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Meter-scale Measurements of VHF structure of natural leader streamers

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We will present maps of negative leaders imaged in the 30-80 MHz band by the LOFAR radio telescope, which is a distributed radio telescope in the Northern Netherlands that can map lightning with meter length and nanosecond timing accuracy. These VHF images show that negative leaders emit bursts of VHF that are about 1-3 μs in duration, most likely in relation to leader stepping. The median time between bursts is around 40 μs, and the median distance is about 7.5 m. Each of these bursts contains around 3-10 discrete VHF pulses. 2/3 of these pulses are consistent with coming from the same location (with 1 meter location accuracy), and the other 1/3 come from up to 3 m away. These data are consistent with the hypothesis that these VHF bursts are due to corona flashes during leader stepping, that the discrete pulses we locate are due to the few very strongest streamers in the corona flash, and the majority of streamers in a corona flash are too weak to be observed as discrete VHF pulses. From these data, we estimate that the strongest streamers in a natural corona flash emit about 4×10^{-6} J in our 30-80 MHz band.

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