Atelier
« Modèles et méthodes mathématiques en filamentation laser »
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Workshop
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Experimental characterization of single filaments; providing realistic parameters for numerical simulations

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The highly nonlinear phenomena associated with filamentation of ultrashort pulses make them a difficult topic of study. The elaborate models that have been constructed depend on the exact value of molecular and atomic parameters. we are attempting to measure these parameters in the filaments themselves. One approach that we have taken is to study the spectrum and the polarization evolution of the propagating ultrashort pulse in the filament. In a collaboration between the University of New Mexico, the University of Wisconsin and the Air Force Research laboratory, we capture in a movie the propagation of the light bullet within the filament, followed by the fluorescence of the various excited ions and molecules. Simultaneous visualization in four dimensions: two spatial, time and wavelength, is obtained by using a large number (> 1300) of synchronized streak camera frames. The slit of the streak camera selects the real image of a cross section of the filament. The light is relayed by two large mirrors, one of which is rotated. Images are continuously captured while the field of view is scanned along the filament by rotating a relay mirror, at a slow enough rate to ensure continuity in the propagation dimension. Filters are used to select a wavelength of observation. This technique promises to provide valuable information on the dynamics of molecular ionization, recombination, and de-excitation in the wake of the filamented pulse. It applies as well to plasma, and filament induced high voltage discharges.

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