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Astronomy

# Earliest supernovae spotted?

## The James Webb Space Telescope may have glimpsed the explosions of the earliest stars

**Alex Wilkins**

WE MAY have spotted the remnants of the very first supernovae in the universe, a chemical fingerprint of the earliest stars and the start of a process that eventually created almost every element in the periodic table as well as the "stardust" that makes up our bodies.

When stars formed after the big bang, they contained mostly just hydrogen and helium. As these first-generation stars, known as population III stars, reached the end of their life, they exploded in supernovae, producing heavier elements that were incorporated into a new generation of stars.

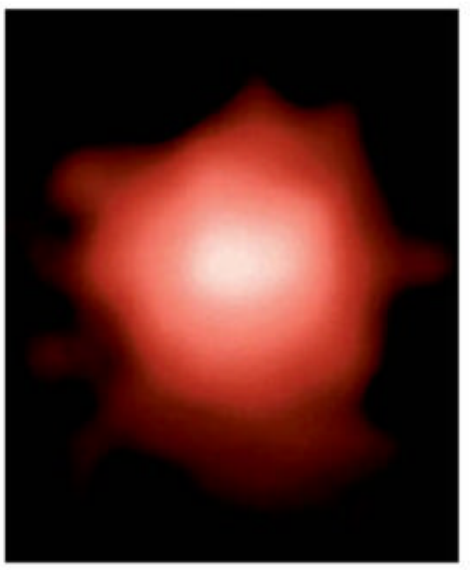
Astronomers haven't been able to observe these ancient stars or their explosions directly, as they would have been born and died just a couple of hundred million years after the big bang.

Instead, Roberto Maiolino at the University of Cambridge and his colleagues have used the James Webb Space Telescope (JWST) to study one of the earliest galaxies ever seen, GLASS-z12, for more than 50 hours. The galaxy, which was born 350 million years after the big bang, was itself spotted using JWST last year.

By analysing the light from the galaxy, the team found it contained carbon, and there were weaker detections of elements like oxygen and neon too. "This is the most distant signature of any heavy element in the universe, which is remarkable," says Maiolino.

The team focused on the ratio of carbon and oxygen within the

**The galaxy GLASS-z12 shows signs of the earliest supernovae in the universe**



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

galaxy because it can tell us what stellar processes are happening. The ratio tends to decrease in galaxies as we look back further in the universe, as there has been less time for stars to repeatedly explode and "pollute" their galaxies with carbon. But oddly, GLASS-z12's carbon-to-oxygen ratio was higher than in many newer galaxies (arXiv, doi.org/k6nq).

It isn't clear what is producing this carbon, but the brief time the galaxy has existed for and its high mass rule out many scenarios, such as regular supernovae from stars like our sun, says Maiolino. One of the few mechanisms that could explain this pattern, he says, is exploding population III stars, which are low-energy and extremely pure in hydrogen and helium, allowing them to produce more carbon than other stars.

If this is the correct explanation, the observation could give us our earliest glimpse of the stellar process that created nearly all of the elements, even without seeing the population III stars directly. "The universe gets polluted astonishingly quickly," says Emma Chapman at Imperial College London, as just one population III supernova is enough for less-pristine stars to start forming. "It really is just a blink of an eye that they're trying to capture."

Finding out more about GLASS-z12 might be tricky because there is only so much of JWST's time that can be devoted to a single object and this galaxy is now comparatively well studied, says Maiolino. But finding other similarly old galaxies and measuring their carbon ratios could also help shed light on population III stars, he says.

The detection of high levels of carbon in such an old galaxy is surprising, says Richard Ellis at University College London, but uncertainty in both the carbon and oxygen ratio measurement and models of population III stellar explosions means there might be other explanations from different kinds of stars. "We have no idea what a population III supernova would look like, it might not even be like a supernova that we see in the nearby universe," says Ellis. ▮

Technology

## AI deduces sewing pattern from a photo of clothing

**ARTIFICIAL intelligence can turn a single photo of an item of clothing being worn into accurate sewing patterns to recreate the garment.**

**Clothing makers use sewing patterns to create the differently shaped pieces of material that form a garment, using them as templates to cut and sew fabric. Reproducing a pattern from an existing garment can be a time-consuming task, so Xiangyu Xu at Sea AI Lab in Singapore and his colleagues have instead turned to AI.**

**The team trained an AI model on 1 million images of people wearing items of clothing and the associated sewing patterns known to be of the same piece of clothing.**

**The researchers then created a two-stage AI system called Sewformer that could look at images of clothes it hadn't seen before, figure out how to disassemble them into their constituent parts and predict where to stitch them to form a garment.**

**In tests, Sewformer was able to recreate the original sewing patterns with 95.7 per cent accuracy (arXiv, doi.org/k6jp).**

**"The first most important application will be in virtual reality or the metaverse," says Xu, who wants the technology to be able to recreate digital versions of clothes people see and wear in real life. But he also hopes that it can be useful in the real world. "You could very easily design a garment by taking a picture of someone," he says. "That will help garment manufacturing factories."**

**"You could very easily design a garment by taking a picture of someone"**

**But others have expressed concern about the AI model. "Whether this tactile knowledge could be reproduced to the same quality and accuracy could be challenged," says Alana James at Northumbria University in Newcastle, UK. She also worries that the research raises ethical questions about digitising highly skilled roles in the fashion industry, such as pattern cutters.** ▮

**Chris Stokel-Walker**