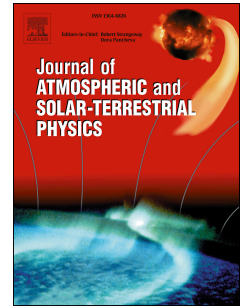


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Analysis of the unique case of ball lightning observation in Mitino, the northwest district of Moscow

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ABSTRACT

Observations of eyewitnesses are the main source of data on ball lightning (BL) properties, but often their descriptions turn out to be incomplete, contradictory and lacking in details. Recently due to the wide use of digital camcorders, still cameras and smart-phones the appearance of a large number of video films enable to study the properties of these objects in more detail. However, even the film caught by the lone observer doesn't allow measuring such the important properties as the dimension of the object and the distance to it. On 27 July 2015 the unique event occurred: BL was simultaneously recorded by three observers located at different points. This allowed us to determine a distance to BL, its diameter (0.75 m) and velocity of its motion at various moments of time. BL movement could be broken into three stages. At first it was approaching to the observers with a velocity of the wind. Then for about 80 s it was moving at a height 40-50 m inside a restricted region with a width 12 m and a length 100 m. At the last stage it rose with a velocity 5.7 m/s to the approaching cloud and flew away with a velocity of the wind 15 m/s. The analysis has shown that such a character of BL motion can be explained if to assume that BL has a positive electric charge ($Q_{bl}=10^{-3}$ C) and its attraction to the storm cloud ($Q_c=5$ C) compensates the wind pressure on BL. Stabilization of BL position at a height 40 m can be explained by variations of electric field intensity above the treetops, by instabilities of wind direction or by BL rotation around a horizontal axis with a linear velocity 0.84 m/s. Evaluations showed that the nearby electricity line did not affect BL motion. The details of BL behavior may serve as an evidence for its material nature.

Keywords:

Ball lightning, Video recording, Parameters determination, Features explanation

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1. Ball lightning observation in Mitino

Thanks to F. Arago's paper (1838) ball lightning investigations acquired a status of a real science problem. Basic data on BL properties are obtained from the evidences of the eyewitnesses of this phenomenon. These data one can find in various monographs and papers (Brand, 1923; Barry, 1980; Bychkov et al., 2010; Bychkov and Nikitin, 2014; Egely, 1993; Grigor'ev, 2006; Imiyantov and Tikhyi, 1980; Nikitin et al., 2014b; Singer, 1971; Stakhanov, 1996; Smirnov, 1988; Stenhoff,

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