P-AMP03 : Temperature Determination in Flames by Different Optical Techniques: Comparison of Simulation Data, Linear and Nonlinear Molecular Spectroscopy

M. Faleschini[1], K. Iskra[1], T. Neger[1]

[1] Inst. f. Experimentalphysik, TU Graz

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In principle, reduction of degenerate four-wave mixing spectra of diatomic molecules to relative populations and rotational temperatures can be performed assuming a quadratic dependence of the relative line strength on particle density in the rotational state excited by the laser field. However, several other effects like saturation, line coupling or collisional quenching affect the signal, complicated even more by the occurrence of other grating contributions. At atmospheric pressure and above, separation of signal contributions from nonlinear polarization, thermal and electrostrictive gratings have to be performed to gain information about temperature and relative particle density. Separation of resonant and nonresonant signals in DFWM spectra has been performed by using crossed polarization setups of the grating-forming lasers. To validate temperature data extracted from DFWM and fluorescence spectra a comparison with linear absorption and flame simulation data was performed.

P-AMP04 : Combustion Diagnostics and Gas Phase Measurements by Laser-Induced Grating Spectroscopy

K. Iskra[1], M. Faleschini[1], T. Neger[1]

[1] Inst. f. Experimentalphysik, TU Graz

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Although somehow more complex in experimental effort and data evaluation nonlinear optical spectroscopic techniques like CARS or DFWM are widely used for diagnostic purposes in hostile environments like plasmas or flames. In degenerate four-wave mixing experiments, the signal is generated by stimulated emission of coherent excited species. But in typical combustion processes, high pressure and temperature affect the signal by collisional quenching or electrostriction, blurring the spectra by strong nonresonant contributions. This adverse effects however give rise to secondary gratings which can be used for determination of bulk gas properties by means of coherent optical detection. Time resolved detection and signal analysis of thermal and electrostrictive grating dynamics allows simple gas phase measurements of transport, thermodynamic and hydrodynamic properties. Sensitive detection of minor species unaffected by nonresonant conributions can be obtained using polarization seperation of pump and probe beams and low laser intensities. DFWM spectra recorded in crossed polarized setups far from saturation have to be corrected for intensity scaling and rotational quantum number progression.

P-AMP05 : Ignition parameters and early flame kernel development of laser-ignited combustible gas mixtures.

H. Kopecek[1], E. Wintner[1], D. Rüdisser[2], K. Iskra[2], T. Neger[2]

[1] Inst. f. Photonik, TU Wien, [2] Inst. f. Experimentalphysik, TU Graz

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Laser induced breakdown of focused pulsed laser radiation, the subsequent plasma formation and thermalisation offers a possibility of ignition of combustible gas mixtures free from electrode interferences, an arbitrary choice of the location within the medium and exact timing regardless of the degree of turbulence. The development and the decreasing costs of solid state laser technologies approach the pay-off for the higher complexity of such an ignition system due to several features unique to laser ignition. The feasability of laser ignition was demonstrated in an 1.5 MW(?) natural gas engine, and several investigations were performed to determine optimal ignition energies, focus shapes and laser wavelengths. The early flame kernel development was investigated by time resolved planar laser induced fluorescence of the OH-radical which occurs predominantly in the flame front. The flame front propagation showed typical features like toroidal initial flame development, flame front return and highly increased flame speed along the laser focus axis.

P-AMP06 **: Application of CEP controlled few cycle pulses to ATI and subsequent rescattering processes**

M. Lezius[1], V. Grill[1], K. O'Keefe[2], F. Krausz[2]

[1] Inst. f. Ionenphysik, Univ. Innsbruck, [2] Inst. f. Photonik, TU Wien

A new experimental set-up for the investigation of above threshold ionization (ATI) of atoms and molecules is reported. Few cycle laser pulses are produced after focussing of about 10 fs laser pulses into a glass capillary to produce a spectral broadening that exceeds one octave. After recompression with TFI-mirrors a laser pulse duration below 5 fs can be obtained. To retrieve information about the carrier envelope phase, part of the infrared spectrum is frequency doubled and interfered with the remaining blue part of the spectrum. The interference spectrum is evaluated online with a CCD camera and a fast PC at 1 kHz repetition rate. The few-cycle laser pulse is additionally focussed into the center of a fast photoion-photoelectron coincidence spectrometer. This way above threshold ionization (ATI) photoelectron spectra are correlated with the respective ion charge and the carrier-envelope phase (CEP). Our set-up is dedicated to the absolute measurement of the CEP and the application of few-cycle laser pulses to achieve attosecond control over the trajectories of ATI-liberated electrons. This work was supported by the FWF Austria (Project P14447)
