ANNUAL PROGRESS SUMMARY

To: technicalreports@afosr.af.mil  
Subject: Annual Progress Statement to Dr. Arje Nachman

Contract/Grant Title: Mathematical Modeling and Experimental Validation of Ultrafast Nonlinear Light-Matter Coupling Associated with Filamentation in Transparent Media  
Contract/Grant #: FA9550-10-1-0561  
Reporting Period: September 30, 2013 to September 29, 2014

Annual accomplishments (200 words max):

The MURI project theory/simulation accomplishments for the past year include: further improvement of a semi-analytic “adiabatic” intense field quantum photoionization model that yields quantitative agreement with compute intensive 3D quantum Schroedinger simulations, extension of the quantum many-body problem to simultaneously include intense field photoionization coupled with electron-electron, electron-ion and electron-neutral scattering, extension of the many-body theory to study THz absorption/emission of the nonequilibrium electron/ion system, a first prediction of zeptosecond waveform generation via high harmonic generation of mid-IR 9µm intense pulses and asymptotic analysis of weakly nonlinear Bessel-like beams with extension of their linear counterparts to study the influence of a turbulent atmosphere and the first simulation of superintense mid-IR multi-TW self-guided light bullet. Experimental accomplishments include the demonstration of a Bessel dressed beam experiment whereby the filaments length was extended tenfold, fabrication of vortex beam phase plates written in silica capable of withstanding multi mJ pulses and a first demonstration of such multi-TW vortex beam propagation at AFRL, a novel scheme utilizing our “dressing” beam concept to generate intense on-axis Raman emission over extended paths, verification of ionization assisted nonlinear saturation and unprecedented conversion efficiency was demonstrated in HHG experiments in the UV.

Archival publications (published) during reporting period:


Changes in research objectives, if any: None

Changes in AFOSR program manager, if any: None

Extensions granted or milestones slipped, if any: None
Include any new discoveries, inventions or patent disclosures during this reporting period (if none, report none):