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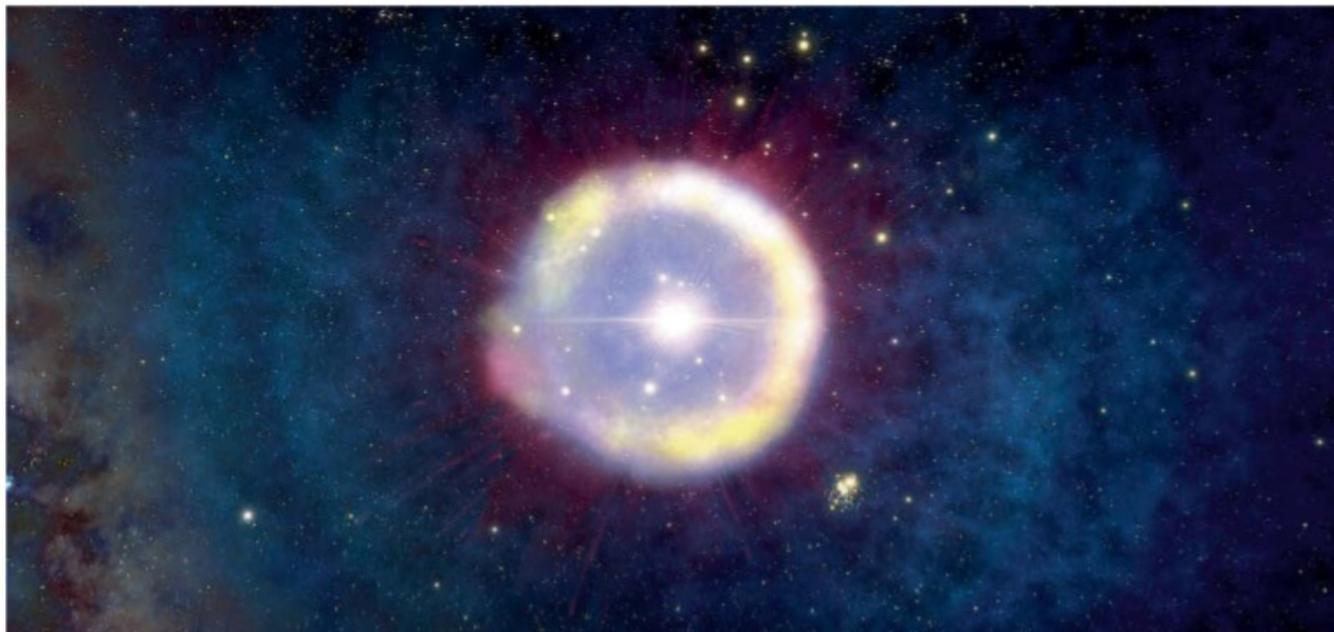
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Astronomy

Quasar contains hints of one of the universe's first stars

Leah Crane



NSF'S NOIRLAB

WE MAY have found traces of the very first stars in the universe. These strange objects, called Population III stars, are expected to have exploded in massive supernovas that destroyed the stars entirely, and astronomers may have seen remnants from one of these extraordinary events.

Yuzuru Yoshii at the University of Tokyo and his colleagues found these hints while examining the light of

30 billion

The quasar's distance from Earth in light years

a quasar, an extremely bright object at the centre of a galaxy powered by matter falling into a supermassive black hole.

The quasar, called J1342+0928, is one of the most distant ever spotted at nearly 30 billion light years away from Earth. It formed less than 700 million years after the big bang.

The spectrum of the quasar's light revealed a huge amount of iron, more than 20 times as much as the sun has. The quasar also seems to have a very low

concentration of magnesium. These elements are important because they are produced in different processes, so their relative abundances can be used to determine what kind of cosmic object they originally came from.

The abundances found in this quasar couldn't be explained by standard models.

The researchers found that the most reasonable way to produce so much iron so soon after the big bang was in a pair-instability supernova: a special kind of explosion that only occurs in extraordinarily massive stars, wherein they explode completely and leave no stellar core behind, unlike other kinds of supernovae.

If such a supernova occurred close to quasar J1342+0928, debris would then have fallen towards the galaxy's centre, eventually becoming incorporated into the quasar.

The amount of magnesium produced in such a supernova is determined largely by the mass of the star that exploded (*The Astrophysical Journal*, doi.org/gqwstr).

"I was delighted and

An artist's impression of the very first stars in the universe

somewhat surprised to find that a pair-instability supernova of a star with a mass about 300 times that of the sun provides a ratio of magnesium to iron that agrees with the low value we derived for the quasar," said Yoshii in a statement.

This is the clearest signature of a pair-instability supernova yet found, he said. Because these supernovae can only occur in stars more than about 130 times as massive as the sun, this may also be evidence for the existence of Population III stars, which would have all been destroyed long ago.

These stars are crucial to our understanding of the universe, because they would have been the first to produce elements more massive than helium.

They are also often considered to be potential seeds for supermassive black holes, which are so unimaginably huge that it is hard to find a way to create them in the early universe without similarly colossal stars. ■

Animals

Newly recognised species of sloth has a head like a coconut

Jake Buehler

THE world has one more sloth species in it than we thought, a genetic analysis has shown.

Three-toed sloths are usually divided into four species. One of them – the maned sloth (*Bradypus torquatus*) – sports a thatch of coarse, brown hair, making the head resemble a husked coconut. Maned sloths occupy a strip of forest along Brazil's Atlantic coastline.

Daniel Casali at the Federal University of Minas Gerais in Brazil and his colleagues compared existing genetic data on 24 maned sloths and the physical features of 55 more to see if they were all the same species. Sloths from the southern states of Espírito Santo and Rio de Janeiro had flatter skulls, broader cheekbones and rounder jawbones than sloths from the northern state of Bahia.

Comparisons of their genes confirmed a deep evolutionary split. The researchers say the southern maned sloth is a fifth species of three-toed sloth, separated from the northern *B. torquatus* by more than 4 million years of evolution (*Journal of Mammalogy*, doi.org/jd7r). They have now given it the name *Bradypus crinitus*.

Timothy Gaudin at the University of Tennessee says that there are "almost certainly" other sloth species yet to be recognised by science too. ■

The southern maned sloth (*Bradypus crinitus*) displaying its coconut-like head



SUELEN_SANCHES