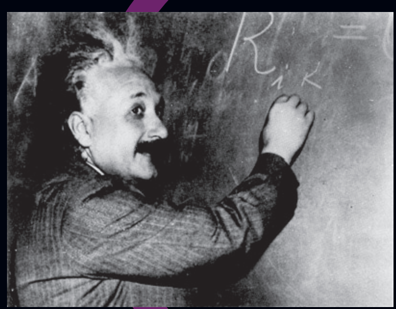
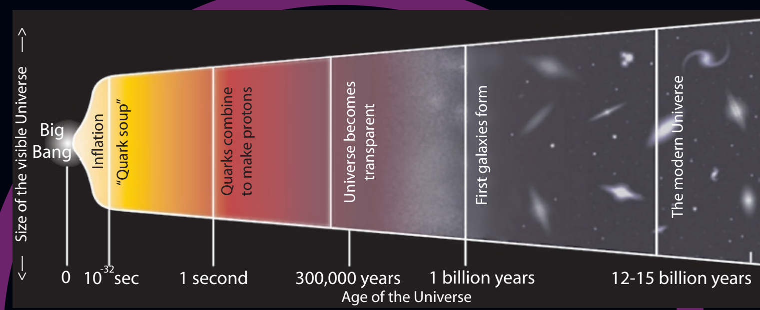
THE EVOLVING UNIVERSE



In 1916, Einstein publishes his General Theory of Relativity. In this theory, the fabric of space itself is distorted by the presence of matter.

For the first time, an evolving Universe seems more likely than a static one.

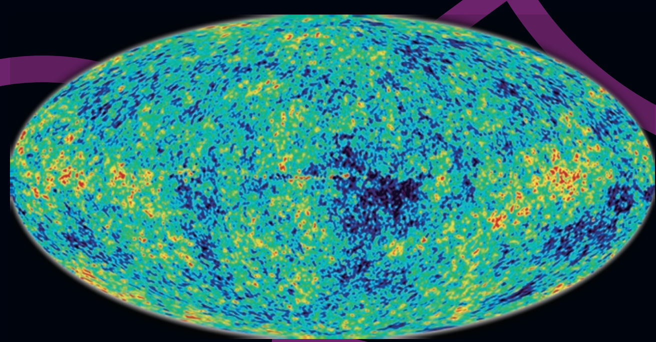


By the end of the 1920s, Edwin Hubble has provided evidence that distant galaxies are moving away from us, with more distant ones moving faster. Most people now agree - the Universe is expanding.

This leads to the Big Bang Model, suggesting that the universe may have begun as a very small, hot place that expanded and cooled to form stars and galaxies as we see them today.

In 1949, Gamow suggests that the light from this initial hot phase of the universe should still be visible all around us, although the expansion of space will have stretched and cooled the light waves by a factor of about 1000, so that we now see them as faint microwaves.

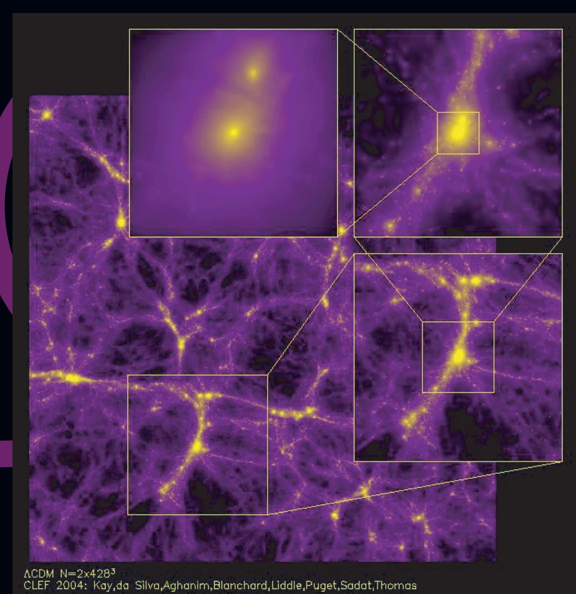
This is the 'Cosmic Microwave Background', which was first detected in 1965 by Penzias and Wilson, and was recently mapped to very high precision by NASA's WMAP satellite. The map on the right shows how the temperature of the background varies over the whole sky. The variations are very slight - about 1 part in 100,000.



Courtesy: NASA, WMAP team

The slight fluctuations in temperature in the microwave background tell us about the distribution of matter in the Universe when it was less than 1/1000th its present size.

Researchers at Oxford, and elsewhere, use supercomputers to simulate how these early fluctuations may have developed into the Universe we see today, with galaxies concentrated along filaments and in clusters, separated by vast empty voids.



Courtesy: NOAO/AURA/NSF

Ongoing technological developments have led to the construction of telescopes, like the Gemini telescope shown here, with ever larger collecting area, allowing us to observe fainter and more distant galaxies.

Gemini's main mirror is 8 metres in diameter - a major feat of engineering! Oxford is involved with projects to develop powerful instruments for telescopes like Gemini, and even larger telescopes.

The details of cosmic evolution on 'small' scales are fascinatingly rich and complex, as this image of colliding galaxies demonstrates.

Oxford astrophysicists use modern telescopes and instruments to carefully examine the properties of both galaxies and the stars within them, and attempt to develop theoretical models to explain their behaviour.

If you want to know more about Physics at Oxford see the web: http://www.physics.ox.ac.uk/

Courtesy: Debra Meloy Elmegreen (Vassar College) et al., & the Hubble Heritage Team (AURA/ STScI/ NASA)

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