Ball Lightning: a Bubble of Electronic Plasma Oscillations

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We present a new theory that explains all characteristic properties of Ball Lightning (BL) in terms of standard physical principles. The basic idea is that free electrons can oscillate inside a relatively thin plasma membrane by responding to the electric field of the induced surface charges. These plasma oscillations are sustained by periodically attracting and incorporating charged particles that are present in the ambient air. BL can thus be viewed as a metastable excited state of atmospheric air. The plasma is only confined by electric forces and constitutes a highly remarkable parametric amplifier, similar to a beating heart.

This model explains the formation of BL with a log-normal distribution of its characteristic properties. It accounts for its relatively long life time and apparently exploring motions. BL has a specific surface tension that allows for elastic deformations, including the passage through key holes. We can also understand how it is able to pass through windowpanes and why it disappears either by violent explosion or silent extinction.