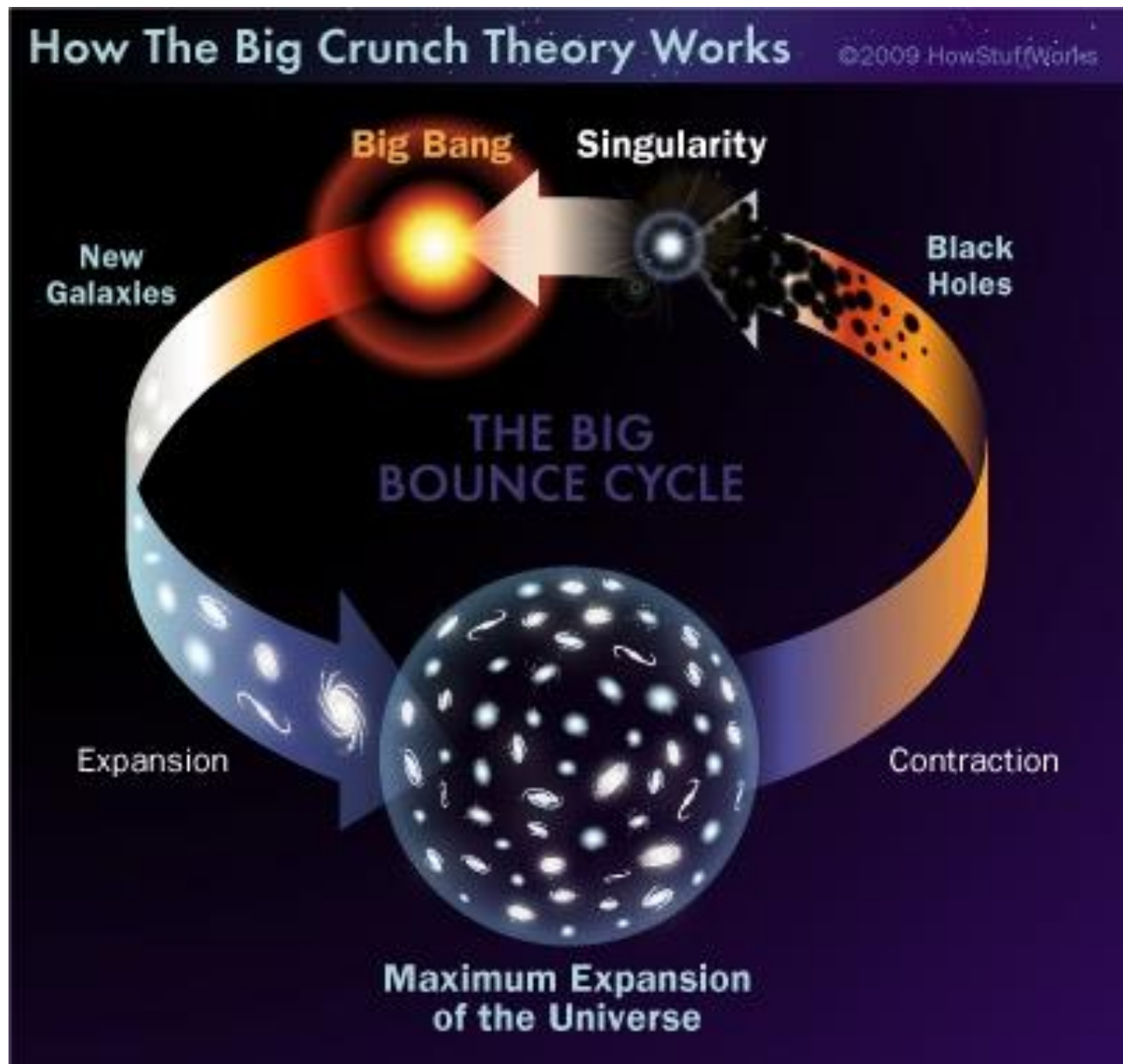
# Other theories about the origin of the universe

- Steady state theory
- Oscillating universe theory
- Creationism
- Many universes
- Digital simulations

# The steady state theory

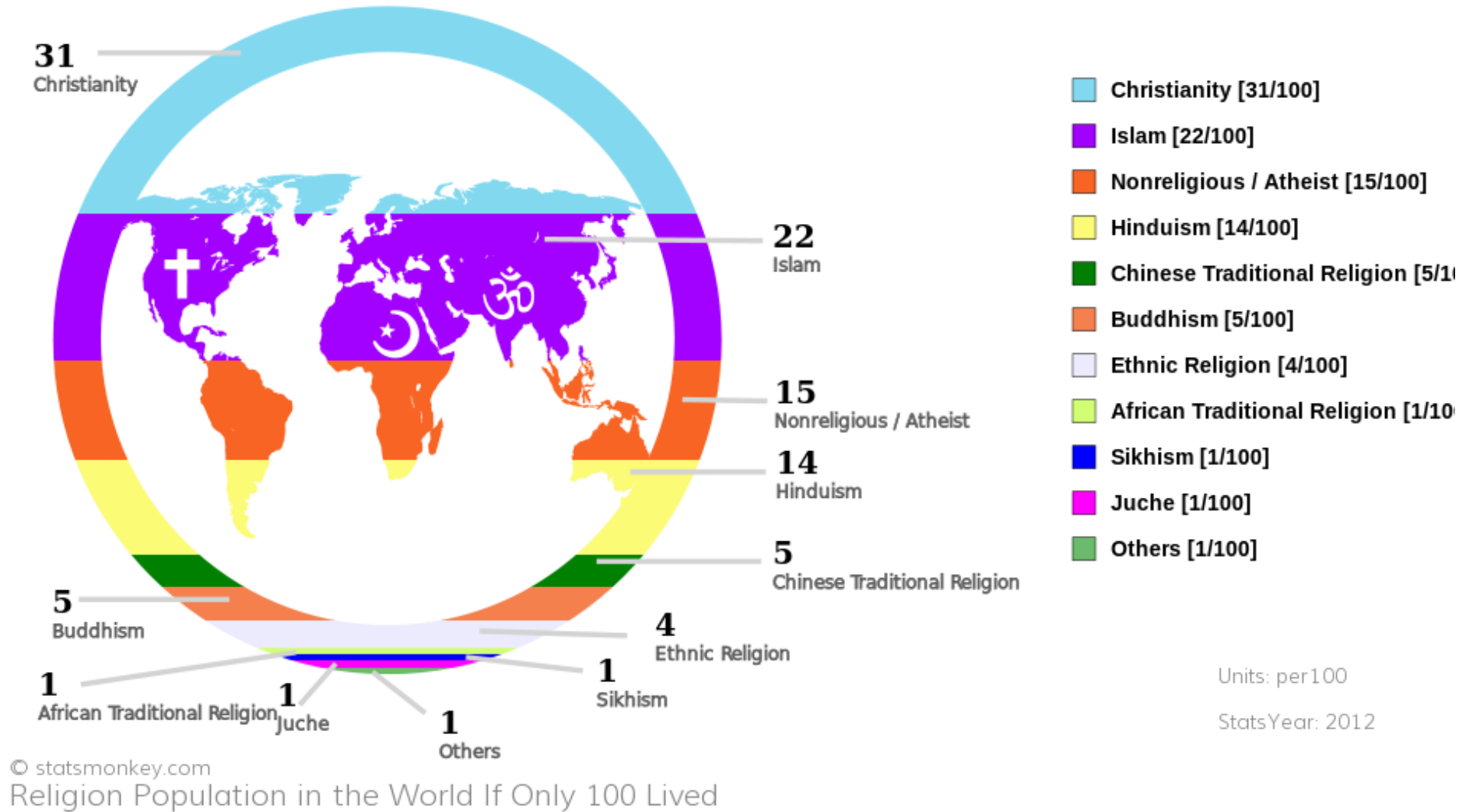
- The universe has always been here and always will be
- It's expanding
- The discovery of the CMBR disproves the SST

# The oscillating universe



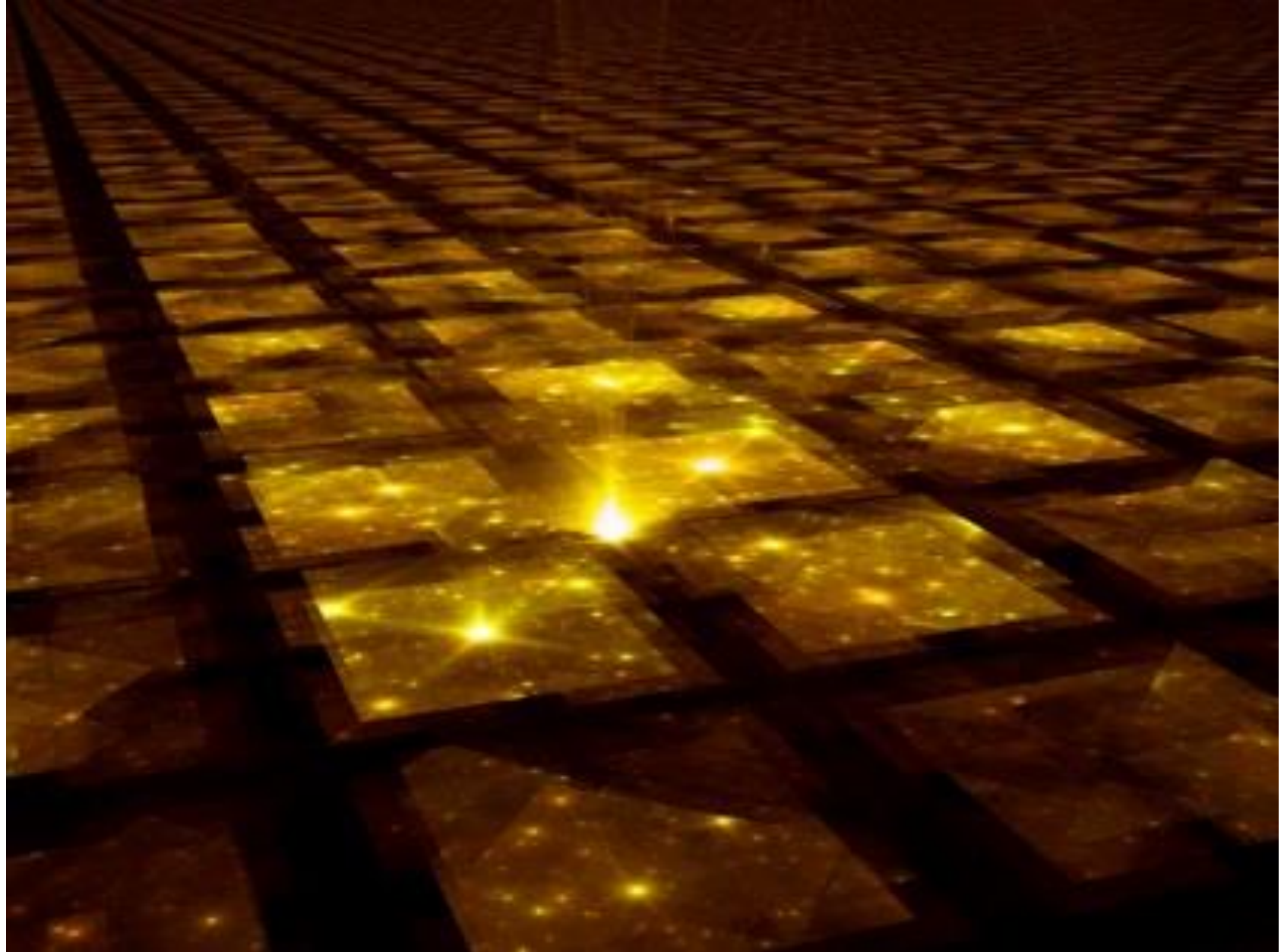
# Creationism

85% of the world's population believe in intelligent design



# Many universes

Each time you make a decision a new universe is created where an alternative 'you' makes the alternative decision.



# Digital simulations

American philosophers have argued that it's more realistic for us to be part of a giant computer simulation as opposed to us resulting from either intelligent design (creationism), or evolution.

