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Fourier analysis of high-frequency current oscillations measured in high-voltage electrical discharge experiments in the laboratory

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Terrestrial Gamma-Ray Flashes (TGFs) were discovered in the early 90s, and are the earth's atmosphere most energetic natural phenomena. TGFs occur in connection with lightning. Some parts of the connection are still unclear. There is no reason to believe that not all lightning produce TGFs.

High-energy radiation also occurs when producing long laboratory sparks. The applied electric potential in the laboratory experiments compared to natural lightning is much lower, but it still enables us to study the time-lapse of events occurring on a nanosecond scale. We are able to study some of the processes relevant for TGF production.

In this presentation, I will study the phenomena of x-ray emissions that originate from long laboratory sparks. The first dataset I will analyze are produced from experiments of high-voltage electrical discharges in a laboratory at Eindhoven University of Technology in 2013.

In the dataset, some high-frequency ($\sim$108MHz) oscillations occur in the high-voltage electrode current, on a microsecond scale before the discharge. These oscillations have previously been noticed, but not investigated.

Preliminary results indicate that the onset of the current in the grounded electrode seem to frequently start with high-frequency oscillations. The timing of these anode current oscillations seems often to coincide well with the timing of measured x-rays. Further investigations on this relationship will be done, with both respect to timing and power.

I will investigate these current oscillations by performing a Fourier analysis, and plot spectrograms for visual presentation of the nanosecond scale oscillations. These results will be compared to both timing and energy of the measured x-rays.