PHOTONIK SEMINAR

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Remote molecule lasers driven by femtosecond laser pulses

In this talk, I will present the generation of remote molecule lasers in air and CO₂ gases driven by femtosecond infrared laser pulses. Stimulated amplifications of self-generated UV harmonics of intense femtosecond infrared laser pulses are experimentally demonstrated with high gain coefficients of 5.02 and ~4.43 cm⁻¹ for nitrogen and carbon dioxide molecules, respectively. The amplified laser emissions have the polarization parallel to that of the pump laser with excellent coherence. It is further shown that these gases serve as gain media with the population inversion established in an unexpected ultrafast time scale comparable to the femtosecond pump laser pulse. The mechanism responsible for the ultrafast population inversion is discussed. Our findings suggest that ultrafast population inversion of molecules in strong infrared laser fields could be a ubiquitous phenomenon enabled by similar working mechanisms, as far as the wavelength of the pump laser is properly chosen.

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