Columbia University Optics and Quantum Electronics Seminar

"Laser Filament Based Water Vapour Condensation"

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Date/Time: Wednesday, October 3d, 11 – 12 noon

Location: 703 NWC

Abstract: Laser filaments are self-sustained light structures of typically 100 μm diameter and up to hundreds of meters in length, widely extending the traditional linear diffraction limit[1]. They stem from the dynamic balance between Kerr self-focusing and defocusing by the self-generated plasma and/or negative higher-order Kerr terms[2]. Based on field experiments in various atmospheric conditions, we show that laser filaments can induce water condensation and fast droplet growth up to several μm in diameter in the atmosphere[3] as soon as the relative humidity (RH) exceeds 70%. This effect mainly relies on photochemical mechanisms allowing efficient binary H_2O–HNO_3 condensation[4]. Thermodynamic as well as kinetic numerical modelling based on this scenario semi-quantitatively reproduces the experimental results, supporting this interpretation. Recent experiments at the 100 TW level, performed at the Forschungs Zentrum Dresden Rossendorf, indicate that the aerosol production scales highly non-linearly (~ I^5) with laser power[5]. These experiments may open new perspectives for real scale applications.

Bio: He is a Professor in Physics at the University Geneva, where he has been a faculty member since 2005. J.P. Wolf was a Professor in Physics at the University Lyon between 1993 and 2005. He was also a visiting Professor at Yale University (Applied Physics) between 1999 and 2000. His research and teaching are focused on high power lasers, non-linear propagation, atmospheric physics and sensing, ultrafast phenomena, quantum control and femtosecond spectroscopy, biophotonics, nanophotonics, imaging.

Hosted by Prof. Tony Heinz• For further information: call 212 854 6564