Research shows first jet from massive young star detected outside our galaxy

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Credit: University of Canterbury

In a significant astronomical discovery, a University of Canterbury (UC) scientist has made the very first detection of a jet from a very young, massive star in a galaxy that is not our own.

Marsden Fellow Dr Anna McLeod, of UC's School of Physical and Chemical Sciences, says this discovery will drive significant advancement in the field of star formation.

"It also gives a further clue on one of the biggest questions in modern astronomy: how do massive stars form?" Dr McLeod says.

"Massive stars are so important because they regulate the formation of new generations of stars as well as the evolution of entire galaxies. Our discovery captures a massive star as it is forming, and it sheds light onto the formation mechanism."

Dr McLeod is the lead author of the new article about the discovery "A parsec-scale optical jet from a massive young star in the Large Magellanic Cloud", co-authored with researchers in Germany, the United Kingdom and the United States, which has been published today in *Nature*, one of the highest-impact scientific journals.

The researchers say the jet spans about 36 light years (or 11 parsecs), which makes it among the largest jets of its kind ever found. The star powering the jet appears to be about 12 times as massive as our sun.

The data used for this work comes from the Very Large Telescope (VLT) in Chile's Atacama Desert, which is among the largest optical telescopes in the world and is one of the most competitive telescopes on which to obtain precious observing time.

"The discovery is very important as it opens new doors in the field. As an added bonus, it also comes with a very rich data set and stunning images of a star-forming region in our neighbour galaxy, the Large Magellanic Cloud," Dr McLeod says.

She explains that while the way in which stars similar to our sun are

formed is understood, this is not the case for stars with masses eight-times that of our sun and above, "namely those stars that are so important in regulating star formation in entire galaxies".

In the paper, Dr McLeod presents compelling evidence that high-mass stars form in a similar way to sun-like stars.

"We have detected a very young and still forming massive star – a so-called young stellar object – which is launching a bipolar jet. The jet is direct evidence for what we call an accretion disk – a disk around the equator of the star through which the star is gathering matter and thus growing, which is what we see in low-mass stars."

Dr McLeod says this discovery is important for various reasons:

- It brings direct evidence for an accretion-mediated formation scenario for massive stars, meaning that we have evidence that massive stars up to 12 times that of our sun form like low-mass stars.
- It is the first jet from a massive young stellar object detected outside of our own galaxy.
- In the Milky Way, most jet-driving massive young stellar objects are invisible to optical telescopes, because they are too deeply embedded in their natal material which shields them from our sight. However, in this case, both the jet and the star are visible in the optical, providing unprecedented insight; it is the first jet from a massive young stellar object observed in optical light.
- The total length of the jet is 11 parsec, making it among the longest observed jets to date.
- The way the jet was identified is unique, because it is only with the kind of instrument used to take the data (the MUSE instrument at the VLT) that this could be done – regular instruments would not have detected the jet. (The VLT can

detect objects roughly 4 billion times fainter than can be detected with the naked eye.)

More information: A parsec-scale optical jet from a massive young star in the Large Magellanic Cloud. *Nature* DOI: 10.1038/nature25189

Provided by University of Canterbury