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Space

Dying star defies explanation

A red supergiant is surrounded by a puzzlingly large bubble of dust and gas

Alex Wilkins

ASTRONOMERS are baffled by a vast sphere of dust and gas around a dying star. This cloud is about half as wide as our solar system and there is no known mechanism that could produce such a large amount of material from one star.

Red supergiants are the largest stars in the universe. They are the latter stage of fairly massive stars that have exhausted most of their fuel, just before exploding in a supernova. During this relatively short phase, the star rapidly expands in volume and expels large amounts of gas and dust that create a bubble around it, called the circumstellar medium, which can influence how the star explodes.

Mark Siebert at Chalmers University of Technology in Sweden and his colleagues have found that a red supergiant star called DFK 52 has the largest known circumstellar medium for this type of object, forming a bubble 50,000 times wider than the distance between Earth and the sun. Mysteriously, the star is also relatively dim, implying it has less energy than is thought to be required to make such a large debris field. "We have no idea how you can throw off this much material in that amount of time," says Siebert.

DFK 52 had previously been observed with several different telescopes, and astronomers found a relatively normal amount of gas being expelled from the star. But when Siebert and his team looked at the star with the Atacama Large Millimeter Array (ALMA) in Chile, which can observe wavelengths of light from much colder, older material, they found a far more extensive structure (arXiv, doi.org/pxnk).

"We see this just enormous circumstellar medium around DFK 52, and it has this extremely, extremely complex geometry to it that we really can't fully explain right now," says Siebert.

As well as an intricate stream of bubbles moving throughout the structure, Siebert and his team identified a ring-like bar around halfway through the overall sphere that is expanding at nearly 30 kilometres per second. They calculated that this must have come from a dramatic event around 4000 years ago, which may be key to explaining how the star produced so much material.

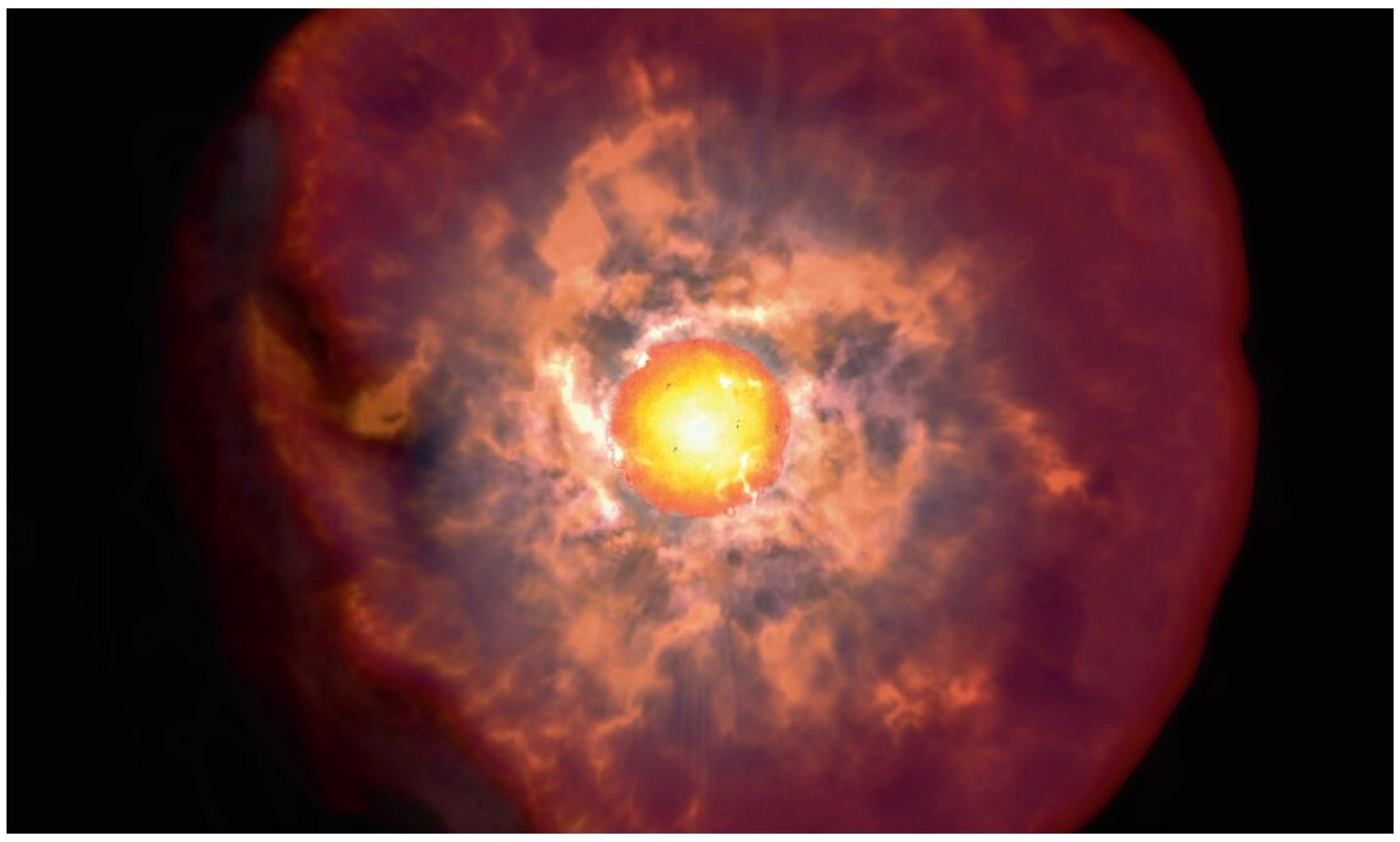
One possible explanation for the large circumstellar medium is that the star was once much brighter and has dramatically dimmed – but red supergiants aren't known to fluctuate in this way, says Siebert.

It is also possible that another star may have been circling close around, or even within, the larger star and slinging off DFK 52's material, but that would have produced a more symmetrical bubble, says Siebert.

"The outburst likely won't change the star's overall evolution, but it could have a significant impact on the appearance of its future supernova," says Emma Beasor at Liverpool John Moores University, UK.

"This is an exciting result and could help us understand some unusual supernovae."

Red supergiants expel gas and dust before exploding in a supernova



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Health

Your frenemies could be ageing you as much as smoking

MANY of us have people in our lives who bring more angst than joy. But rather than just dragging us down, these individuals could be speeding up the rate at which we age.

In 2012, researchers at the University of Utah found that "frenemies" – relationships that blow hot and cold – seem to accelerate the shortening of our telomeres, the protective caps at the end of chromosomes. Shortening happens naturally with age and has been linked to heart disease.

Now, Byungkyu Lee at New York University and his colleagues have analysed the effects that negative social ties have on tiny chemical changes to DNA called methylation marks. This is an example of epigenetics, the way your behaviours and environment can cause changes that affect how your genes work. "As we age, the pattern of these marks shifts in predictable ways," says Lee.

The team got 2232 people to provide saliva samples for epigenetic testing and to describe their relationships with key members of their social network, answering questions such as: "How often has X hassled you, caused problems or made life difficult?"

Anyone who caused such issues either occasionally or often was labelled a "hassler". These individuals seemed to have a significant impact, with each hassler being linked to accelerated biological ageing in people by about 0.5 per cent, making their biological age 2.5 months older, on average, than expected (medRxiv, doi.org/px25).

"People with 'hasslers' in their lives were 2.5 months older biologically than their actual age"

Negative social ties may trigger a chronic inflammatory stress response, with Lee's team observing higher levels of these markers in people with such relationships, which may impair the immune system.

"The biological impact of having a high proportion of hasslers in one's social network is comparable in magnitude to the difference between never-smokers and ever-smokers," says Lee.

David Robson