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Ball Lightning

One of atmospheric science's greatest enigmas, this elusive electrical phenomenon has confounded those seeking to observe it and has defied explanation for centuries. Reportedly occurring during intense thunderstorms, ball lightning appears as an amorphous, glowing, sphere-like shape, frequently with dendritic, lightning-like tendrils emanating from it. The central "ball," most commonly red, orange, or yellow, ranges in size from a few inches to more than 10 feet across. Witnesses have claimed that it hovers, slowly traverses the air, and can even pass through walls before vanishing after a few seconds—either by dissipation or through an explosion. Dismissed by scientists for decades as a physically impossible artifact of folklore, ball lightning has very little photographic documentation, yet it has inspired a hodgepodge of explanations over the years—some plausible, but many not. Its rarity and strangeness simply didn't inspire much serious research.

In February 2000, however, researchers John Abrahamson and James Dinniss of the Chemical and Process Engineering Department of New Zealand's University of Canterbury published an article in the science journal Nature entitled "Ball Lightning Caused by Oxidation of Nanoparticle Networks from Normal Lightning Strikes on Soil," in which the authors detail their hypothesis. Based on simulated lightning strikes on soil, they hypothesized that cloud-to-ground lightning strikes initiate a process whereby a "ball" of semi-cohesive networks of miniscule (nano-scale) particles, laden with chemical energy, rise into the air and then release that energy as light and heat—ball lightning—through a rather complex process culminating in oxidation. In 2006, Israeli scientists at Tel Aviv University, who were interested in ball lightning and intrigued by Abrahamson's and Dinniss's theory, attempted to simulate the phenomenon by discharging a lightning-like arc onto sheets of silicon oxide. As predicted by the New Zealanders' theory, the strike did indeed create ball lightning. Brazilian and American researchers then successfully repeated the experiment in successive years. But while it was able to be created in a carefully controlled environment, the phenomenon still hadn't been scientifically observed in nature, despite hundreds of years of anecdotal accounts.

A few years later, however, in 2012, Chinese researchers who were observing lightning strikes with a video camera and a spectrometer noticed something unusual during their research. After a powerful cloud-to-ground lightning strike, a

glowing ball, roughly five meters in diameter, rose from the strike point and traveled 15 meters before disappearing 1.6 seconds after emerging. Retrospectively, this was a "eureka" moment for the group of ad hoc ball lightning hunters. The spectrometer data would later reveal elements within the ball: calcium, iron, and silicon, identical to those found in the ground where the strike entered.

Ball lightning does exist, and science continues to unlock its secrets, but we still cannot explain it with complete confidence. For example, an article published in the Journal of Geophysical Research in 2102 by J. J. Lowke and coauthors argued that the Abrahamson–Dinniss theory doesn't explain ball lightning occurring inside of houses or airplane cockpits, as has been reported over decades. They proposed a second possible cause: atmospheric ions impinging and collecting on the inside surface of insulating glass windows. Much about ball lightning remains a mystery, and the phenomenon's secrets may remain hidden from science for decades or even centuries to come.

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