

The effect of anomalous passing of ball lightning through absorbing filters

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The ball lightning as a long-living self-sustained object with minimal values of induction of magnetic field in its centre presents an exclusive interest for solving a number of problems including a problem of nuclear fusion [1]. The ball lightning has also an ability to penetrate through window panes and metal. Sometimes they were even observed on board of the airplane. The appearance of the ball lightning in the airplane is dangerous, because it can cause a short circuit and hence lead to crash of the airplane. Several attempts have been made to explain high penetrating ability of the ball lightning. A general view of the experimental region for investigation of ball lightning is shown in Fig.1 (a) and a scheme of the experiments is given in Fig.1 (c). The electrotechnical parameters of “Prometheus” installations, typical wave fronts of voltage and current in discharge cell (domaintron), the probe potential and the current in collector circuit are given in [1,2]. In experiments were used absorbing filters from glass, organic glass, textolite, aluminium, steel and plumbum. The region of passage of ball lightning is wittingly overlapped by means of absorbing filters. The absorbing filters were square-shaped with a side of 1 meter. In all cases the luminosity intensity of ball lightning that passed through the absorbing filter was significantly lower than the luminosity intensity of the

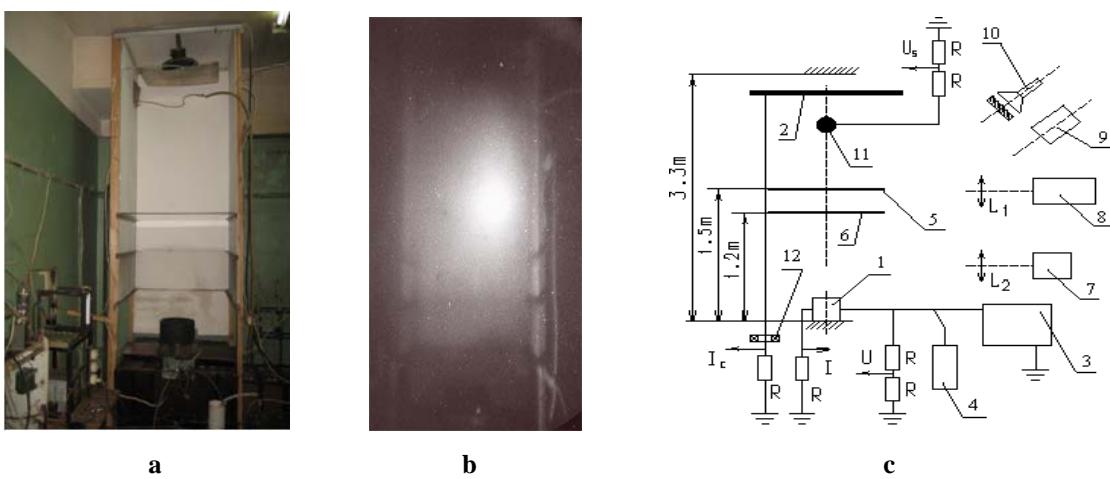


Fig.1.General view of the experimental region for generation of the ball lightning – (a); an image of the ball lightning on the installation “Prometheus-2” in the absence of the absorbing filters – (b) and the scheme of experiments - (c). Designations: 1-discharge cell (domaintron); 2- collector under the lab ceiling; 3-main storage condenser; 4-start unit; 5, 6-absorbing filters; 7- electron-optical converter; 8-electron-optical camera; 9- X-rays detector; 10- detector of microwave radiation ; 11-potential probe; 12- Rogowski loop; L-lense.

ball lightning, which was approaching to the absorbing filter. When the ball lightning enters in the absorbing filter the half-sphere is visually observed above it. Maximum of the luminosity is located in the region, which is corresponding to an external spherical layer. With increasing thickness of the absorbing filter the intensity of luminosity reduces and at some thickness in the area over the absorbing filter are seen only an aura. Passage of a ball lightning through an absorbing filter of 2 mm thick from aluminium allows to suggest that the maximum energy of electrons in the external spherical layer is 350 keV. It should be noted also that ability of passing through the metal does not allow to use the method of absorbers for correct determination of energy particles of ball lightning. In reality the energy of particles in a ball lightning is much larger than 350 keV. There are reasons to assume that inside the region with surplus positive charge there is a circular current of relativistic electrons with a high value of amplitude. The charge particles which are located in the equatorial part of the external spherical layer have the maximal angular velocity. Author supposed that electron current in the spherical external layer considerably exceeds the ion current and generates a poloidal magnetic field. With increase of a thickness of an absorbing filter the intensity of a luminosity of a passing ball lightning decreases. At some value of a thickness of an absorbing filter it was found, that aura above an absorbing filter completely disappears. A dark spherical formation (DSF) has been discovered under the ceiling in the experiments with very thick absorbing filter (60 mm polyethylene or 4 mm carbon steel sheet). A dark formation has been clearly seen through a blue filter. The diameter of this formation was approximately equal to the diameter of the ball lightning in the absence of absorbing filter. Dark spherical formations, which are observed under the ceiling for a very short period, do not have luminosity. The usage of the electron-optical converter is useless.

For phenomenon of anomalous passage of ball lightning through the metallic absorbing filter can be given the next explanation. A ball lightning has its own poloidal magnetic field. When approaching of ball lightning the magnetic field begin to penetrate into absorbing filter. The vortex electromagnetic fields of the ball lightning entering in the absorbing filter promotes the appearance of the outgoing ball lightning. Following by Maxwell equation ($\partial \vec{H} / \partial t = -\text{rot} \vec{E}$) time-varying magnetic field generates a vortex electric field in the area above the absorbing filter. There is also reason to believe that the intensity of electric field is sufficient to ionize the air above the absorbing filter. Ionization is carried out by means of a strong electric field. The measurements of the applied voltage to the domaintron (discharge cell) in pulse mode revealed that the measured value is approximately four times higher than the charging voltage

($U_{ap} = 50$ kV) of the capacitive storage [2]. This effect can only be explained by the presence of a strong electric field inside the region of the ball lightning origin. The region in which the ball lightning arises can be treated as an element of the electric circuit and the main voltage drop occurs in this region. The average value of electric field intensity inside of the ball lightning can be found by dividing the measured value of voltage $U = 230$ kV on radius of ball lightning $- R = 10$ cm. This value is equal to $2.3 \cdot 10^4$ V/cm and it is sufficient for ionization of neutral atoms in air by means of a strong electric field. A strong electric field creates a spherical halo outside of the ball lightnings, which are observed in the Nature. The existence of strong field related with the large-scale charge separation in a plasma. A process of charge separation occurs also in this region because of diffusion of charge particles crosswise the non-uniform magnetic field. The electrons in a process of diffusion move towards the region with weaker magnetic field faster than ions which are produced by these electrons in the region of existing electric field. The electrons and ions rotate by azimuth and create above the absorbing filter a so-called passing ball lightning, which is observed in experiments. At certain value of thickness of the absorbing filter the hard quants are practically absent in the bremsstrahlung spectrum. It is connected with a decrease of the electron output due to the hardening of a spectrum. At some value of the product of the total absorption coefficient of radiation $\mu(E)$ and thickness of absorbing filters d the luminosity of ball lightning above an absorbing filter completely disappears and leaves only a dark spherical formation. The dark spherical formation was observed under ceiling even when several sheets of steel and aluminum with a thickness of 1 to 4 mm were used as absorbing filters. A sheet of plumbum 1 cm thick and the plumbum blocks BS-50 was placed from above on the sheets of steel and aluminum (see Fig.2 (b)). The thickness of blocks BS-50 was equal to 5 cm. It is obvious that the electromagnetic field can not penetrate through thick absorbing filter such as plumbum 6 cm thick. With help of existing representations these results can not be explained. In the experiment on the interaction of ball lightning with an absorbing filter installed at an angle it was found not only a ball lightning, which deflected from absorbing filter, but also the dark spherical formation behind the absorbing filter - Fig.2 (c). If crosswise the direction of motion of the dark spherical formation is installed a sheet of metal so that it has rotational and vibrational degrees of freedom, i.e. hang it in one point, then the interaction of DSF with a sheet leads to oscillation of this sheet. This means that the particles from which consist DSF possess the impulse, i.e. they have not only speed but also mass. The presence of particles that have mass and also possess an exclusively high-penetration ability gives a reason to believe that

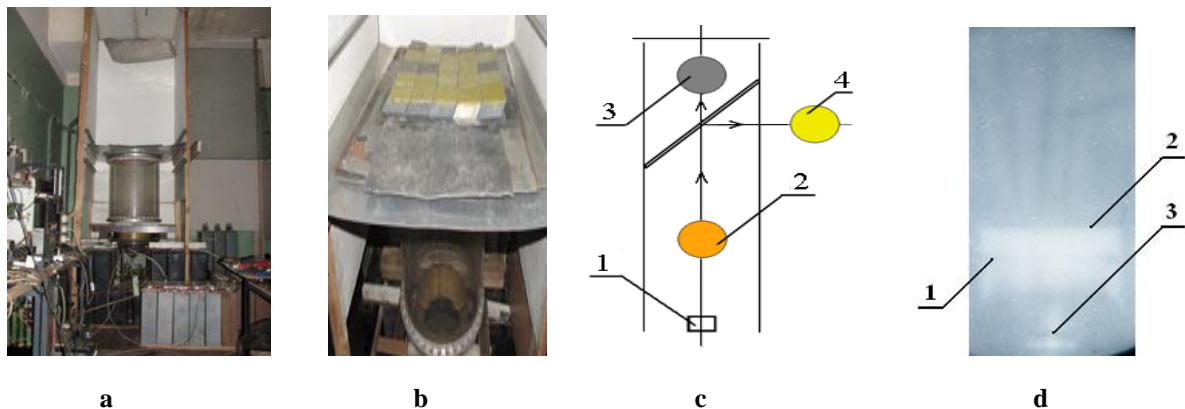


Fig. 2. The experimental region with chamber from plexiglass – (a); absorbing filters including blocs BS-50 on the top of chamber – (b); the scheme of experiment on interaction of a ball lightning with absorbing filters which was installed under angle – (c) and integral image of area discharge at presence a two absorbing filters: sheet of glass thick 4 mm and sheet of aluminium with thick 2 mm – (d). Designations in (c): 1- discharge cell (domaintron); 2- ball lightning in an area of its origin; 3-dark spherical formation: 4-ball lightning which deflected from filter. Designations in (d): 1- absorbing filter from glass; 2 - absorbing filter from aluminium; 3- discharge cell . the dark spherical formation probably consists from the neutrino – neutrino of eighth type. This means that during the interaction of the ball lightning with thick absorbing filter a process of particles generation with high penetration ability takes place. Hydrogen, which is required for protons, there is always in the air due to its finite humidity. The existence of protons also is caused by presence of hydrocarbonic radical groups in the constructional elements of a discharge cell. The energy of protons in a ball lightning is sufficient for generation of neutrino. It should be noted that the orientation of the electric field intensity and poloidal magnetic field intensity in the ball lightning are the same as in an accelerator of cyclotron type. Generation of neutrinos occurs at interaction of high-energy protons with absorbing filter. Existence of a weak luminosity (see Fig. 2 (d)) takes place due to the interaction of intense neutrino flux with molecules and atoms of air. It is possible only at very high density of neutrinos of eighth type which are in experiment. Probably, the particles from which consists the dark spherical formation are the fundamental particles from which the substance in the Universe consists [2]. P.L. Kapitza suggested that the ball lightning is "a window to the other world". The final results can be obtained only after the measurements of the neutrino flux.

References

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