



## Press Release

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### Light sparked by colliding black holes seen for the first time

Astronomers have witnessed for the first time flares of light that may have been created by the collision of two black holes.

Their findings potentially create a new chapter within astrophysics because the merger of black holes was not expected to generate light waves, as the gravity associated with black holes is so great that nothing – not even light – usually escapes from them.

The study – published in *Physical Review Letters* – involved an international team of scientists, including physicists from the University of Edinburgh.

Previous observations have shown that when two black holes spiral around each other and ultimately collide and merge they generate ripples in space and time known as gravitational waves.

The phenomena is a direct consequence of Einstein's theory of gravity and was first detected by scientists in 2015, leading to the Nobel Prize in Physics.

In the latest study, a black hole merger was spotted by the National Science Foundation's Laser Interferometer Gravitational-wave Observatory (LIGO) and the European Virgo detector in May 2019. As the black holes collided with each other, they sent out the expected gravitational waves.

Shortly after, the California Institute of Technology's (Caltech) Zwicky Transient Facility (ZTF), located at the Palomar Observatory near San Diego, captured a flare of light that was pinpointed to the same area as the gravitational wave event.

Matthew Graham, lead author, research Professor of Astronomy at Caltech and project scientist at ZTF, said: "This supermassive black hole was burbling along for years before this more abrupt flare.

"The flare occurred on the right timescale, and in the right location, to be coincident with the gravitational-wave event. In our study, we conclude that the flare is likely the result of a black hole merger, but we cannot completely rule out other possibilities."

Supermassive black holes lurk at the centre of most galaxies, including our own, the Milky Way. These central supermassive black holes can be surrounded by a disc of flowing gas which contains swarms of stars and smaller black holes.

The flow of the gas helps to bring the smaller black holes together, enabling them to merge, and creates a larger black hole within the disk. Upon creation, the new black hole has a large velocity and it is given what scientists described as "a kick" through the gas disk.

Experts said it is the reaction of the gas to the new speeding black hole that creates a bright light flare, visible with telescopes.

The newly formed larger black hole should cause another burst of light in the next few years, according to the scientists.



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Dr Nicholas Ross, project collaborator and STFC Ernest Rutherford Fellow at the Institute for Astronomy, University of Edinburgh, said: "This result, the optical flash resulting from two black holes colliding and crushing the gas around them, is so exciting.

"As a wee kid, I was hooked by the idea of black holes and now, as a big kid, the fact that we have 'seen' as well as 'heard' these black hole mergers, is an amazing discovery that has deep implications for astrophysics.

"I'd like to thank the LIGO, Virgo and ZTF collaborations for their dedication and hard work over the years and I hope this finding inspires people of all ages and informs future studies in astronomy."

The paper, titled, "A Candidate Electromagnetic Counterpart to the Binary Black Hole Merger Gravitational Wave Event GW190521g" was funded by the NSF, NASA, the Heising-Simons Foundation, and the GROWTH (Global Relay of Observatories Watching Transients Happen) programme.

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