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Supercontinuum Generation and Polarization as Probes of Laser Filamentation Dynamics

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In laser filamentation, the microscopic dynamics of ionization and dipole excitation result in macroscopic reshaping of the spatial, temporal and spectral properties of the propagating laser pulse. Therefore, the properties of the laser pulse after filamentation can provide a sensitive probe of the rich interaction dynamics which enable laser propagation as a filament. In this talk, I will present measurements of the supercontinuum spectrum and polarization state of the light emitted from a laser filament with elliptical input polarization. We observe anomalous spectral broadening and polarization rotation for particular values of the input laser ellipticity, which are present only for molecular gases. The results demonstrate the strong interplay between polarization and supercontinuum generation in filamentation, and call for accurate modeling of the nonlinear susceptibility and ionization of molecular gases. Furthermore, I will discuss the progress of current investigations into the dynamics of filamentation in the few-optical-cycle regime, enabled by the development of new high-energy and high-repetition rate laser sources based on Optical Parametric Chirped Pulse Amplification (OPCPA).