

Study explains the mystery of ball lightning

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Credit: AI-generated image ([disclaimer](#))

(Phys.org)—Sightings of ball lightning have been made for centuries around the world – usually the size of a grapefruit and lasting up to twenty seconds – but no explanation of how it occurs has been universally accepted by science.

In a paper published in the [Journal of Geophysical Research Atmospheres](#) entitled 'The Birth of Ball Lightning' CSIRO and Australia National

University scientists present a new mathematical theory which explains how and why it occurs.

Previous competing theories have cited [microwave radiation](#) from thunderclouds, oxidising aerosols, nuclear energy, dark matter, antimatter, and even [black holes](#) as possible causes.

Led by CSIRO scientist John Lowke, the new theory focuses on how ball lightning occurs in houses and aeroplanes – and how it can pass through glass. His theory also proposes that ball lightning is caused when leftover ions (electric energy), which are very dense, are swept to the ground following a [lightning strike](#).

"A crucial proof of any theory of ball lightning would be if the theory could be used to make ball lightning. This is the first paper which gives a mathematical solution explaining the birth or initiation of ball lightning," says Lowke.

Lowke proposes that ball lightning occurs in houses and aeroplanes when a stream of ions accumulates on the outside of a glass window and the resulting electric field on the other side excites [air molecules](#) to form a ball discharge. The discharge requires a driving electric field of about a million volts.

"Other theories have suggested ball lightning is created by slowly burning particles of silicon formed in a lightning strike, but this is flawed. One of the ball lightning observations cited in this paper occurred when there was no thunderstorm and was driven by ions from the aircraft radar operated at maximum power during a dense fog."

Lowke used eye-witness accounts of ball lightning by two former US Air Force pilots to verify the theory. Former [US Air Force](#) lieutenant Don Smith recalls: "After flying for about 15 minutes, there developed on the

randome (radar cover) two horns of Saint Elmo's fire. It looked as if the airplane now had bull's horns...they were glowing with the blue of electricity."

Lowke's paper gives the first [mathematical solution](#) explaining the birth or initiation of [ball lightning](#) using standard equations for the motion of electrons and ions. He argues it is unique because it not only explains the birth of the ball but also how it can form on glass and appear to pass through glass resulting in globes of light in people's homes or in aeroplane cockpits.

Provided by CSIRO

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