The Constantly Changing Hubble Constant

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Find the presentation at https://tinyurl.com/bycke8v6

Interactive content

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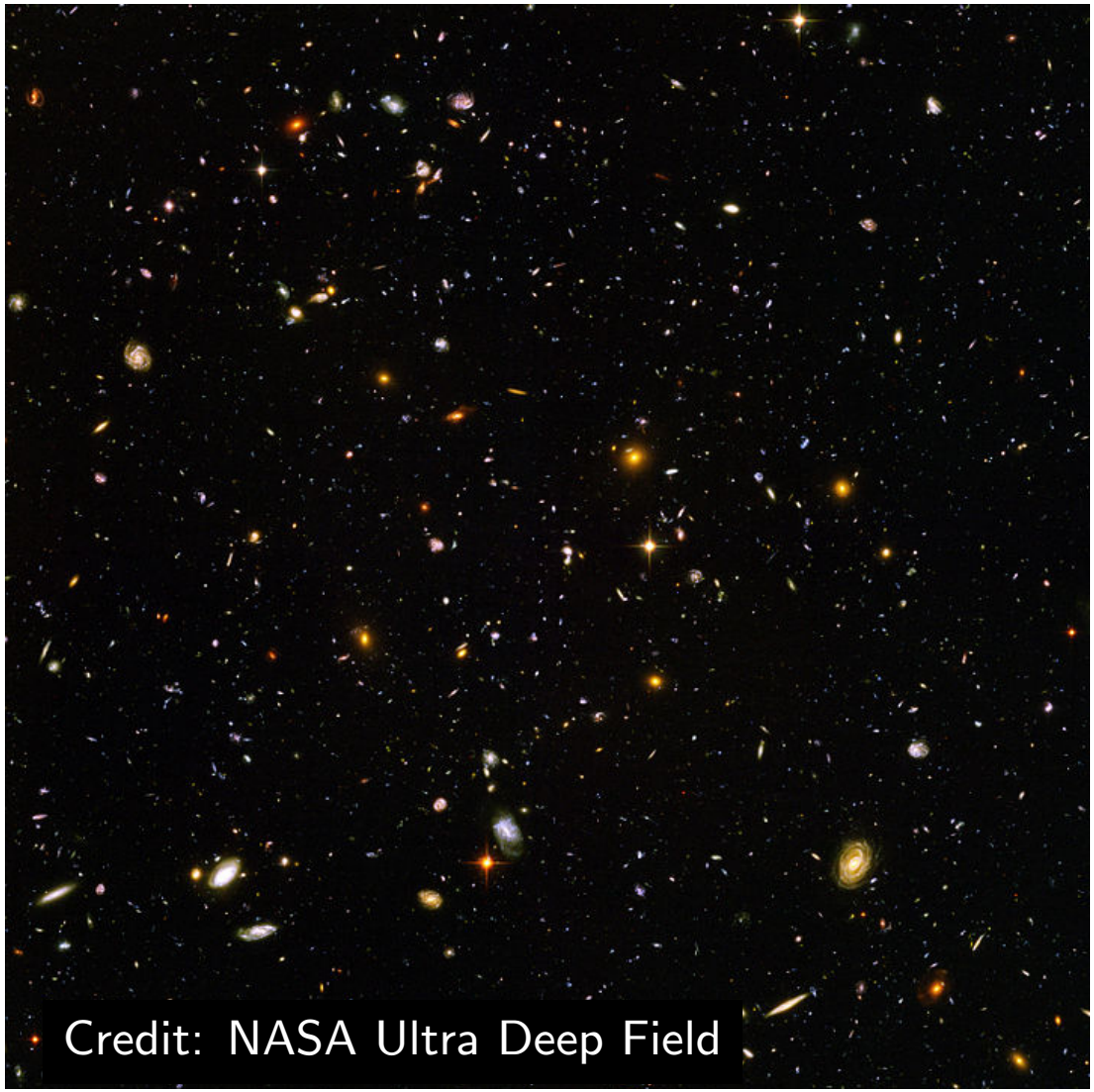
The Universe is expanding!

- But what does this actually mean?
- How do we know it is expanding?
- Why is it expanding?
- How fast is it expanding?
- Are cosmologists completely realistic about the uncertainties in their results?

How do we know?

- Everywhere we look, distant galaxies are receeding; more distant galaxies are receeding faster.
- So either we are at the centre of a cosmic conspiracy, or all the space between all the galaxies is expanding.



Is the solar system expanding? Are *we* expanding?

Go to `www.menti.com` (code 9850 5737) and choose one possibility:

1. Yes, a lot
2. Yes, but only a tiny amount
3. No

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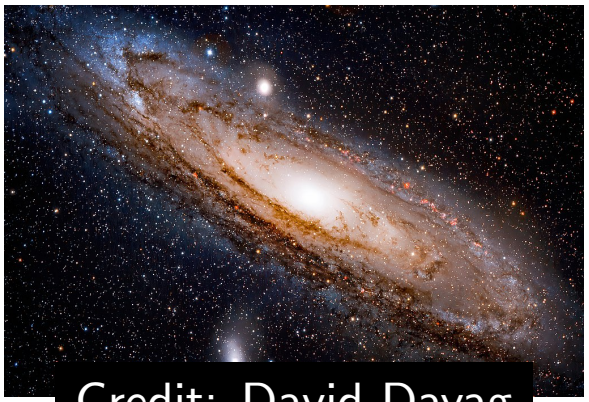
Is the solar system expanding? Are *we* expanding?

- Other forces - molecular forces between the molecules in your body, and gravitational forces between the Sun and the planets - are far more than strong enough to overcome the effect of cosmic expansion.
- Gravity is even strong enough to keep the Andromeda Galaxy from receeding from us.



Credit: David Dayag

- It's only the furthest objects - where gravity becomes negligible - that receed.

What does *recession velocity* actually mean?

- We speak as if the distant galaxies are moving away from us. This is informal language.
- They aren't really moving, they just appear to be - because the intervening space is expanding.
- Sometimes this makes a difference - for example, the recession velocity can exceed the speed of light.

So how fast is the expansion?

- For every increase in distance of one megaparsec, there's an increase in recession velocity of 70 kilometers per second.
- So the expansion speed is 70 kilometers per second per megaparsec.
- One megaparsec is about three million light years. It's the typical distance between galaxies.
- 70 kilometers per second is about 150,000 miles per hour.
- Over 13.5 million years, distances increase by about one percent.
- Continental drift is about six times faster.

H0

- The expansion rate is denoted ‘H0’.
- The ‘H’ commemorates Edwin Hubble (1889-1953), who was one of the first to measure it.

Credit: Johan Hagemeyer

- The ‘0’ refers to today. The expansion rate was different in the distant past.

Credit: Johan Hagemeyer (1884-1962), Public domain, via Wikimedia Commons