

# Megavolt discharges triggered and guided with laser filaments

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**Abstract:** Long ionized channels appear as a result of nonlinear propagation of femtosecond terawatt pulses. We demonstrate the ability of such filament bundles to trigger and guide megavolt discharges across a gap up to 3.8 m.

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Filaments are self-guiding structures due to the dynamic balance between Kerr self-focusing and plasma-induced defocusing. The Teramobile project, supported by the French CNRS and the German DFG has been launched in 1999 to study the filamentation propagation and to develop applications in the atmosphere, by using this worldwide unique mobile multi-terawatt laser [1]. One of the main applications is lightning control. In this respect, we investigated the triggering and guiding of high voltage discharges, which is the first step towards atmospheric scale experiments. Unlike previous experiments, where discharges were triggered by a plasma focus, we used for the first time long conducting filaments. This opens new perspectives in lightning control. Triggering and guiding have been observed over a gap up to 3.8 m in air [2]. We show that aiming the laser beam in the vicinity of the two electrodes allows to ohmically bridge the electrodes, which results in (i) a reduced breakdown threshold to 68% of the value for natural discharges, (ii) a straight guided discharge path, and (iii) an increasing streamer propagation velocity of a factor 3 (Fig.1). In order to extend the plasma lifetime, we are investigating the use of a multi-pulse scheme [3] to reduce electron loss and extend the guided length. Connected to this problematic is triggering discharges in the leader mode [4], which better simulates actual lightning processes.

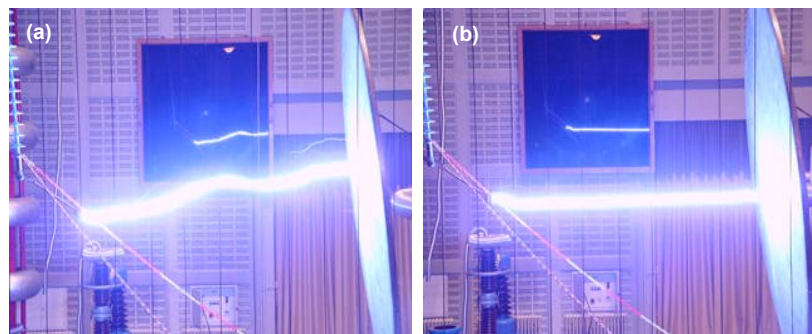


Fig. 1. (a) unguided discharge, (b) guided discharge.

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