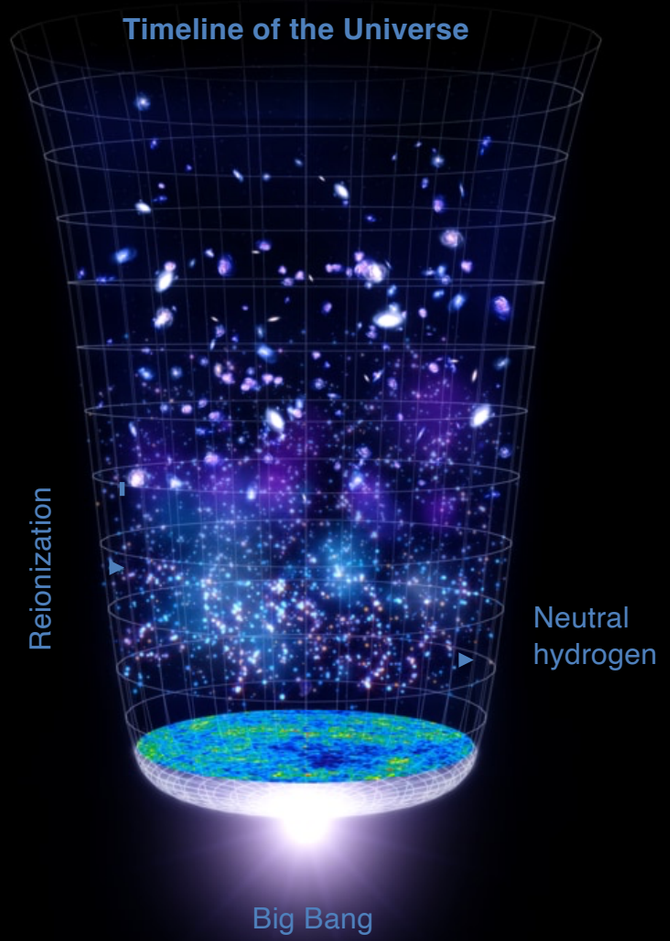
Probing the Era of Reionization

After the Big Bang, the universe cooled enough for complete atoms to form –electrons could exist in orbits around nuclei. This cool, “neutral” gas was opaque to light, which limits our view of the very young universe. Then, about a billion years later, the gas between the galaxies (the intergalactic medium, or IGM) was heated up again, atoms lost electrons (were ionized) and light could travel freely through the universe. To understand the history of the universe, we need to know more about how and when reionization occurred.

Neutral hydrogen scatters a type of ultraviolet light called Lyman alpha light, but ionized hydrogen does not. So we can use Lyman alpha light, or the lack of it, to trace the existence of neutral hydrogen in the IGM. We calculated the fraction of neutral hydrogen in the IGM around 700 million years after the big bang using Lyman alpha light.

Our observations were taken using NASA time on the Keck Observatory in Hawaii. Our measurements revealed the hydrogen in the IGM was highly ionized at this time — we detected more Lyman alpha light from this era than any other previous study. We also discovered a cluster of four Lyman-alpha-emitting galaxies in an adjacent ionized bubbles (energy from within the galaxies was heating and ionizing the nearby IGM, creating a bubble of hot gas)

Our findings directly show that reionization in the IGM did not occur uniformly. It started in small ionized bubbles around ionizing sources like galaxies, and those bubbles expanded outward until all the IGM’s hydrogen was ionized.



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