

A candidate redshift $z \approx 8$ galaxy and rapid changes in that population at an age of 500 Myr

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Searches for very-high-redshift galaxies over the past decade have yielded a large sample of more than 6,000 galaxies existing just 900–2,000 million years (Myr) after the Big Bang (redshifts $6 > z > 3$). The Hubble Ultra Deep Field (HUDF09) data have yielded the first reliable detections of $z \approx 8$ galaxies that, together with reports of a γ -ray burst at $z \approx 8.2$, constitute the earliest objects reliably reported to date.

Observations of $z \approx 7$ – 8 galaxies suggest substantial star formation at $z > 9$ – 10 . Here we use the full two-year HUDF09 data to conduct an ultra-deep search for $z \approx 10$ galaxies in the heart of the reionization epoch, only 500 Myr after the Big Bang. Not only do we find one possible $z \approx 10$ galaxy candidate, but we show that, regardless of source detections, the star formation rate density is much smaller ($\sim 10\%$) at this time than it is just ~ 200 Myr later at $z \approx 8$. This demonstrates how rapid galaxy build-up was at $z \approx 10$, as galaxies increased in both luminosity density and volume density from $z \approx 10$ to $z \approx 8$. The 100–200 Myr before $z \approx 10$ is clearly a crucial phase in the assembly of the earliest galaxies.

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