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Abstract for an Invited Paper
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Ultra-short radiation generation from Mid IR-THz range using plasma wakes and relativistic ionization fronts[1]

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In this talk we will discuss two different concepts for frequency downshifting and upshifting of an IR laser to cover the entire bandwidth from 1 to 300 μm using two different plasma techniques. Recently we have demonstrated a new scheme that utilizes frequency downshifting of a Ti-saphhire laser using a wake produced in a tailored plasma structure to generate multi-millijoule energy, single-cycle, long-wavelength IR pulses [1,2]. Extending this idea, sub-joule, single-cycle terahertz pulses can be generated by using a picosecond 10 μm CO_2 driving laser. On the other hand, such a CO_2 laser can be frequency upshifted by colliding it with an underdense but relativistic ionization front [3]. In this case the wavelength can be tuned from 1-10 μm by simply tuning the gas density. These plasma techniques seem extremely promising to covering the entire molecular fingerprint region. References: [1] Z. Nie, et. al., Nat. Photon. 12, 489-494 (2018). [2] Z. Nie, et. al., Nat. Comm. 11, 2787 (2020). [3] W. B. Mori, Phys. Rev. A 44, 5118 (1991).

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