

Cosmology and the Expanding Universe:

- 1925 Belief Milky Way was our whole universe.
- Hubble measured distance to object M31 by finding Cepheid variable star and using it to calculate distance to work out if there are more galaxies and spectroscopic survey to find out if they are moving away by calculating redness
- Space is expanding caused by big bang (single point origin all things came)

Biological Evolution:

- Before belief in supernatural origin but fossil evidence outlawed that species not static
- Charles Darwin proposed non-supernatural mechanism species could change
 - Natural selection: Survival of the fittest + produce more fit offspring that inherit genes
- **Tree of life:** species diversify cos of natural variation from recombination and mutation
- **Point of origin:** where creatures had original come from
- **Miller-Urey experiment:** simulate primitive earth and explain how simple chemical compounds become complex organic substances

The Quantum Mechanical World:

- Explains Interactions between energy and matter on an atomic scale and subatomic
- Originally nature of light was known as stream of particles but now it showed as a wave by James Clerk
- Einstein figured out particles of light are photons
- **Photoelectric effect:** some material like silicon absorb light and gives off electrons. But rate of which electrons are emitted is sensitive to its colour
 - Einstein proposed: light was a series of particles that carried a discrete amount of energy and that amount of energy was proportional to the frequency of light
- **Implications(Schrodinger cat):**
 - One physical systems don't seem to be able to be described or even defined without an observer who seems to need to be a conscious being.
 - Another is that the properties of two physical systems can become **entangled** so that **changing one effects the other instantly**, even if they are far apart
Einstein disliked this notion, calling it "spooky action at distance". But even he couldn't make it go away

Mind is the operation of the brain

- Descartes: **Dualism** believed in an immaterial, ghost-like soul that was totally different from the mechanical operations of the body, but which somehow possessed it during a person's life.
 - Issue: no-one could explain how soul could affect body
- Discovery synapse transmit electric currents neurons excite or inhibits activity
- **Frank Rosenblatt:** created the first artificial network that can learn

J.Rober opherheimer: