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Space

Blip detected in space could be the earliest galaxy we've ever seen

Jonathan O'Callaghan

ASTRONOMERS might have discovered a galaxy that formed extremely early in the universe, nearly 200 million years before its closest competitor, but there could be other explanations too.

Giovanni Gandolfi at the University of Padua in Italy and his colleagues probed data from the James Webb Space Telescope (JWST) to look for distant objects that formed early in our universe's 13.8-billion-year history.

The further away a galaxy is from Earth, the longer its light will have taken to reach us and the more it will be shifted to the red end of the spectrum by the expansion of space, a property known as redshift.

To date, the earliest confirmed galaxy – which was spotted by JWST and is called MoM-z14 – has a redshift of 14.4, meaning the light now reaching us from it began travelling towards us when the universe was 280 million years old. Gandolfi and his team, however, have reported an object with a redshift of 32, implying that we are viewing it as it was when the universe was just 90 million years old (arXiv, doi.org/p4vp). They named it Capotauro, after a mountain in Italy.

"Capotauro could be the farthest galaxy ever seen," says Gandolfi, at a "timescale that is compatible with the first stars and black holes to form in the universe".

The researchers arrived at this conclusion by noticing a small blip that appeared to be a distant galaxy in a deep JWST survey of the sky. Using different filters on the telescope, they could calculate how much the light from the galaxy would have been redshifted, arriving at a figure of 32.

The possible galaxy was detected using the James Webb Space Telescope

BEST-BACKGROUNDS/SHUTTERSTOCK

If correct, the object might be an extremely young galaxy in the process of formation, or something more unusual like a primordial black hole surrounded by a dense atmosphere – a hypothesised object known as a black hole star.

However, the supposed galaxy appears unusually bright, similar to galaxies seen at later redshifts like MoM-z14, giving it a suspected mass of around a billion times that of the sun – beyond what models suggest should be possible at this age of the universe.

To achieve such a mass, the efficiency at which the galaxy turned gas into stars would have to be close to 100 per cent, says Nicha Leethochawalit at the National Astronomical Research Institute of Thailand: "It means no stars can explode." But modelling suggests no more than 10 to 20 per cent is possible. "I think there's something wrong," she says.

If it isn't a galaxy, Gandolfi and his team say the object could instead be explained by a brown dwarf – a failed star – or a rogue planet in our galaxy drifting through JWST's field of view, appearing similar to the distant blob of a galaxy. Those explanations are interesting too, says Gandolfi, because it would be a particularly remote and cold brown dwarf or planet, up to 6000 light years away and at room temperature.

"It could be one of the first substellar objects ever formed in our galaxy," says Gandolfi.

Quantum computing

Quantum router might speed up quantum computers

QUANTUM computers may be able to run useful algorithms more quickly, thanks to a new quantum router that helps data get to the right place faster.

Traditional computers avoid becoming slow when faced with a complicated program in part by using random access memory (RAM) to temporarily store some information. The component key to building RAM's quantum counterpart, QRAM, is a router. This isn't the router that directs your internet queries to the right IP address, but rather an internal router that directs informational traffic inside a computer.

Connie Miao at Stanford University in California and her colleagues have now built such a device. The router consists of qubits, the basic building blocks of quantum computers and quantum memories, made from tiny superconducting circuits and controlled by electromagnetic pulses.

Similar to a traditional router, this quantum one sent quantum information to quantum addresses. What distinguishes the device as being fully quantum is that it allows the address to be encoded not just in one place, but in a "superposition" of two. The team tested this with three qubits and found the routing to have about 95 per cent fidelity. The work will appear in *PRX Quantum*.

This means that if it were incorporated into a QRAM, the device could push information into a quantum state where it is impossible to say which of the two locations it is stored in – exactly the kind of phenomenon believed to make quantum computers powerful.

"The device allowed the address to be encoded not just in one place, but in a 'superposition' of two"

Luming Duan at Tsinghua University in China, whose team previously built a quantum router that only worked during some runs, says the new device is an important step towards building practical QRAMs, which may enable quantum machine learning algorithms to run.

Karmela Padavic-Callaghan