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Femtosecond laser filamentation for atmospheric sensing

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Filamentation of femtosecond laser pulses propagating in air has been extensively investigated in recent years. The dynamic balance between Kerr self-focusing and defocusing in air clamps the laser intensity to about 5×10^{13} W/cm^2 (intensity clamping) in the focal spot when the 800 nm laser pulses are employed and leaves a long weak plasma column in the laser propagation path, a so-called filament. This high clamped intensity inside the filament core can induce in all matters in the path of filaments fragmentation, resulting in characteristic optical emissions from the excited fragments. In this talk, we will present filament-induced nonlinear spectroscopy and introduce its application in the field of atmospheric sensing. We will first focus on the feasibility of remote sensing of pollutants by demonstrating 'clean' spectra from various targets ranging from gases, aerosols to solids, which could be used for identifying various substances including chemical and biological species in the atmosphere. Subsequently, we will show the techniques for improving signal-to noise ratios of filament-induced nonlinear spectroscopy, especially with the methods of ASE and seed amplification initiated by femtosecond laser filamentation in air. Finally, the mechanisms of fluorescence as well as the seed amplification induced by femtosecond filament excitation in air are presented.

Biography

Huailiang Xu received his Ph.D. from Lund University, Sweden in 2004. He then worked as a postdoctoral researcher at Laval University, Canada. In January 2008, he became an Assistant Professor at The University of Tokyo, Japan. Since September 2009, he has been a full Professor at Jilin University, China. He has published more than 85 papers in reputed journals and three Springer book chapters.

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