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# BALL LIGHTNING AS CAPILLARY PHENOMENON

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## ABSTRACT

In this article its author attempts to explain the nature of such phenomenon as ball lightning, using the idea on the surface reaction between “electronic liquid” and an electrical plus charge being on a small particle (seed).

**Keywords:** Ball, Lightning, Capillary, Phenomenon

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## 1. INTRODUCTION

What know us about the ball lightning (fireball)?

1) The fireballs are a very rare natural phenomenon of spherical or ellipsoidal in shape. They exist only for a short time and can explode in the end of its existence.
2) The ball lightning has a strong glow because emit intense electromagnetic waves – also in the visible part of the spectrum; the balls lightning can be of different colors.
3) As a rule, the fireballs are observed during severe thunderstorm but not only during it.

4) The balls lightning float in the earth's atmosphere.

5) Doing that, they can make hissing noises and give off a bad odor.

Up to today, there are no any theories satisfying to the all peculiarities of the fireballs represented (peculiarities) above by us. However almost the all authors of these theories consider that we deal with plasma in the case with the balls lightning containing electrons $e^-$ and plus charges $e^+$, let us say, conditional positrons (see, for example, Medvedev (1999). An ultrarelativistic plasma is examined there. Its annihilation generates electromagnetic radiation. Its intensity is defined, in particular, with the help of Bose-Einstein distribution. This intensity is proportional to the plasma temperature to the fourth power at that the velocity of the mass center of the system, as a whole, being equal to zero. Only plasma particles are in motion, by the way, with relativistic velocities. The dependence obtained by the author of Medvedev (1999) is full incorrect since the right side does not transform identically to its left side under the relativistic conditions. It should be also noted that the object studied in Medvedev (1999) is, in fact, a stable fireball. Evidently, when the density of electrons and positrons exceeds a certain limit, the stability will be broken, and an explosion will occur. However, from where may free positrons appear on our world during a severe thunderstorm?

Here I have to note the following. The insolvency of the work Medvedev (1999) was for the first time shown in my article Veitsman (2013).

There is the thunderstorm in atmosphere. Let us have in it the certain cluster of the free electrons and a small particle (some microns) containing on its surface and in pores a plus electrical charge. Let it be equivalent to sum charges of conditional positrons $n\overline{e^+}$. Let the cluster and the particle (in reality. a seed) meet in space. Then we obtain a certain spherical system where two processes have place: the transfer of the electrons to our small particle and the reaction of annihilation between electrons and conditional positrons. The first process can be represented in the following form:

$$[\rho_{e^-}]_{gas} \rightarrow [\rho_{e^-}]_{liquid} + Q\uparrow \tag{1}$$

where $[\rho_{e^-}]_{gas}$ and $[\rho_{e^-}]_{liquid}$ are the electron density respectively in the electronic gas and liquid in our system, i.e., we study a system containing electronic drop with interface and an electronic gas surrounding the drop; $Q\uparrow$ heat released upon the condensation of the electronic gas to the electronic liquid.

The second process will have a form:

$$e^- + \overline{e^+} \rightarrow 2h\nu\,, \tag{2}$$

where $e^-$ is electron; $\overline{e^+}$ conditional positron; $h$ Planck's constant; $\nu$ the frequency of the electromagnetic waves.

Process (1) is a "controlling process" in our system under study because it is going much more slowly than process (2). We should also note that the radiation of the sort (2) must be to scatter itself on the electrons being in the drop. Owen the processes (1) and (2), the temperature in system under study has to be very high.

Our system has an interesting peculiarity: it represents first of all a drop of "electronic liquid", and the all electrons have repulsion between them within the

drop. In this case, such drop can exist only when there are very much of the charges $\overline{e^+}$ in it, and the electrons come in the drop slowly. Besides surface tension in the system cannot be big.

In Veitsman (2002) was shown, drops and bubbles could not be in equilibrium at their increase, in another side, we know from the thermodynamics of the irreversible processes, that process will be stable, if it is near to the state of equilibrium. As known, the fireballs can be quite stable a while in its short life.

Now it is about the floating of the fireballs in the earth's atmosphere. This is quite natural process because the electron density in the fireball much less than the density of air. At that the radius of the fireball has to be enough big in order to Archimedes force can make possible the floating of our object in air.

The fireballs can hiss being in a stationery state. It may be explained by different causals, on which we know nothing today. However, we can here remember about the humming of high-voltage wires.

At last, it is about a bad odor (see above). Here all is understandably. There can be different substances in seeds; some of them (substances) can give off a bad odor at high temperatures.

The fireballs do not exist for a long time, however the time of its live can be much more than the existence time of the electrical discharge during thunderstorm in atmosphere. This discharge is a chaos. The fireball can be in the stationery existence only near equilibrium state and as the chaos – in the end of its life. The fireball is some a kind of compressed spring – electrons are compressed in it (fire-ball) owing to the attractive forces between electrons and conditional positrons. If the positrons have been spent, "the spring" is unclenched, and the potential energy of the compression is released. As a result, explosion! However, it can be different – as with electrical discharged at severe thunderstorm. Now the fireball discharges struck in a grounded object, and again the explosion.

## 2. CONCLUSIONS

The fireball is a rarely seen natural object. Its appearance is due to a combination of a number of unlikely factors. In particular, they are the process of the electrons and conditional positrons annihilation and the process of the electron diffusion to the annihilation place. This place is a surface of a seed and pores in it, therefore the theory of the fireball has direct relation to capillarity.

## CONFLICT OF INTERESTS

None.

## ACKNOWLEDGMENTS

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