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JWST spots oldest ever galaxy...

Jonathan O'Callaghan

JUST weeks into its mission, the James Webb Space Telescope (JWST) has broken the record for the oldest galaxy ever observed by nearly 100 million years.

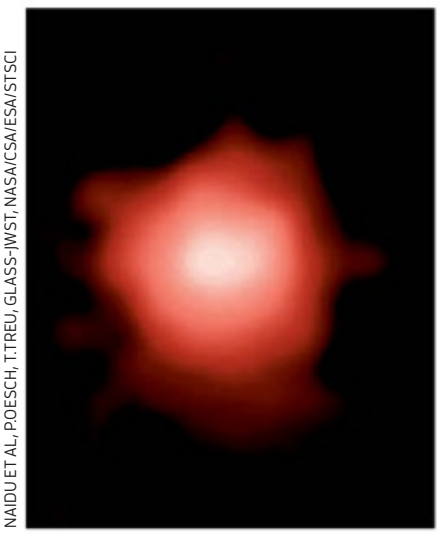
Seeing some of the most distant and earliest galaxies to form after the big bang 13.8 billion years ago is one of the key goals of JWST. When these emerged is currently unknown: the previous oldest identified galaxy, found by the Hubble Space Telescope, is called GN-z11 and dates back to 400 million years after the birth of the universe.

Rohan Naidu at the Harvard-Smithsonian Center for Astrophysics and his colleagues think they have already found an older one in a publicly released JWST data set called GLASS. Known as GLASS-z13, the galaxy dates back to just 300 million years after the big bang. The team also found a second galaxy, GLASS-z11, of a comparable age to GN-z11 (arxiv.org/abs/2207.09434).

"We found two compelling candidates for extremely distant galaxies," says Naidu. "If these galaxies are at the distance we think they are, the universe is only a few hundred million years old at that point."

The two galaxies appear to have grown the equivalent mass of a billion suns since they began forming. That is something we would expect for galaxies that have been developing for around 500 million years, says the team, possibly hinting that stars formed more rapidly than we thought in the early universe.

Both galaxies are very small, GLASS-z13 being only about 1600 light years across and GLASS-z11 about 2300 light years. By comparison, our Milky Way is some 100,000 light years across.



NAIDU ET AL, P.OESCH, T.TREU, GLASS-JWST, NASA/CSA/ESA/STSCI

GLASS-z13 dates back to 300 million years after the big bang

Gabriel Brammer at the Niels Bohr Institute in Denmark, part of the GLASS team and a co-discoverer of GN-z11, says that further analysis will be needed to confirm the distance to the two galaxies. Only JWST can do that work. "They're very convincing candidates," he says. "We were pretty confident that JWST would see distant galaxies. But we're a little bit surprised how easy it is to detect them."

A separate team led by Marco Castellano at the Astronomical Observatory of Rome in Italy also found that GLASS-z13 was the earliest known galaxy (arxiv.org/abs/2207.09436).

JWST should make discoveries like this regularly. Longer hunts for ancient galaxies should be able to probe much further, perhaps to less than 200 million years after the big bang, when some of the first galaxies and stars in the universe are thought to have formed.

"How early does star formation start in the universe?" asks Naidu. "It's one of the last major unknowns in our broad timeline of the universe." ▮

...and a glut of Milky Way-shaped galaxies

Will Gater

ASTRONOMERS analysing some of the first scientific data released by the James Webb Space Telescope (JWST) have already seen something unexpected.

A deep view of the early universe appears to show a surprisingly high number of disc-shaped galaxies, rather than the large number of clumpy, irregular ones we thought would be there.

This suggests that the disc structures in certain galaxies, including the Milky Way, may have formed more rapidly than current theories predict.

Leonardo Ferreira at the University of Nottingham, UK, and his colleagues looked at galaxies within JWST's "deep-field" image of the galaxy cluster SMACS J0723.3-7327, which was first released to the public on 12 July. The researchers examined several hundred of these distant galaxies – which existed a couple of billion years after the big bang – by eye and with the aid of computers, in order to classify them into their different shapes.

Previous work using data from Hubble Space Telescope observations and computer modelling indicated disc-shaped galaxies should only account for about 5 per cent of the sample studied in this new JWST image.

50%

Proportion of disc-shaped galaxies seen by JWST

But the team actually found that roughly half the galaxies scrutinised were disc-shaped (arxiv.org/abs/2207.09428).

The result, if confirmed by further, more extensive, surveys as JWST gathers more data, could mean that the disc structure in galaxies we see around us today emerged far earlier than astrophysicists imagined.

They thought this because disc shapes are generally believed to arise when galaxies have had a long time to settle down after an earlier, tumultuous period of collisions and mergers – one that is associated with irregular-shaped galaxies, the kind astronomers thought they would see more of.

That, says Ferreira, has "huge implications" for the models that astrophysicists currently use to explain how galaxies are born and evolve. "This is a clue already that something's off," he says.

There could also be wider implications for cosmological models of the expansion of the universe, dark matter and dark energy, which often include predictions for how galaxies evolve over time. "If the models can't predict the formation of galaxies, the models [are] not actually correct," says Ferreira.

Brooke Simmons at Lancaster University, UK, says this early result from JWST data is "really interesting work" that is "potentially going to hold up".

She suspects the reason NASA's newest space telescope, which detects in the infrared part of the spectrum, may be seeing the disc galaxies where Hubble wasn't able to spot them is that JWST not only observes at different wavelengths, but also has bigger optics.

"The mirror for JWST is two-and-a-half-times bigger than the mirror from Hubble," says Simmons. "So it's just a bigger light bucket, so you can get a really deep image much faster."

In order to confirm the new result, Simmons says astronomers will need to analyse light from the galaxies to see if they are spinning in the way discs are expected to rotate – something that should be well within the capabilities of JWST's instruments. ▮