

Largest yellow hypergiant star spotted

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HR 5171, the brightest star just below the centre of this wide-field image, is a yellow hypergiant, a very rare type of stars with only a dozen known in our galaxy. Its size is over 1,300 times that of the Sun -- one of the 10 largest stars found so far. Observations with ESO's Very Large Telescope Interferometer have shown that it is actually a double star, with the companion in contact with the main star. Credit: ESO/Digitized Sky Survey 2

ESO's Very Large Telescope has revealed the largest yellow star—and one of the 10 largest stars found so far. This hypergiant has been found

to measure more than 1,300 times the diameter of the Sun, and to be part of a double star system, with the second component so close that it is in contact with the main star. Observations spanning over 60 years also indicate that this remarkable object is changing very rapidly.

Using ESO's Very Large Telescope Interferometer (VLTI), Olivier Chesneau (Observatoire de la Côte d'Azur, Nice, France) and an international team of collaborators have found that the yellow hypergiant star [HR 5171 A](#) is absolutely huge—1300 times the [diameter](#) of the Sun and much bigger than was expected. This makes it the largest yellow star known. It is also in the top ten of the largest [stars](#) known—50% larger than the famous red supergiant Betelgeuse—and about one million times brighter than the Sun.

"The new observations also showed that this star has a very close binary partner, which was a real surprise," says Chesneau. "The two stars are so close that they touch and the whole system resembles a gigantic peanut."

The astronomers made use of a technique called interferometry to combine the light collected from multiple individual telescopes, effectively creating a giant telescope up to 140 metres in size. The new results prompted the team to thoroughly investigate older observations of the star spanning more than sixty years, to see how it had behaved in the past.

Yellow hypergiants are very rare, with only a dozen or so known in our galaxy—the best-known example being Rho Cassiopeiae. They are among the biggest and brightest stars known and are at a stage of their lives when they are unstable and changing rapidly. Due to this instability, yellow hypergiants also expel material outwards, forming a large, extended atmosphere around the star.

Despite its great distance of nearly 12 000 light-years from Earth, the

object can just about be seen with the naked eye by the keen-sighted. HR 5171 A has been found to be getting bigger over the last 40 years, cooling as it grows, and its evolution has now been caught in action. Only a few stars are caught in this very brief phase, where they undergo a dramatic change in temperature as they rapidly evolve.

By analysing data on the star's varying brightness, using observations from other observatories, the astronomers confirmed the object to be an eclipsing binary system where the smaller component passes in front and behind the larger one as it orbits. In this case HR 5171 A is orbited by its companion star every 1300 days. The smaller companion is only slightly hotter than HR 5171 A's surface temperature of 5000 degrees Celsius.

Chesneau concludes "The companion we have found is very significant as it can have an influence on the fate of HR 5171 A, for example, stripping off its outer layers and modifying its evolution."

This new discovery highlights the importance of studying these huge and short-lived yellow hypergiants, and could provide a means of understanding the evolutionary processes of massive stars in general.

More information: This research was presented in a paper "The yellow hypergiant HR 5171 A: Resolving a massive interacting binary in the common envelope phase", by Chesneau et al., to appear in the journal *Astronomy & Astrophysics*. arxiv.org/pdf/1401.2628v2.pdf

Provided by ESO

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