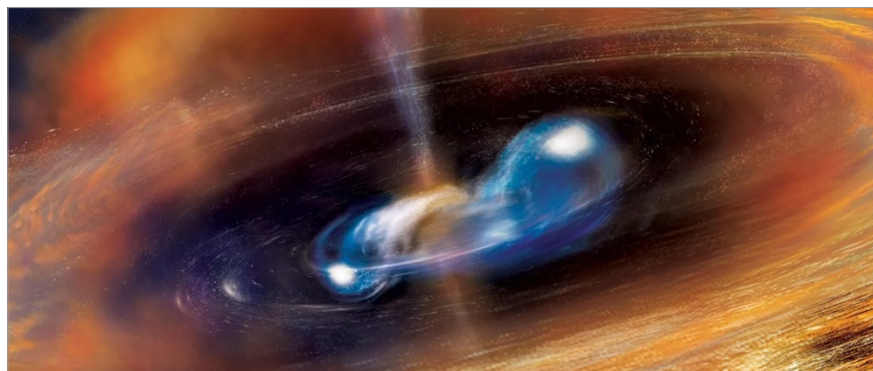




INSTITUTE OF ASTRONOMY PUBLIC OPEN EVENING

— 18 JANUARY 2023 —



Astronomers discover an enigmatic cosmic explosion

Gamma-ray bursts are ultra-bright flashes of gamma rays – the most energetic form of light. At their peak brightness they can shine as brightly as all the stars in the observable Universe combined, but their short-lived nature makes them difficult to study.

They are usually detected in the distant Universe and come in two categories. “Long” bursts last somewhere between a few seconds and several minutes and are followed by an afterglow of less energetic light. They are thought to be the result of a massive star collapsing to a dense neutron star or a black hole at the end of its life. The star then ejects its outer parts in a supernova-like explosion, which we observe as a gamma-ray burst.

“Short” bursts on the other hand typically last for less than a second and are thought to be caused by two massive stars orbiting each other in a binary system. These two stars will eventually spiral into each other

and merge, causing a gamma-ray burst.

However recent findings challenge the theory of how gamma-ray bursts form. A routine observation of a gamma-ray burst named GRB 211211A revealed that it didn’t fit into either the “long” or “short” category. Despite originating outside a galaxy typical for hosting short bursts, GRB 211211A lasted almost a minute.

Further investigations carried out by a team of international astronomers led by Jillian Rastinejad led to an unexpected discovery of a kilonova, proof of the collision of two neutron stars – or a neutron star and a black hole. Kilonovae are thought to be the main mechanism for creating heavy elements including gold and uranium.

Follow-up observations with the ALMA radio telescope in Chile or JWST will be needed to confirm the team’s findings and learn more about this exciting phenomenon.

TONIGHT'S SPEAKER



Matt Bothwell
Invisible Galaxies!

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).

News stories written by **Natasha Goodman**. 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



Astronomers find hidden black holes with NASA's Chandra

Hundreds of black holes previously hidden were found using NASA's Chandra X-ray Observatory. Prior to this, astronomers had predicted the presence of supermassive black holes at the center of almost all large galaxies, however only black holes actively pulling in material that produces radiation could be observed.

By combining data from the Chandra Source Catalog – the definitive list of X-ray sources detected by Chandra that is open to the public – and optical data from the Sloan Digital Sky Survey

(SDSS), astronomers were able to identify black holes that had been buried under dust and gas.

Researchers were also able to identify 817 XBONG candidates, over 10 times the number known before Chandra was in operation. X-ray bright optically normal galaxies (XBONGs) are galaxies that appear normal in visible light but shine brightly in X-rays. About half of the XBONG candidates identified represent a population of previously hidden black holes. Further evidence for this was provided by data from NASA's Wide-Field Infrared Survey

Explorer.

"These results show how powerful it is to compare X-ray and optical data mines," said co-author Amanda Malnati, of Smith College in Northampton, Massachusetts. "The Chandra Source Catalog is a growing treasure that will help astronomers make discoveries for years to come."

Discovering buried black holes helps astronomers give a more accurate census of black holes in the universe and is the first step in learning about the true nature of XBONGs.



Supermassive black hole snacks on the same star once every few years

A supermassive black hole almost 900 million light years away is periodically eating away part of an orbiting star. Approximately every 1200 days the star reaches its closest approach to the black hole and has material stripped away from it.

Such removal of material is known as a tidal disruption event (TDE) - and this particular one, named AT2018fyk, is only the second ever found to repeat itself. AT2018fyk was first spotted in 2018, when astronomers observed

a sudden brightening of the black hole that lasted 600 days. This temporary brightening was caused by the hot, bright stellar material falling into the black hole before dimming. Initially it was thought that this TDE was a one-off occurrence, but almost four years later the black hole was seen to undergo the same brightening. "That's really, really weird, and that's not at all predicted by standard theories of TDEs" said Eric Coughlin of Syracuse University in New York. The

second brightening led Coughlin and his colleagues to suggest that rather than destroying the star entirely, the black hole is ripping off between 1 and 10% of the star each time it gets too close. The black hole is currently snacking on the star and AT2018fyk is still bright. Researchers expect it to dim suddenly in August 2023 before brightening once more in March 2025. They will continue to observe it to see what else we can learn about how black holes devour matter.

Joke of the Week

I tried to give a serious talk on black holes, but no one appreciated the gravity of the situation.