3D-reconstruction of high-voltage discharge channel using multiangle shooting

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Registration of pulsed discharges in long air gaps shows their complicated structure [1-4]. Turns, breaks, branchings of a leader channel and relatively weak “suspended” branches are observed (fig. 1). These peculiarities correspond to leader steps.



Fig. 1. Integral shooting of atmospheric discharge.

Simultaneous integral shooting of discharge from several azimuthally spaced aspects are carried out. Shooting of discharge in different time points, relative to field rise time, realized by means of forced “switching-off” of electric field in the gap.

Reconstruction of three-dimensional shape of discharge channel by images from several views is of interest for analysis of discharge current configurations. Thereto cloud photogrammetry method is used. Processing techniques of low-textured not simply connected object images are considered.

Though axial symmetry of electrode system, observed discharge shape is definitely of three-dimensional nature. Trajectory of leader growth only in rough way follows the external field axis. Primary channel once has local knot-like peculiarities. Single branchings of primary channel are directed not only in the line of leader but also oppositely directed.

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References

1. Gorin B. N., Karpov M.A. et al. Engineering and testing of electron-optical cameras with brightness amplification for lightning and long spark research, Proc. of Fifth Russian conference on atmospheric electricity, Vladimir, Russia, 2003, v. 1, p. 263.
2. Lebedev V.B., Feldman G.G. et al. Features of Application of Image Converter Cameras for Research on Lightning and Discharges in Long Air Gaps. SPIE, V. 5580, 2005, p. 887.
3. A.V. Oginov, E.V. Oreshkin, K.V. Shpakov, S.A. Chaikovsky, Research of initial phase of long spark discharge evolution on ERG installation, Book of Abstracts of XXXVIII International Conference on Plasma Physics and CF, February 14 – 18, 2011, Zvenigorod, p. 226.
4. A. V. Agafonov, A. V. Bagulya, O. D. Dalkarov et al. Observation of Neutron Bursts Produced by Laboratory High-Voltage Atmospheric Discharge, Phys. Rev. Lett., 111, 115003 (2013).