Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Mapping Rotational Wavepacket Dynamics with Chirped Probe Pulses[1] DMITRI ROMANOV, JOHANAN ODHNER, ROBERT LEVIS, Temple Univ — We develop an analytical model description of the strong-field pump-probe polarization spectroscopy of rotational transients in molecular gases in a situation when the probe pulse is considerably chirped: the frequency modulation over the pulse duration is comparable with the carrier frequency. In this scenario, a femtosecond pump laser pulse prepares a rotational wavepacket in a gas-phase sample at room temperature. The rotational revivals of the wavepacket are then mapped onto a chirped broadband probe pulse derived from a laser filament. The slow-varying envelope approximation being inapplicable, an alternative approach is proposed which is capable of incorporating the substantial chirp and the related temporal dispersion of refractive indices. Analytical expressions are obtained for the probe signal modulation over the interaction region and for the resulting heterodyned transient birefringence spectra. Dependencies of the outputs on the probe pulse parameters reveal the trade-offs and the ways to optimize the temporal-spectral imaging. The results are in good agreement with the experiments on snapshot imaging of rotational revival patterns in nitrogen gas.

[1]We gratefully acknowledge financial support through AFOSR MURI Grant No. FA9550-10-1-0561

Dmitri Romanov
Temple Univ

Date submitted: 31 Jan 2014 Electronic form version 1.4