

Propagation and R.F. Emission Patterns of Lightning Leaders as Observed by the LOFAR Radio Telescope

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LOFAR (LOW Frequency ARray) is a radio telescope that consists of a large number of dual-polarized antennas spread over the northern Netherlands and beyond. The LOFAR for Lightning Imaging project (LOFAR-LIM) has successfully used LOFAR to map out lightning in the Netherlands. Since LOFAR covers a large frequency range (10-90 MHz), has antennas spread over a large area, and saves the raw trace data from the antennas, LOFAR-LIM can combine all the strongest aspects of both lightning mapping arrays and lightning interferometers. These aspects include a nanosecond resolution between pulses, nanosecond timing accuracy, and an ability to map lightning in all 3 spatial dimensions and time. LOFAR should be able to map out overhead lightning with a spatial accuracy on the order of meters.

We will present an intra-cloud flash and a cloud-to-ground flash that have been mapped using a new 3-dimensional interferometric technique. These maps contain enough detail that fast processes, such as recoil leaders and even return strokes, can be mapped in full 3 dimensions. We will also show intensity and polarization footprints of RF pulses received from stepped leaders and discuss the implications for the propagation physics of stepped leaders.

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