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**Intense terahertz waves and applications**

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**Abstract**

Terahertz (THz) radiation, located in-between microwave and infrared frequencies, belongs to one of the most interesting and less explored regions of the electromagnetic spectrum. Through THz spectroscopy, abundant physical, chemical, and structural information of materials can be retrieved. Thus, it can be utilized in various applications that range from THz imaging for medical and security reasons to spectroscopic characterization of materials and remote spectroscopic detection and quantification of gases in atmosphere. Here we discuss our advances towards the generation of intense, broadband THz fields based on two-color filamentation of laser pulses 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 sources will be presented. These, among others, include the use of mid-infrared two-color laser pulses to drive the filamentation in air, resulting in an unprecedented THz conversion efficiency of a few percent, exceeding by far any previously reported experimental values for plasma-based THz sources.