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Space- and time-resolved absolute measurements of ionization in atomic and molecular gases JARED WAHLSTRAND, SINA ZAHEDPOUR, HOWARD MILCHBERG, University of Maryland — Field ionization of atoms and molecules is a fundamental aspect of light-matter interactions that plays a role in the propagation of ultrashort optical pulses and in high harmonic generation. We present absolute time-resolved and 2D in space-resolved measurements of the ionization of the noble gases He through Xe as well as O_2 and N_2 using ultra-broadband 2D spectral interferometry. The refractive index is measured with 5 fs time resolution and 3 μm spatial resolution, with absolute results ranging from the multiphoton through tunneling ionization regimes. These results, combined with our previous measurements at nonionizing intensities [1,2], constitute a measurement of the nonlinear response of the noble gases from the weak field limit up to full ionization of the first electron. For the molecular gases, we use prepulses to prepare an ensemble of partially aligned molecules and examine alignment-dependent ionization rates. Our measurements may serve as an experimental benchmark of calculations of strong field ionization.

[1] J. K. Wahlstrand, Y.-H. Cheng, and H. M. Milchberg, Phys. Rev. A 85, 043820 (2012).
[2] J. K. Wahlstrand, Y.-H. Cheng, and H. M. Milchberg, Phys. Rev. Lett 109, 113904 (2012).

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