INSTITUTE OF ASTRONOMY
PUBLIC OPEN EVENING

— 16 November 2022 —

A team of astronomers studied some of the oldest stars in the universe and found evidence suggesting that the building blocks of planets start to form while their host star is still growing.

Previously it had been thought that planets only formed once their star had reached its final mass, but these new results suggest otherwise. This changes our understanding of planetary formation and could help astronomers determine when planet formation starts.

A team of researchers, led by Dr Amy Bonsor of the University of Cambridge, studied the atmospheres of white dwarfs to investigate planet formation. White dwarfs are the slowly cooling remnants of Sun-like stars and have lifetimes of up to 10^10 years, making them some of the oldest objects in the universe. “Some white dwarfs are amazing laboratories, because their thin atmospheres are almost like celestial graveyards” says Bonsor.

Generally a planet’s interior is obscured from view, but a class of white dwarfs known as ‘polluted’ systems have atmospheres full of elements such as magnesium, iron and calcium – which could resolve this problem. White dwarfs do not usually have such heavy element-rich atmospheres; these elements must have come from small bodies crashing into the white dwarfs. Spectral analysis of polluted atmospheres can therefore reveal the compositions of these small bodies and the conditions under which they formed.

Bonsor and her colleagues studied the atmospheres of 200 polluted white dwarfs from nearby galaxies. Their analysis revealed that the elements observed in these atmospheres must have been formed by melting caused by very short-lived radioactive elements. These radioactive elements could only exist in the earliest stages of the planetary system before decaying, so melting must have occurred early on. This suggests that planet formation starts early, when the host star is still growing.

TONIGHT'S SPEAKER

Carolin Crawford

The First Images from JWST

Our weekly welcome

WELCOME to our weekly public open evenings for the 2022/23 season. Each night there will be a half-hour talk which begins promptly at 7.15pm. Please note that the talk will be recorded and archived for online streaming.

The talk is followed by an opportunity to observe if (and only if!) the weather is clear. The IoA’s historical Northumberland and Thorrowgood telescopes, along with our modern 16-inch telescope, will be open for observations. In addition, the Cambridge Astronomical Association will provide a floorshow outdoors on the Observatory lawns, relaying live images from their telescopes and providing a commentary. If we’re unlucky and it’s cloudy, we’ll offer you a conciliatory cup of tea after the talk (with perhaps some more astro-information in the lecture theatre for those who want to stay on).

If you have any questions, suggestions or comments about the IoA Open Evenings please contact Matt Bothwell at bothwell@ast.cam.ac.uk.

The talk schedule for this term can be viewed at: www.public.ast.cam.ac.uk

MAVEN observes Martian light show

International Gemini Observatory/NOIRLab/NSF/AURA/J. da Silva/Spaceengine/M. Zamani

For the first time in eight years, NASA's MAVEN saw two different types of ultraviolet aurorae occurring simultaneously because of solar storms. MAVEN (Mars Atmosphere and Volatile Evolution mission) is currently the only mission observing both solar activity and the response of Martian atmosphere.

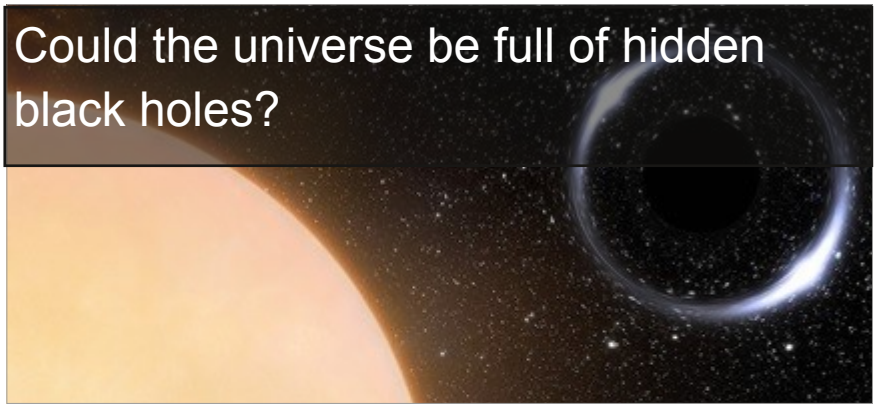
On August 27th huge bursts of radiation were produced by the Sun. These bursts were accompanied by a coronal mass ejection, a massive explosion of gas and magnetic energy that leaves the Sun and travels through space. Real-time analysis and simulations allowed MAVEN's research team to correctly predict when this storm would reach Mars.

This predictive ability is vital as Mars doesn't have a magnetic field like Earth to shield it from harmful radiation. Forecasting is essential to protect current missions and prepare for future exploration on Mars.

MAVEN observed both diffuse and a proton aurora simultaneously due to Mars being at its closest approach to the Sun. During this time, dust storms heat the atmosphere enough to allow water vapour to reach high altitudes where it interacts with UV radiation and releases hydrogen atoms, lighting up the planet with UV emissions. The proton aurorae happened to occur at the same time as the arrival of energetic particles capable of penetrating deeper into the atmosphere, creating diffuse aurora.

Researchers are hopeful that this will be the first of many exciting observations. "Our team cannot wait for the next few years of observing the most extreme conditions during the MAVEN mission's lifetime" says Shannon Curry, MAVEN's lead investigator at the University of California.

Could the universe be full of hidden black holes?



No black hole has ever been observed to have a star similar in mass to our Sun orbiting it. Instead, black holes tend to form tight orbits with their companion stars. These companion stars are stripped of their matter, which glows brightly as it falls into the black hole. This acts as a source of X-rays, allowing astronomers to detect black holes.

However, astronomers have speculated that there could be another type of black hole that does not emit these X-rays and has remained unseen. Kareem El-Bardy of Harvard University and others think they have discovered the first such example of a 'hidden' black hole using Gaia.

The team found a Sun-like star with a peculiar cartwheel motion, suggesting that it is orbiting a massive companion. This companion cannot be observed in any wavelengths, and the star's motion shows that it is too massive to be a neutron star. The object cannot be an ordinary star either, as a star that massive would be 500 times brighter than its Sun-like companion. It is therefore thought to be a black hole.

The existence of this system, Gaia BH1, suggests that hidden black holes are much more common than previously thought.

The process by which these systems form remain unclear. Most black holes form by supernovae explosions which a Sun-like star could not survive, so another hypothesis is needed. To find this more observations will be needed. El-Bardy remains optimistic that "Future Gaia releases will likely find dozens more".

Joke of the Week

What happens in Cygnus X-1 stays in Cygnus X-1.