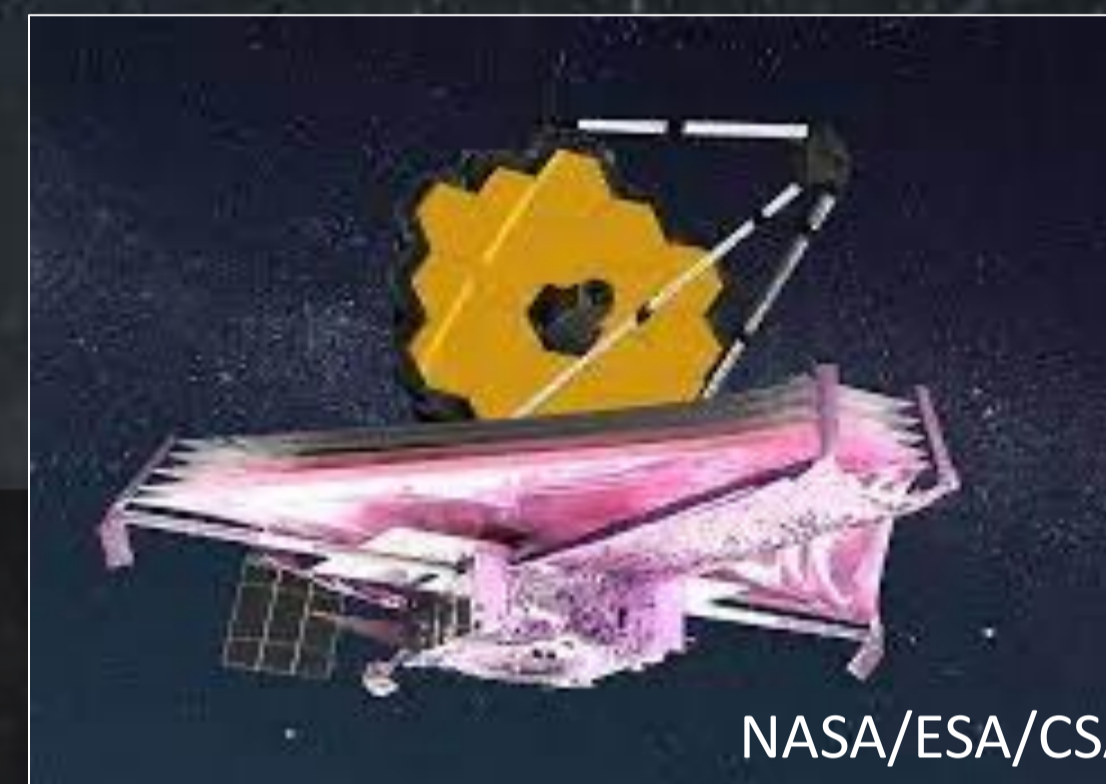


At an early stage in the evolution of the Universe, it underwent an inflationary expansion, causing it to cool, and the temperature dropped to a point where hydrogen could form at the Epoch of Recombination. From then, there were no significant sources of radiation until gas condensing around inhomogeneities in the dark matter density field formed the first stars and galaxies, bringing an end to the Cosmic Dark Ages and heralding a new era of cosmic history. This was the Epoch of Reionization, as stellar radiation provided energetic photons to begin reionizing cosmic hydrogen. With telescopes like ALMA and the forthcoming JWST, we look back to these first stars and the environments in which they formed.



ESO/NRAO/NAOJ

ALMA
Telescope of 66 antennae located in Chile, which for the first time provided detailed information about atomic and molecular gas associated with distant galaxies.



NASA/ESA/CSA

JWST
Space observatory launched on 25/12/2021, now in orbit around the Sun at a position 4x as far away from the Earth as the moon. Soon to start observing fainter, more distant galaxies than have ever before been accessible.

Research Questions

How did Reionization happen?

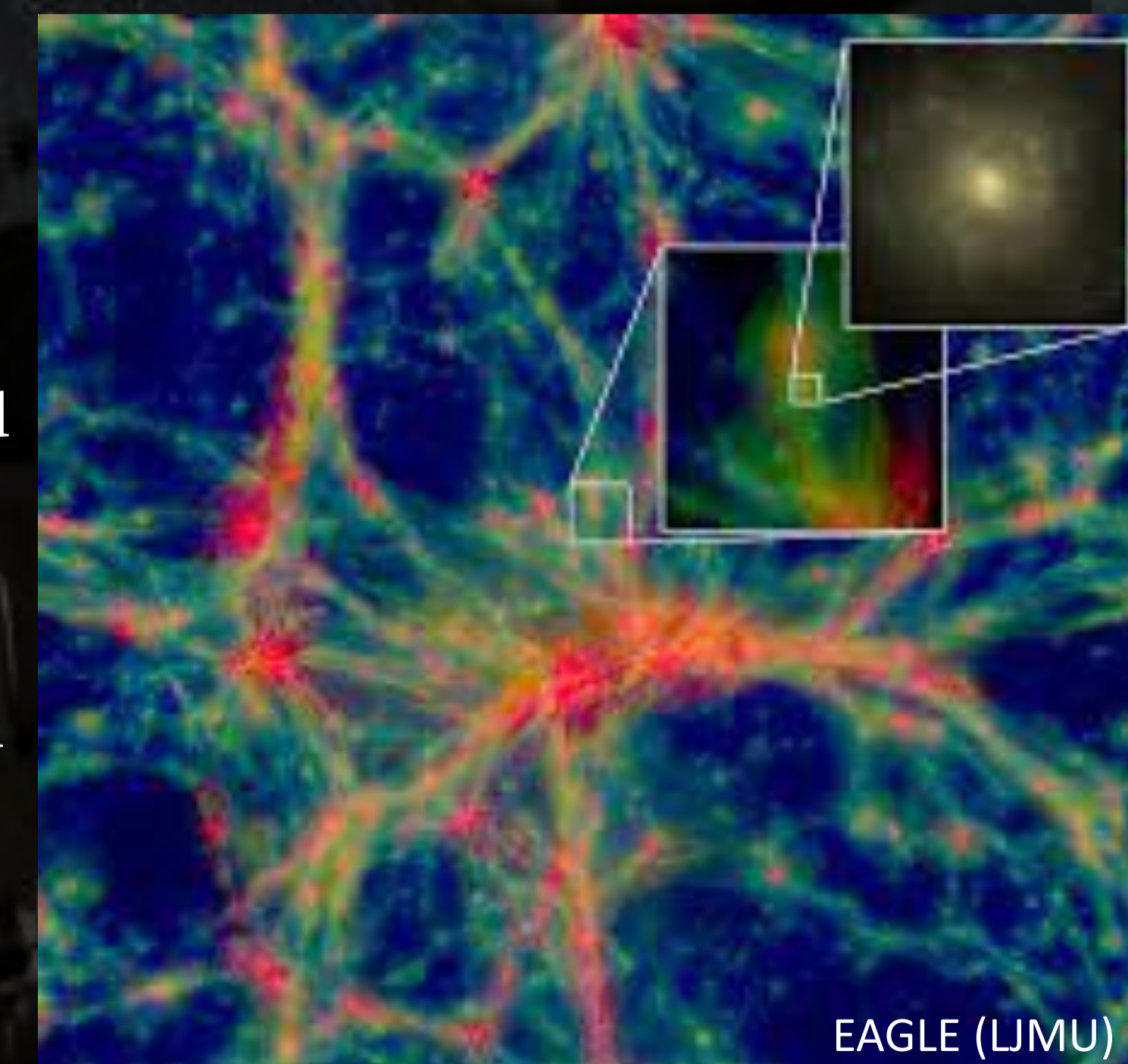
By identifying star formation at early times, we can build a picture of how much the first populations of stars contributed to exciting cosmic hydrogen, leading to cosmic reionization, the final major phase transition of the Universe.



HUBBLE (NASA)

How do early galaxies grow?

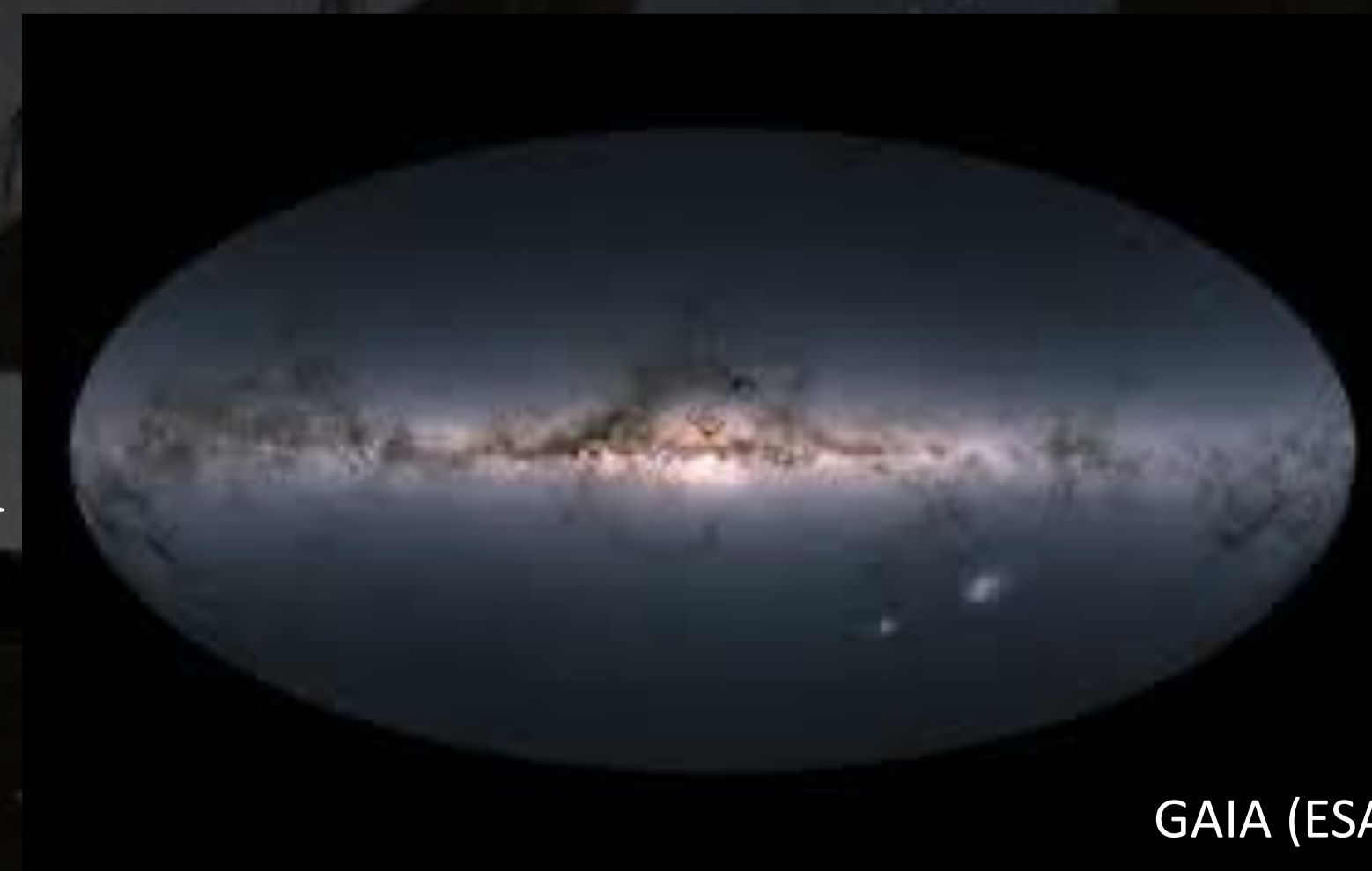
The large scale structure of the Universe is arranged into the Cosmic Web, comprised of dense, compact nodes and elongated interconnecting filaments of dark matter, galaxies and intergalactic gas, with low-density void regions between them.



EAGLE (LJMU)

When do galaxies start to form the structure we see today?

Early galaxies have a wide distribution of structures; some have been shaped by a history of merging with other galaxies, some are dominated by chaotic and turbulent internal motion, and some are supported by a rotating disk like our own Milky Way. With high-resolution observations we can identify structure in galaxies from approximately 1 billion years after the Big Bang and find out how early in cosmic history galactic disks form.



GAIA (ESA)

Using light emitted by gas in distant galaxies, we can determine the internal velocity structure, and understand whether the dominant mechanism of galaxy growth at early times is through gaining material smoothly from the Cosmic Web, or through merging with other galaxies.

References

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