Do distant galaxies refute the big bang?

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In May 2024 an international team of astronomers announced that they were able to confirm the existence of the most distant galaxy known so far. With the help of the James Webb Space Telescope (JWST), they investigated the recently discovered object *JADES-GS-z14-0* and verified that it is indeed a galaxy with a redshift of z ≈ 14 (figure 1).[1] According to the standard model of cosmology, the light we see today left the galaxy only 300 Myr after the big bang and only 120–180 Myr after the formation of the first stars.[2] However, the galaxy does not look like a pristine galaxy. It turned out that it has an unexpectedly high luminosity, resulting from a massive and spatially extended stellar population. A follow-up study also showed that the gas within the galaxy is enriched with heavy elements like oxygen and carbon.[3] According to the big bang model, many first-generation stars must already have exploded as supernovae, thereby releasing these elements into the interstellar medium.

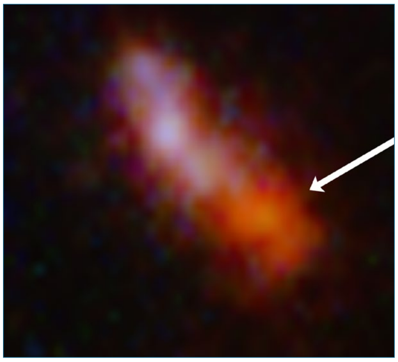

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Figure 1. JADES-GS-z14-0, the furthest known galaxy, beside a foreground galaxy on the top left

JWST results confirm predictions by creation astronomers

One motivation for the construction of the JWST was the prospect of being able to discover galaxies like *JADES-GS-z14-0* at unprecedented distances from Earth. Proponents of the big bang model see this as an opportunity to study galaxies in an early stage of their formation. They expected that these galaxies would be small and unstructured and that they would host populations of recently formed stars with small amounts of heavy elements. On the other hand, recent-creation astronomers have tended to anticipate that distant galaxies have similar properties to nearby ones and have hoped that their existence would refute the big bang model. Based on the ASC model, Lisle, for instance, predicted fully grown distant galaxies.[4] Today, we have the results from about two and a half years of observations with the JWST, and a preliminary assessment of these contrary expectations is feasible.

In summary, many predictions of creation-astronomer Lisle have turned out to be correct. As he anticipated, distant galaxies are more massive and structured and contain more heavy elements than expected. Nonetheless, most astronomers still consider the results to be compatible with the standard model of cosmology and, at most, acknowledge the presence of some tensions.[5] How can it be the case that two groups with very different expectations regard the JWST observations as agreeing with their models? And what would have to happen for one of the models to be falsified?

Many results are highly model-dependent

An important aspect to understand the current situation is that many galaxy properties cannot be inferred in a model-dependent way. The only quantities directly accessible to a measurement by the JWST are the spectrum, the apparent magnitude, the angular size, and the spatial structure of a galaxy. To derive its distance, size, absolute magnitude, and mass, a specific cosmological model, which describes the geometry of the universe over time, has to be assumed. Even if the discoverers of *JADES-GS-z14-0* state, for instance, that it has a radius of only 260 pc,[1] this is only true if their adopted cosmological model is correct. Based on the cosmological standard model, distant galaxies indeed tend to be smaller, less bright, and less massive with increasing distance, which fits the expectation that galaxies grow over time. But, in alternative models, distant galaxies are comparable to nearby galaxies with respect to size and brightness. Therefore, there are a couple of viable scenarios: evolving galaxies in the cosmological standard model and non-evolving galaxies, for example, in a static universe with galaxy redshifts being interpreted as Doppler shifts.[6] Since both options are consistent with the JWST data concerning angular size and apparent magnitude, they also pass the Tolman test regarding surface brightness.

However, there are some model-independent quantities that could help answer the question as to whether distant galaxies have similar properties to galaxies in our cosmological neighbourhood. The most important of them is their spectrum, after being corrected for different redshifts. Quasar spectra seem to provide evidence that the local and distant universe are different. These objects are thought to be extremely luminous active galactic nuclei powered by black holes. For redshifts $z > 6$, their spectra feature a Gunn-Peterson trough, and wavelengths shorter than the Lyman alpha line are suppressed.[7] This is usually interpreted as being caused by large amounts of neutral hydrogen gas in the distant universe, which was later (re-)ionized by the light of the

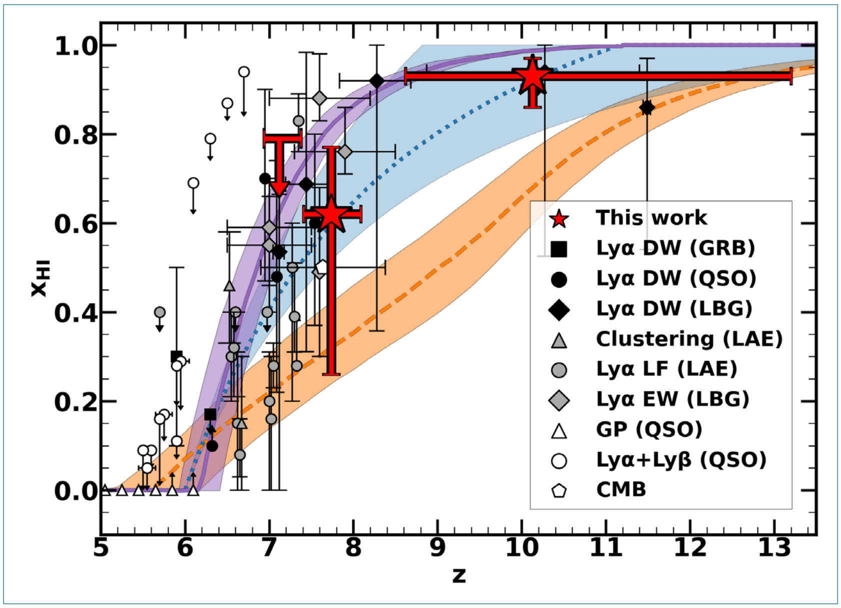

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Figure 2. Neutral hydrogen fraction as a function of redshift based on data from galaxies (LAE, LBG), quasars (QSO), gamma ray bursts (GRB), and the cosmic microwave background (CMB)

first luminous objects. Unfortunately, it seems that the evidence for a possible (re-)ionization of the universe has only been discussed in the creation literature in an article by Worraker from 2006.[8] Therein, he investigates an alternative view that quasars might not be very distant objects. However, in the meantime, there is more and better data concerning a possible era of (re-)ionization, not only from quasar spectra but also from Lyman-alpha emitting galaxies, gamma ray bursts, and the cosmic microwave background (see figure 2).[9] An up-to-date assessment of these results and their implications on creation models would be highly desirable.

If distant galaxies have the same properties as nearby galaxies, an analysis of their spectrum should yield similar star formation histories. According to evolutionary stellar models, all nearby galaxies host old stars. Therefore, they should also be found in distant galaxies. However, corresponding studies state that they only contain very young stars, indicating a recent formation of these galaxies, as expected in the standard model of cosmology.[5] There are several reasons why this is not necessarily at odds with the ASC model. Distant galaxies are often found by searching for objects with high UV luminosities, which favours the detection of galaxies with young stars.[10] Besides this selection effect, young stars can dominate the integrated light spectrum of a galaxy and outshine older star populations.[11] In addition, star formation histories are determined by fitting stellar population models to the observed spectrum. In this procedure, stellar ages that would exceed the age of the universe according to the standard cosmological model are often disallowed by default.[12] From a creation perspective, it would be very interesting to investigate, whether these effects are sufficient to explain the differences between spectra of nearby and distant galaxies or if there are intrinsic differences.

No clear refutation of the big bang model

One reason that the standard cosmological model so far can conform to unexpected results is that it often does not make precise predictions concerning the formation of galaxies. Many presumptions about the timing of the first emergence of important galaxy properties are mainly based on numerical simulations that are extended with new features and physical processes in case of disagreement with new observations.[2] And even if expectations are backed up with observational data, they can turn out to be mistaken. In a textbook published in 2020, it was considered to be one of the most robust results of galaxy evolution that the Hubble sequence, with its distinction between elliptical, spiral, and barred galaxies, emerged 4 Gyr after the big bang,[10] a result which also has been used as an argument against the idea of a recent creation.[13] But with the observations of the JWST, it was realized that some data corrections applied to the results of the Hubble Space Telescope were unreliable and that the basic galaxy morphologies must have arisen within a few 100 Myr after the big bang.[14] In this case, there are indeed pre-JWST simulations that agree with these new results.[15] Figure 3 shows a mature spiral galaxy at a redshift $z \approx 3.25$, which corresponds to 2 Gyr after the big bang.[16]

In spite of some unexpected discoveries and unfulfilled expectations for proponents of the standard model, there are currently no results that clearly refute it.[5] Some very bright galaxies in the first JWST images turned out to be unproblematic because they are much closer than initially thought.[17] On the other hand, some very massive galaxy candidates that require unplausible star formation efficiencies have been spectroscopically confirmed.[18] However, taking into account experimental and theoretical error bars, even more massive galaxy candidates would have to be confirmed for solid discrepancies with the standard cosmological model. It must be emphasized that even a refutation

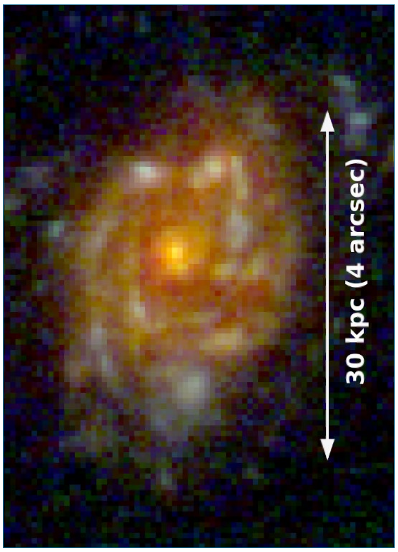

Figure 3. Big Wheel, a spiral galaxy at redshift 3.25 (2 Gyr after the assumed big bang), "surprisingly similar to today's largest disks regarding size and mass".

Image: Wang et al., 2024, arXiv:2409.17956 | CC BY 4.0

of the standard model would not necessarily rule out the idea of a big bang. The former implies a quantitative timeline for the history of the universe since the big bang, with a fixed relation between redshift and the age of the universe. In case more time is needed for the formation of the first galaxies, suggestions have been made for how this timeline could be altered without giving up successful parts of the big bang model.[19]

Some creation models allow for distant galaxies to be different than local ones

As predicted by Lisle, distant and nearby galaxies are found to be more similar than expected based on the standard model of cosmology. Nonetheless, more work is needed to verify that a consistent model with identical properties for nearby and distant galaxies is possible. In particular, the indications for an era of (re-)ionization and possibly different stellar populations require more investigations. Here, it must be emphasized that the confirmation of galaxy properties that evolve as a function of distance would invalidate the ASC model. But this would not necessarily rule out that the anisotropic synchrony convention is the correct way to understand the biblical report about the creation of the stars. If the Dasha approach by Faulkner is the correct solution to the time travel problem,[20] it may also be the case that distant galaxies have different properties than local galaxies. Because the light of distant galaxies needs to travel larger distances to reach Earth, we might see them in a state in which they have not yet been subject to time-lapsed formation processes for a long time.

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