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E1-508: Optical signatures of electrical breakdown trajectories in air

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Optical signatures of electrical breakdown trajectories in air were investigated by utilizing image processing techniques on a set of photographic images. The experimental technique consisted of capturing the photographic images of impulse flashover trajectories between a rod and a plane electrode. Three cameras focused on the spark gap were triggered simultaneously to obtain the images of the sparks in 3D.

The light intensity variation across the discharge channels shows that the intensity profiles follow a Gaussian distribution with a standard deviation of about 1.1 mm (2.7 pixels in scale where a 500 mm spark corresponds to 1200 pixels). The light intensity along the channel remains a constant (225 ± 6) up to the point where branches appear. The intensity of the light in the main channel drops when the branches appear (due to the channel current split between two or more channels) and remains constant at a slightly lower value. The intensity drop does not show a linear relationship with the number of branches. This feature can be used extensively in remote sensing and characterization of lightning channels.

A weak correlation was seen between the peak intensities measured by different cameras looking at the same spark which can be attributed to the irregular variation across the plane of the cameras which may shadow the true intensity variation in the channel. No clear dependency of the light intensity on the depth of the channel was seen. This supports the idea of using stereo images in extracting the depth of natural lightning channels.

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