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## Observations by the LOFAR radio telescope of a fast negative leader propagation mode

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We report on recent observations made by the LOFAR radio-telescope of a fast propagation mode in negative leaders we named Rapid Negative Leader (RNL).

The RNL has a variety of properties that make them clearly distinct from negative leaders or dart leaders, such as -- fast propagation, -- emission of strong broad-band pulses, -- emission of very high VHF power, -- a reduced density of located sources, and -- terminating with the spawning of a large number of negative leaders in a small area. RNLs are almost always observed in the initial stage of a lightning flash, but may also occur much later. They may occur repeatedly in a certain part of the cloud.

We interpret a RNL as negative leader developing in strong electric field due to a relatively small highly-charged cloud, probably created by a local turbulence, with a typical size of order 5 km<sup>2</sup>. The strong field will lead to a larger than usual charge at the leader tip resulting in an increased propagation velocity as well as a strongly enhanced emission of VHF power.

Since for the initiation of a lightning flash strong ambient electric fields are required, it is thus no surprise that the initial leader is in fact a RNL.

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