The Frugal Cosmic Ant

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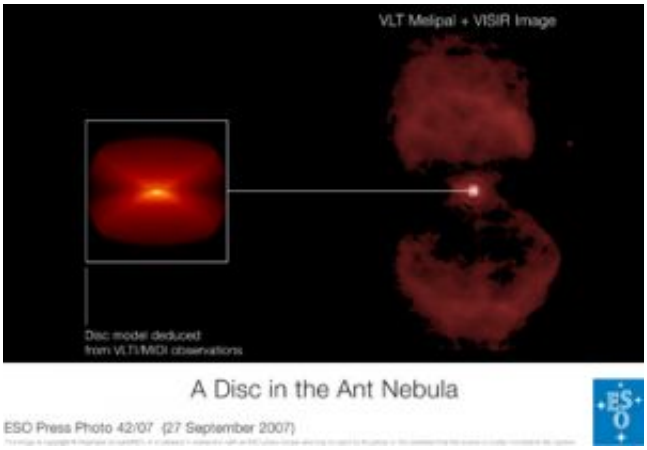

Using ESO&acutes Very Large Telescope Interferometer, astronomers have uncovered a disc in the heart of the Ant Nebula. The disc seems, however, too &acuteskinny&acute to explain how the nebula got its intriguing ant-like shape. The image on the right shows a previously taken image of the Ant Nebula, in the mid-infrared, with the VLT Imager and Spectrometer for the mid-InfraRed (VISIR). The image on the left shows a model of the dusty disc the astronomers uncovered with the MID-infrared Interferometric instrument (MIDI), which combined the light from two 8.2-m VLT Unit Telescopes. The lower part of the image representing the southern lobe is brighter, for this lobe is closer to our line-of-sight. The major axis of the flat, nearly edge-on disc is perpendicular to the axis of the bipolar lobes of the nebula. The disc extends from about 9 times the mean distance between the Earth and the Sun (9 Astronomical Units or 9 AU) to more than 500 AU. Credit: ESO

Using ESO's Very Large Telescope Interferometer and its unique ability to see small details, astronomers have uncovered a flat, nearly edge-on

disc of silicates in the heart of the magnificent Ant Nebula. The disc seems, however, too 'skinny' to explain how the nebula got its intriguing ant-like shape.

But how can a spherical star produce such complex structures? The answer, many astronomers think, requires understanding of the discs surrounding the central star. By their nature, these discs bear witness to the phenomena that lead to the asymmetrical structures of planetary nebulae.

The Ant Nebula is located about 5 000 light-years away. The central star is as bright as 10 000 Suns and has a temperature of 35 000 degrees Celsius. It is the last phase before this solar-like star will become a white dwarf.

"The challenge is to actually detect these discs," explains team leader Olivier Chesneau, from the Observatoire de la Côte d'Azur, France. "Most astronomical instruments do not have a sharp enough view to find, let alone study them. The Very Large Telescope Interferometer however, with its exceptionally high spatial resolution, is a powerful disc-hunter."

The disc of the Ant Nebula, which cannot be detected with a single 8.2-m VLT Unit Telescope, was uncovered in the interferometric mode where two 8.2-m Unit Telescopes were used to combine light, through the MID-infrared Interferometric instrument (MIDI). The observations reveal a flat, nearly edge-on disc whose major axis is perpendicular to the axis of the bipolar lobes. The disc extends from about 9 times the mean distance between the Earth and the Sun (9 Astronomical Units or 9 AU) to more than 500 AU. At the distance of the Ant Nebula, this corresponds to having detected structures that subtend an angle of only 6 milli-arcseconds. This is similar to distinguishing a two-storey building on the Moon.

The dust mass stored in the disc appears to be only one hundred thousandth the mass of the Sun and is a hundred times smaller than the mass found in the bipolar lobes.

"We must therefore conclude that the disc is too light to have a significant impact on the outflowing material and cannot explain the shape of the Ant Nebula", says Chesneau. "Instead, it looks more like this disc is some remnant of the material expelled by the star."

The observations also provide unquestionable evidence that the disc is primarily composed of amorphous silicate. "This," says Chesneau, "most likely indicates that the disc is young, perhaps as young as the planetary nebula itself."

The astronomers favour the possibility that the large quantity of material in the lobes was propelled by several large-scale events, triggered with the help of a cool stellar companion. The solution of the mystery thus resides in the core of the system, and requires better characterisation of the hot central star and its putative companion, currently hidden from our view by the dusty disc.

The results are presented in a Letter to the Editor published by the research journal *Astronomy and Astrophysics* ("A silicate disk in the heart of the Ant" by O. Chesneau et al.).

Source: ESO

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