Mystery of Ball Lightning ?

Ball lightning may be the accumulation of ions on the outside of non-conducting surfaces such as a window.

Fri Oct 12, 2012 10:52 AM ET
Content provided by Darren Osborne, ABC Science

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Like a plasma ball, ball lightning may be nothing more than glowing gas formed by an electric field. Click to enlarge this image.
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A team of Australian scientists believe they have uncovered the cause of one of nature's most bizarre phenomenon - ball lightning.

Ball lightning, typically the size of a grapefruit, is a rarely seen event that lasts up to 20 seconds.

"Ball lightning has been reported by hundreds of people ... for hundreds of years and it has been a mystery," says CSIRO scientist John Lowke, lead author of a new study published in the Journal of Geophysical Research Atmospheres.

Previous theories have suggested microwave radiation, oxidizing aerosols, nuclear energy, dark matter, antimatter, and even black holes as possible causes. One recent theory suggests it is burning silicon that has been vaporized by a lightning strike.

To unravel the mystery Lowke and colleagues at the CSIRO and the Australian National University turned their attention to reports of ball lightning forming near windows.

"There are many observations of ball lightning appearing from a glass window either in a house (or) ... in the cockpit of an aircraft," Lowke says. "If it's burning silicon, how did it come in?"

After hitting the ground and lighting the sky, lightning strikes leave behind a trail of charged particles, or ions. In most cases, these positive and negative ions recombine in a split seconds, says Lowke. Any remaining ions travel down to the ground.

Lowke's theory, is that some of these ions can accumulate on the outside of non-conducting surfaces such as a window.

"These ions pile up and produce an electrical field which penetrates the glass," he says.

Lowke says the field gives free electrons on the inside of the window enough energy to knock off electrons from surrounding air molecules, as well as release photons, creating a glowing ball.

Recreating it in the lab

"This is the first paper which gives a mathematical solution explaining the birth or initiation of ball lighting," says Lowke.

He says the next step is to use the theory to replicate ball lightning in the laboratory. That may still prove difficult, as it would require equipment capable of producing 100 million volts.

But a ball lightning event seen by a former US Air Force pilot suggests another approach.

While flying a C-133A cargo plane from California to Hawaii in the mid-1960s, former Lieutenant Don Smith saw two horns of Saint Elmo's fire appear on the plane's randome (radar cover), followed by ball lightning inside the cockpit.

"It looked as if the airplane had bull's horns...they were glowing with the blue of electricity," says Lowke. "(It) was driven by ions from the aircraft radar operated at maximum power during a dense fog."