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Understanding the Lightning Leader¹

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Before the flash and the bang that lay-people think of as lightning, it is necessary to break down a channel of air several kilometers long through what is known as the leader process. We have been studying the growth of lightning leaders for nearly a decade through a combination of balloon-borne electric field measurements on balloons and on the ground, time of arrival radio-measurements, and high-speed video cameras. Our combination of techniques can penetrate clouds and shows the development of both positive and negative leader channels growing at about 0.001c and carrying net-charge around the sky as they try to minimize electrostatic energy. Recent analysis has revealed the existence of step-recoil waves that propagate away from the tip of a growing leader as well as K-changes that propagate toward the leader tip. These waves probably help keep the leader hot and conductive enough to allow it to persist over the several hundred milliseconds it needs to reach ground.

In collaboration with William Winn, Ken Eack, Jeff LaPierre, New Mexico Tech, Langmuir Lab; William Hager, University of Florida; and Gaopeng Lu, Duke University, ECE Dept.

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