

STAVROS NIARCHOS FOUNDATION – FORTH SEMINAR SERIES

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16:00 – 17:00

A. Payatakes Seminar Room

" Intense THz sources: upscaling the power "

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Abstract

The terahertz (THz) frequency range is one of the most interesting regions of the electromagnetic spectrum and lies between the far-infrared and the microwave region, in a frequency interval from 0.1 THz to 30 THz. Historically, this part of the spectrum was known as the "THz gap" due to the lack of coherent sources in this frequency range. Nevertheless, during the last two decades numerous works have been done on coherent sources, making it possible to access the THz frequency region of the electromagnetic spectrum and reveal its unique properties. Despite this rapid development, the power of available THz sources remains rather low, limiting the interactions of THz radiation with matter mostly in the realm of linear optics, while nonlinear free space THz optics stays largely out of reach.

Here we discuss our advances towards the generation of intense, broadband THz pulses. We focus on the generation scheme based on two-color filamentation in air, under which the fundamental and the second harmonic of an ultrashort pulsed laser are combined and focused into air forming a filament, which produces intense THz pulses in the far field. Novel approaches to enhance the THz emission and further upscale the efficiency of these THz sources will be presented. These include, firstly the use of abruptly autofocusing beams for generating strong THz pulses at well-defined remote locations. Secondly, the THz emission through filamentation in liquids and finally the use of mid-infrared two-color laser pulses to drive the filamentation in air. Further improvement of these sources can increase the emitted THz energy at the multi-millijoule level with peak electric and magnetic fields at the gigavolt per centimeter and kilotesla level respectively. Quasi-static ultrashort electric and magnetic bursts at these intensities will be enabling free space extreme nonlinear and relativistic science.