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65th Annual Meeting of the APS Division of Plasma Physics Monday–Friday, October 30–November 3 2023; Denver, Colorado

Session TO05: Fundamental Plasmas: Laboratory, Nonneutral, and Strongly Coupled Plasmas

9:30 AM–12:18 PM, Thursday, November 2, 2023

Room: Governor's Square 14

Chair: Derek Thuecks, Washington College

Abstract: TO05.00013 : Comparative study of ionization and optical nonlinearities of gas molecules using single-shot spatio-temporally-resolved visualization*

11:54 AM–12:06 PM

← Abstract →

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We employ state-of-the-art single-shot frequency-domain holography (FDH) [1-3] to study the optical nonlinearities of gas molecules such as CO₂ and N₂O, which include the instantaneous electronic and delayed rotational Raman responses, as well as ionization effects. FDH enables single-shot time-resolved measurements of the optical nonlinearities induced by an intense pump laser pulse via the reconstruction of the electric fields of chirped reference and probe laser pulses. Our findings indicate that CO₂ exhibits significant nonlinearities comparable to N₂O, attributed to a combination of high Raman nonlinearities and a high ionization threshold. This study should provide important information for high-intensity laser experiments using gas molecules such as laser filamentation and high-order harmonic generation.

[1] S. P. Le Blanc et al. Opt. Lett. 56, 764-766 (2000). [2] D. Dempsey et al. Opt. Lett. 45, 1252-1255 (2020). [3] D. Dempsey et al. Opt. Commun. 545, 129669 (2023)

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