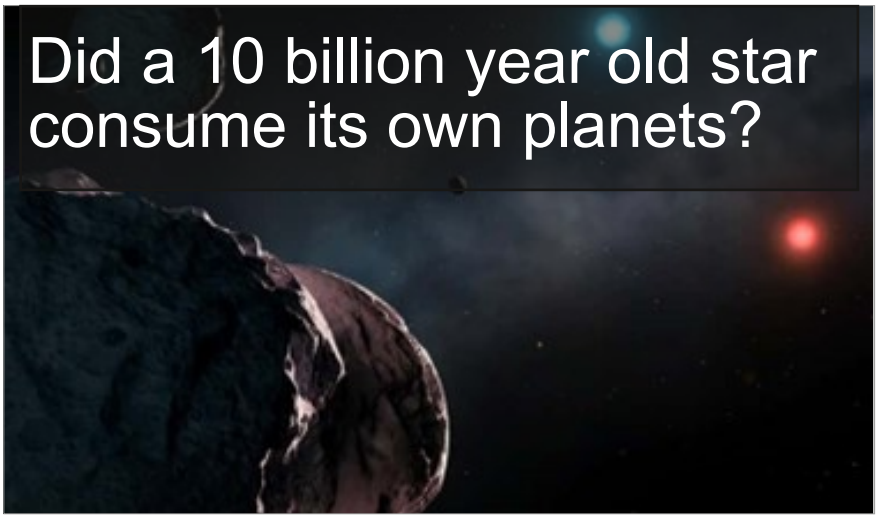
INSTITUTE OF ASTRONOMY
PUBLIC OPEN EVENING

— 9 November 2022 —

Did a 10 billion year old star consume its own planets?



Last year astronomers spotted a white dwarf star, WD J2147-4035, at a distance of 90 light years from Earth. White dwarfs are the remains of dead stars that no longer carry out nuclear fusion and are not massive enough to form neutron stars or black holes. It is though that 97% of all living stars in the Milky Way will eventually become white dwarfs, making them common objects.

This white dwarf in question, however, was found to be unusually cold. Since white dwarfs cool gradually over time, this suggests that WD J2147-4035 is much older than the other stars in its vicinity. A more detailed analysis conducted by Abbigail Elms at the University of Warwick used data from the Gaia space telescope, along with the Dark Energy Survey and X-ray data, to estimate the age of WD J2147-4035 as 10.7 billion years old. For comparison, Earth itself is only 4.6 billion years old.

Elms and her colleagues also observed the spectral signature of WD J2147-4035 to determine its chemical composition. They found sodium, potassium, lithium and possibly carbon – which were thought to have come from consuming planetary debris. However, the levels of potassium and lithium were higher than those typically seen in white dwarfs.

The researchers attempted to create a model based on what is understood about our solar system that could explain how orbiting planets may have resulted in giving WD J2147-4035 its observed chemical signature. But they were unable to produce a model capable of explaining all their findings. “At the moment, we can’t explain the chemical composition of WD J2147-4035 with solar system bodies, so something was going on in the early galaxy which we need to do some more analysis on”, says Elms.

TONIGHT'S SPEAKER

Steve Young

Using exo-asteroids to find hidden planets

Our weekly welcome

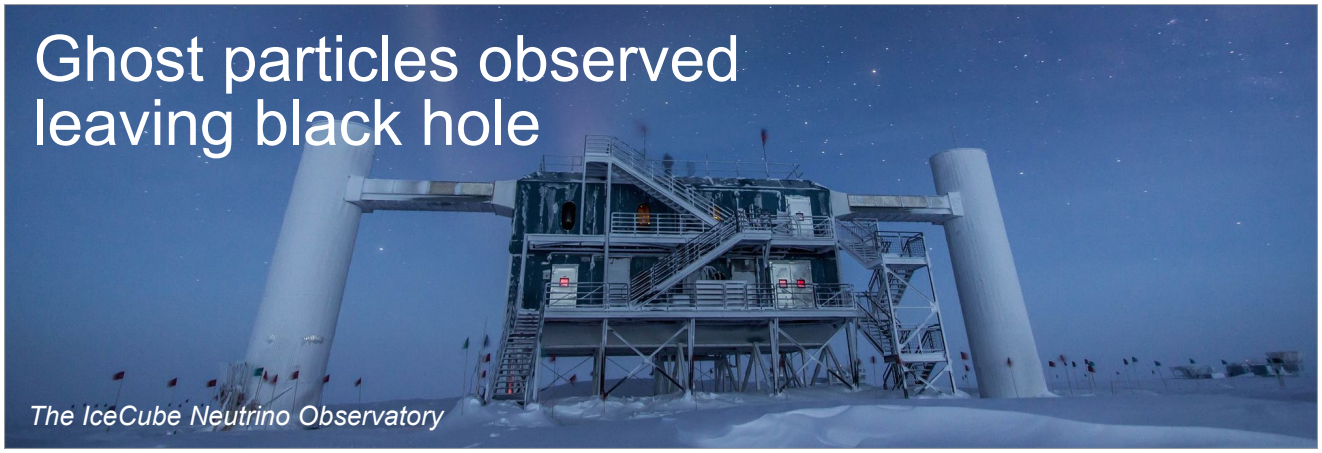
WELCOME to our weekly public open evenings for the 2022/23 season. Each night there will be a half-hour talk which begins promptly at 7.15pm. Please note that the talk will be recorded and archived for online streaming.

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

Ghost particles observed leaving black hole



The IceCube Neutrino Observatory

The IceCube laboratory has gathered the best evidence yet showing that neutrinos are being produced by the black hole at the centre of M77.

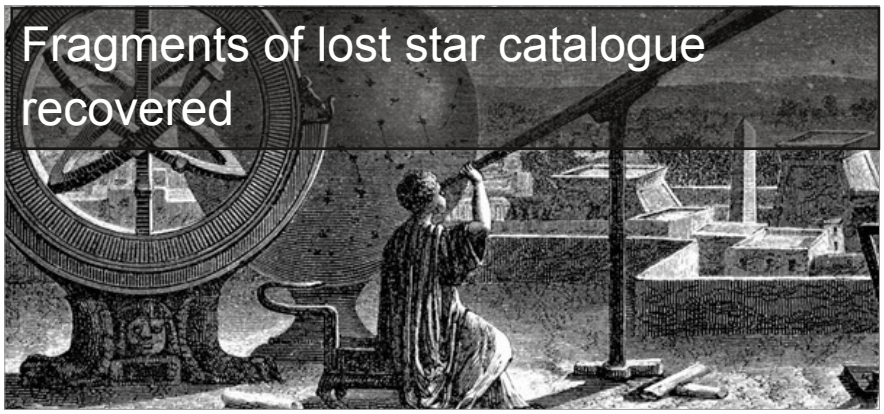
Neutrinos are particles that carry no electrical charge and have nearly no mass. They rarely interact with atoms (approximately 100 trillion neutrinos pass through your body each second unnoticed), making them incredibly difficult to detect and earning them the nickname ‘ghost particles’. This meant that, until recently, only one galaxy (TXS 0506+056) was known to produce neutrinos.

But new observations from IceCube, combined with analysis techniques involving machine learning, produced results suggesting that 79 of the neutrinos detected by IceCube over the past decade originated from M77. This implies that the supermassive black hole at the centre of M77 has a strong magnetic field able to act as a particle accelerator.

With this new finding astronomers get closer to answering the question of how neutrinos are produced and how that process relates to the cosmic rays and gamma rays. IceCube’s observations of M77 could help discover the origin of cosmic rays.

Unfortunately, the results obtained from the new analysis techniques have a statistical significance of 4.2 sigma – which is below the required 5 sigma. A statistical significance of 5 sigma would correspond to a one in a million that the findings were simply caused by random fluctuations. However, IceCube’s principal investigator remains optimistic: “I think we have the tools to solve the oldest problem in astronomy” says Francis Halzen of the University of Wisconsin.

Fragments of lost star catalogue recovered



Fragments of a star catalogue from the second century B.C were found in a manuscript which had been erased centuries later. It was analysed using a technique known as multispectral imaging, in which photos are taken in many wavelengths of light from different angles. Light reflecting off the ink revealed a hidden text.

The text, once translated, was found to contain a description of the constellation Corona Borealis.

The positions of stars were described using numerical coordinates written in unusual notation thought to be unique to Hipparchus.

Hipparchus was a Greek astronomer thought to have created the first star catalogue that defined positions in the sky using two coordinates – rather than describing constellation’s positions relative to each other.

Planetarium software was used to calculate where the stars in Corona Borealis would have been in the sky in 129 B.C while Hipparchus was alive. These calculated positions matched those of the manuscript to within one degree.

Researchers are hopeful that more fragments could turn up. “There’s so much more to find in these manuscripts,” says Victor Gysembergh of Sorbonne University in Paris. “We’ve hardly scraped the surface”.

Joke of the Week

An infinite crowd of mathematicians enter a bar. The first one orders a pint of beer, the second one orders half a pint of beer, the third one orders a quarter pint of beer – The bartender hands over two pints of beer and says, “you lot ought to know your limits”.