

BALL LIGHTNING: NEW PHYSICS, NEW ENERGY SOURCE, OR JUST ENTERTAINMENT?

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Ball lightning is a natural phenomenon characterized by a glowing ball of light that forms outside in the open air and inside closed rooms, aircraft, and submarines; floats along at about 1 m/s (even against the prevailing wind) or flies along side aircraft at hundreds of m/s; lasts 1 to 1000 seconds; passes through glass and metal with or without leaving a hole; does no great harm to people on contact or kills them promptly. Ball lightning can reportedly produce impressive artifacts; e.g. excavating ~ 200 tons of water saturated earth in less than 20 minutes. Since the effects of ball lightning vary considerably, the underlying physics may be very different for different events.

Although laboratory experiments have produced a glowing ball of light that lasts for as long as there is a source of electrical power and then decays within a half second, the underlying physics of naturally occurring ball lightning—including its source of energy—is not known. This presentation focuses on cases that leave measurable effects with no apparent connection to a power source.

Some effects are consistent with large induced currents. If these effects are caused by a radiating in the TEM mode, then the RF signatures should be observable by satellite and ground based sensors. Observations of long-lived RF bursts are indeed observed with satellite based systems. The following alternate explanations have been examined and found lacking: plasma instabilities, communication signals, radar signals, meteors, and malfunctioning electronics. These observations have not been tied to ball lightning observations. In addition, many and perhaps all of these emissions originated above the ionosphere--based on the lack of frequency chirping of lower frequency components passing through the ionosphere. If these RF bursts are caused by whatever causes ball lightning, then the phenomenon is not limited to the atmosphere and may be more fundamental than atmospheric discharges. The next step is to search for RF signals from ball lightning with a network of ground based sensors.

More generally, reported observations are compared to existing theories and a path forward to investigating this elusive phenomenon is proposed.