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Astronomy

Maps of planet-forming zones will help the hunt for alien life

Leah Crane

PLANETARY nurseries have been mapped in the most detail yet, and they are richer than expected in organic molecules – the basic chemical building blocks for life to arise. Studying such maps could help us understand whether we are alone in the universe.

Planets are thought to form in areas of dust and gas called protoplanetary discs, which encircle young stars. We have observed these discs in the past, and even seen signs of planets taking shape in them, but the Molecules with ALMA at Planet-forming Scales (MAPS) project has mapped the chemical composition of these areas in more detail than before, using the Atacama Large Millimeter/submillimeter Array (ALMA).

"Though bad for complex life forms, cyanides seem to be good for kick-starting the chemistry of life"

The researchers looked at the discs around five nearby stars and found that each has a unique chemical make-up that varies significantly between different areas within each disc (arxiv.org/abs/2109.06268).

"We see this incredible amount of chemical variety, both between and within discs," says Jane Huang at the University of Michigan, part of the MAPS project. "We're seeing these intricate gap and ring structures… and without this high resolution you wouldn't know that was there."

The project examined organic chemicals, a class of carbon-containing substances that are important for the possibility of life as we know it. "There was a lot more of this organic material than we expected – between 10 and 100 times more than our best models had predicted," says MAPS collaborator John Ilee at the University of Leeds, UK.

But not every location in the discs had so much organic material. "We had expected an uneven distribution, but we hadn't expected it to look like this," says MAPS team member Karin Öberg at the Harvard-Smithsonian Center for Astrophysics in Massachusetts. "It might really matter where in the disc and when in the disc's lifetime a planet forms for its inventory of organic chemicals."

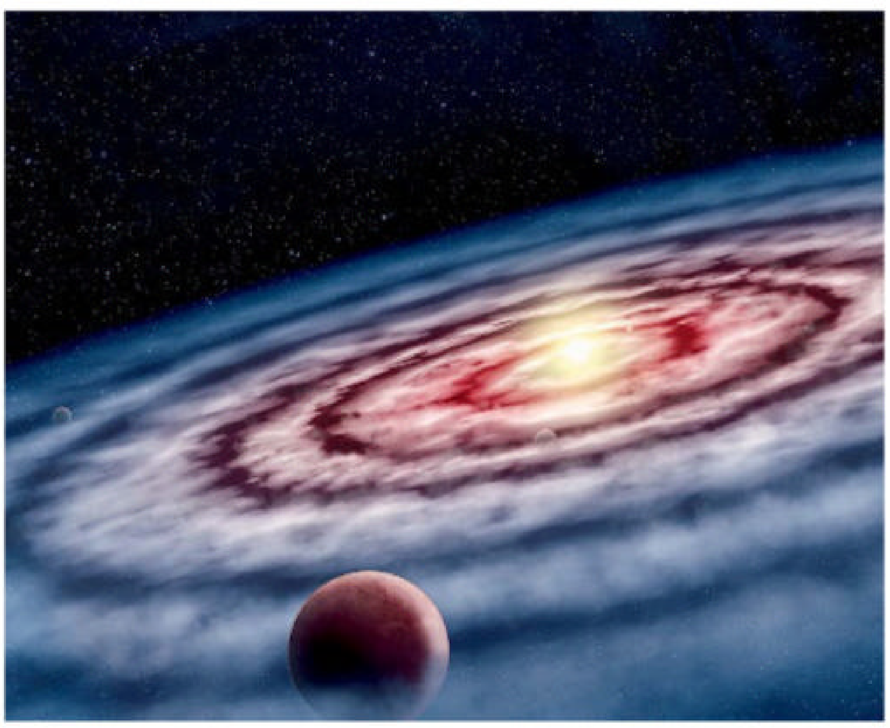
Understanding this is important to figuring out which worlds beyond our solar system might have the potential for alien life. "There are many more steps to go before anything like a little green man is invoked, but we know that these chemicals are important to life on Earth," says Ilee.

One of the most prominent of these organic molecules was cyanide, which the researchers found in all five discs. "Despite being terrible for… complex life forms such as ourselves, cyanides seem to be very good for kick-starting the chemistry of life," says Öberg.

The ubiquity of cyanide-based molecules may be a hint that many worlds scattered around the universe have the right ingredients for life, a promising sign that our solar system may not be particularly special. The chemical compositions of the discs matched up well with the chemicals that we see in comets in our solar system, which are the last remaining relics of our own protoplanetary disc.

But before we can make sweeping statements about all protoplanetary discs, we will have to observe more of them in detail to find out if these five are typical. These are some of the biggest, brightest discs we have seen, which made them easier to observe, but it also means that we can't necessarily use them to generalise about planetary nurseries. ■

An artist's impression of a protoplanetary disc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Bioengineering

Catnip chemical from yeast could be mosquito beater

Michael Le Page

A KEY ingredient in catnip can now be made by genetically engineered yeast, paving the way to a possible new mass-produced insect repellent.

The chemical, nepetalactone, is a very good repellent, but catnip plants (*Nepeta cataria*) don't have enough of it to make production from these commercially viable.

Insect repellents can help prevent serious diseases such as malaria, as well as nuisance bites. DEET is the most widely used mosquito repellent worldwide and is often still the most effective. However, some mosquito populations are evolving resistance to DEET.

Many studies have shown that nepetalactone is an effective insect repellent, with some even finding it more effective than DEET. Yet while catnip in various forms has long been used as a repellent, making a plentiful, cheap version isn't feasible using the plant.

To address this, Vincent Martin and his team at Concordia University in Canada added eight genes to a strain of yeast to create a chemical pathway for making nepetalactone (bioRxiv, doi.org/gwpx).

"We still need to do some work to boost levels," says Martin. "I don't believe it will be a huge hurdle." The main obstacle is that the process also produces a substance toxic to the yeast. However, other groups using yeasts to produce various chemicals have had the same issue and solved it, says Martin.

The researchers are now in talks with companies about getting the investment required to develop t he process and commercialise it.

They will also need to look at whether nepetalactone acts as a cat attractant as well as an insect repellent. "If you are walking around with this molecule on you, will there be no mosquitoes, but all the neighbourhood cats chasing you around? To be honest, I don't know," says Martin. ■