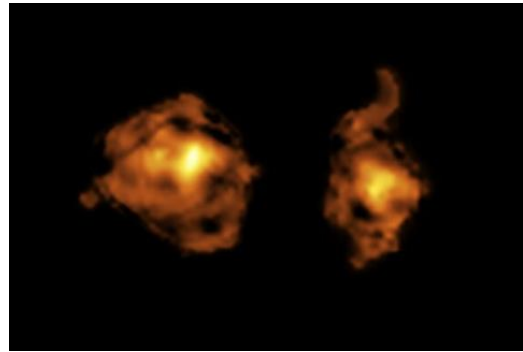


DUELLING GALAXIES

We don't usually compare what we see going on out there in space with mediaeval ritual, but in this case it is hard to resist. Astronomers have found two galaxies fighting it out like knights at a joust.

Image from the Atacama Large Millimeter/submillimeter Array



Most cosmic objects, such as planets, stars and galaxies, are born through the combination of smaller lumps of cosmic construction material (clouds of cosmic gas and dust) into bigger lumps. This how our Solar System formed, with the Sun taking up most of the construction material, and the Earth, other planets and other bodies forming from the leftovers.

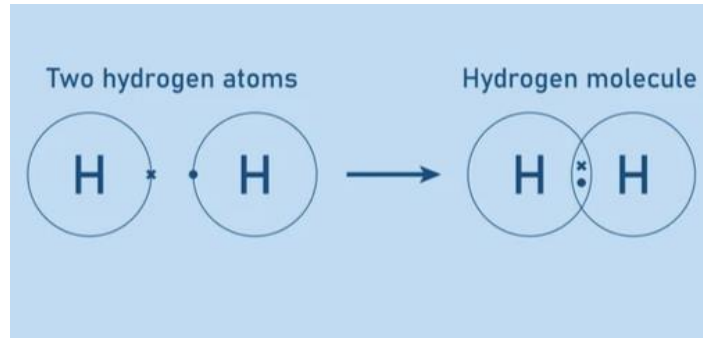


The universe came into existence just under 14 billion years ago, with the main phase of star and galaxy formation peaking at around 11 billion years ago. At that time galaxies and stars were forming at a huge rate, with those galaxies colliding and coalescing into bigger ones.

A four-year study involving the Atacama Large Millimetre Array (ALMA), a large, internationally run radio telescope in Chile, and the European Southern Observatory's Very Large Telescope (VLT) has revealed two galaxies that seem to be involved in a savage duel. It is an unequal fight because one of the galaxies is armed with a super-massive black hole.

The two galaxies are approaching one another at almost two million kilometres an hour, and as they get closer, their gravitational fields increasingly distort one another. These distortions cause material from both attacker and victim to fall into the black hole. As that material falls in, it gets very hot, reaching temperatures of millions of degrees. The result is that each blob of infalling material emits intense bursts of X-rays and ultraviolet radiation. These are intensely disruptive to the victim, dispersing its material and strongly inhibiting its ability to make new stars.

Stars form from collapsing clouds of gas and dust, with the key ingredient being cold molecules of hydrogen. A hydrogen molecule consists of two atoms of hydrogen joined together.



The bursts of radiation from the attacker's black hole heat up those molecules, causing them to break down into individual atoms. A hydrogen atom consists of a single proton with a single electron orbiting around it. If the hydrogen atoms are hit with sufficiently high-energy radiation, they lose their electrons; they have become ionized. The result is a "soup of free protons and electrons". Hot hydrogen atoms are much less likely to allow gravity to collapse them, and ionized hydrogen even less so. The black hole is almost certainly damaging the attacking galaxy too, but it is still likely to be the dominant entity in the coming merger. This picture is a far cry from those fascinating computer simulations of galactic collisions and mergers. They present the mergers as graceful, cosmic ballets. These findings look more like cannibalism.



Simulation - A black hole consuming stellar material

We are seeing those galaxies as they were 11 billion years ago, so that merger is now long over. However, such mergers are still going on today. A comprehensive set of observations show that the Andromeda Galaxy, a spiral a bit bigger than our galaxy, the Milky Way, is heading almost straight at us at about

400,000 kilometres an hour. As it approaches, the mutual gravitational attraction between the two galaxies will cause them to accelerate. The collision will happen in about 5 billion years. The result will be a large, elliptical galaxy. In this case both galaxies are armed with massive black holes, so it will be an even match. However, the Sun will have run out of fuel by then, and it is highly unlikely we will be around to see it.

Before dawn, Saturn is visible low in the southeast and Venus low in the east. During the evening, Mars lies in the southwest. The Moon will be Full on the 11th.

Ken Tapping, 3rd June, 2025

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