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Space

JWST spots unusually large and young galaxies

Leah Crane and Alex Wilkins

MANY galaxies in the early universe seem to be far more massive than expected. Researchers using the James Webb Space Telescope (JWST) spotted galaxies with masses up to 100 billion times that of the sun that must have formed faster than current models can explain.

Ivo Labbé at Swinburne University of Technology in Australia and his colleagues measured the distances to six massive galaxies using a phenomenon called redshift. Objects that are further from Earth are moving away from us more quickly, which causes them to appear more red than nearby objects. They found that these galaxies were all around 30 billion light years away, meaning that they formed within 700 million years of the big bang.

"I would have guessed that galaxies like this would not exist this early in the universe," says Pieter van Dokkum at Yale University in Connecticut, who was part of the research team. That is because the galaxies all had masses at least 10 billion times that of the sun, with one weighing in at 100 billion solar masses.

30bn

Distance away that the galaxies are in light years

From models of galactic evolution, we would expect galaxies as young as these to be relatively low mass, without many stars at all, and then to grow over time until they became more like our own Milky Way galaxy, which has a mass of about 1.5 trillion solar masses (*Nature*, doi.org/jxpk).



ESA/JWST, NASA & CSA, A. MARTEL

While these young galaxies are massive, they are also surprisingly compact. "What could be going on is that the centres of galaxies form very early, earlier than we thought, then the rest of the galaxy builds up around them," says van Dokkum. "I suspect that we're looking at not-finished products, but beginnings that happened very quickly."

The exact mechanism behind this "fast-track" galaxy formation – or galactic core formation, as it may be – remains to be seen.

"If all of this holds up with further investigation, then we are looking at having to rethink about some of the early history of galaxy formation," says Andrew Pontzen at University College London.

JWST has also spotted several other galaxies that seem to have formed well before expected, but they also need confirmation

Galaxies spotted by the James Webb Space Telescope

before we can say for sure that galaxies formed earlier in the universe than we thought. Follow-ups will consist of observations and analysis of the galaxies' light spectra with JWST.

If these findings do hold up, it may be a problem for our understanding of the universe more generally, not just galaxy formation.

"It was pointed out to us after we submitted the paper that there wasn't actually enough gas in the universe at that point to form [as many massive galaxies as this study suggests] – and that was a bit of a shocker," says Labbé. "If you form these monsters, and they contain more stars than the available gas in the universe, that's a bit of a problem." ■

Health

HIIT seems safe and boosts fitness after a heart attack

Alice Klein

AFTER a cardiac event, people are often advised to improve their heart health via gentle exercise. Now, research suggests that high-intensity interval training (HIIT) is also safe after a heart attack or other cardiac event and may improve fitness faster than moderate-intensity exercise.

Gordon McGregor at University Hospitals Coventry and Warwickshire NHS Trust in the UK and his colleagues looked at 382 adults, with an average age of 59, who had been referred to cardiac rehabilitation centres with coronary heart disease or after a recent heart attack or heart-related procedure. They had shown no signs of their condition worsening for at least two weeks.

Some were randomly chosen to do moderate exercise: 20 to 40 minutes of continuous activity on an exercise machine at 60 to 80 per cent of their maximum aerobic capacity. The rest did HIIT, vigorous bursts of exercise interspersed with short rest periods. This involved exercising for 1 minute on a stationary bike at more than 85 per cent of their maximum capacity, then 1 minute's rest, repeated 10 times.

The HIIT group showed greater improvements in cardiorespiratory fitness, measured via peak oxygen uptake during exercise (*European Journal of Preventive Cardiology*, doi.org/jx3h). This may reduce the risk of premature death by around 15 per cent, says McGregor.

One participant developed chest pain during a HIIT session and was diagnosed with an irregular heart rhythm, but it wasn't life threatening and was probably unrelated to the training, says McGregor.

The Association of Chartered Physiotherapists in Cardiovascular Rehabilitation, which writes the UK's cardiac rehab guidelines, is reviewing this trial and will release updated guidelines this year. ■