

Big Bang Theory

- the universe began as a tiny/pin-sized point of all matter, energy and space.
- the point rapidly expanded (why?) and became what the universe is today, in about 13.7 billion years.

Evidence that this happened:

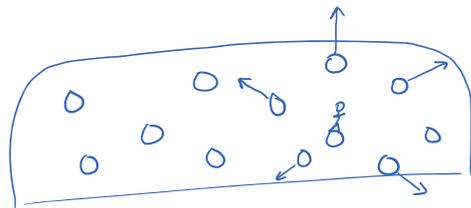
① Cosmic Microwave Background Radiation

- heat left over from Big Bang
- the infra red heat waves have been stretched through expansion to become microwaves (Doppler Effect)
- 3°K ($-273^{\circ}\text{C} = 0^{\circ}\text{K}$, 0°K is as cold as we can get)

② Nucleosynthesis

- light elements (Hydrogen) can only form in a big bang process (the universe is mostly made of H)

③ Hubble Expansion



unrisen loaf of raisin bread

- each raisin represents a galaxy
- the dough between raisins expands, more dough betw will expand more, making it look like our raisin is the centre.
- the further away the raisins/galaxies are, the faster they move away (space itself is expanding, not just galaxies moving away)

faster they move away (space itself expanding, not just galaxies moving away)

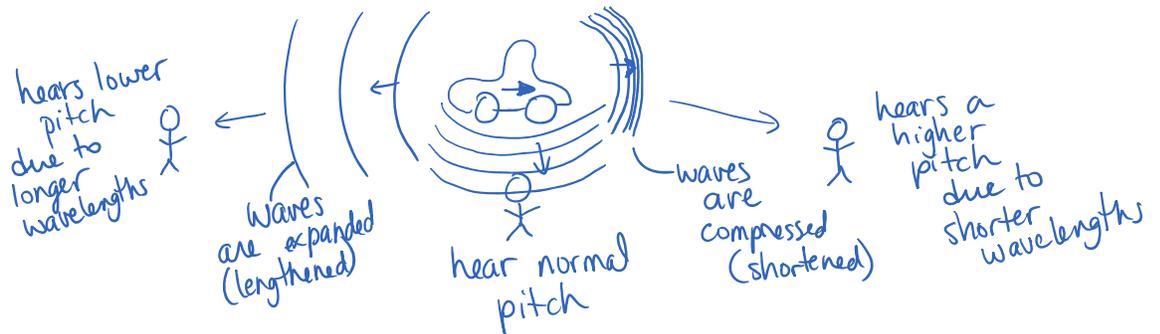
④ Mass measurements in Universe

- there was found to be insufficient mass for gravity to take over
- the universe is expanding, and accelerating, apart.

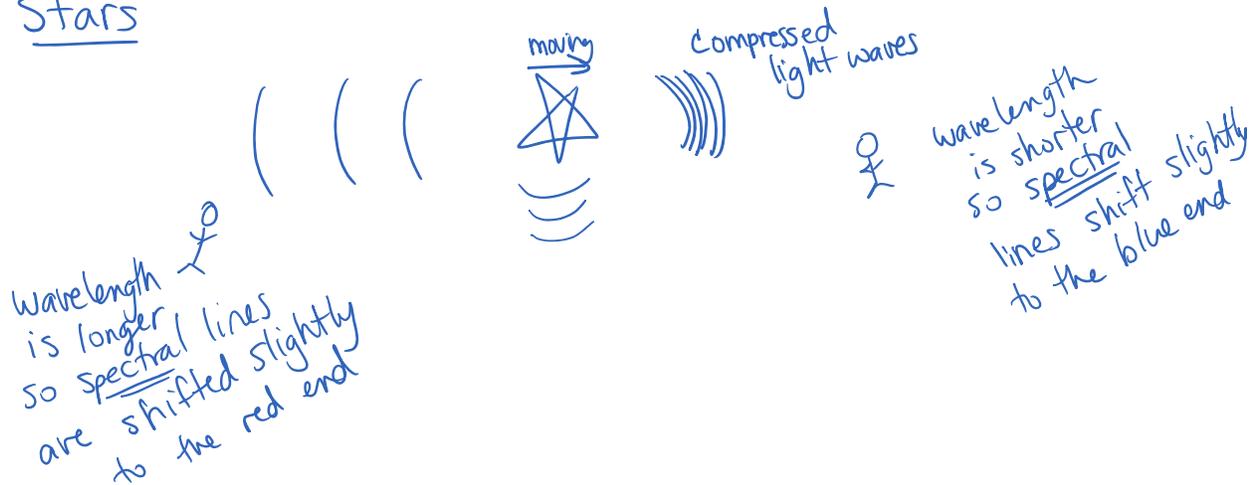
⑤ Doppler Effect

- shows that everything is moving away
- changes in wavelength due to motion

Car



Stars

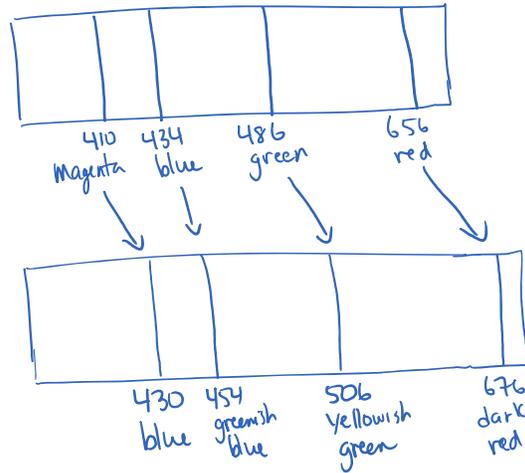


As the star moves away, the spectral lines shift

As the star moves away, the spectral lines shift toward the red end, but the star's colour (indicating temperature) doesn't change.

How to tell in the spectrum:

Normal unshifted spectrum of Hydrogen



Star moving away, wavelength stretched to be longer (by 20 nm)