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THz Generation by Optical Cherenkov Emission from Ionizing Two-Color Laser Pulses[1] LUKE JOHNSON, JOHN PALASTRO, KI-YONG KIM, THOMAS ANTONSEN, IREAP, University of Maryland — Coherent mixing of an ultrashort laser pulse (800nm, 40fs) and its harmonic (400nm) in a nitrogen gas cell produces broadband, THz radiation emitted in a narrow cone around the optical axis. Asymmetry in the time dependence around the peaks of the two-color electric field results in a post-ionization plasma current that varies slowly in time, driving the THz radiation. We have simulated the THz and optical pulse propagation using a 2D scalar unidirectional propagation equation for the electric field spectral components [2]. We find that the emission angle can be explained as an optical Cherenkov effect: specifically, the front of the low frequency photocurrent moves faster than the phase and group velocity of the THz, resulting in conical emission. The optical Cherenkov model can be unified with the "off-axis phase matching model" [3], so that both mechanisms for generating off-axis THz can be considered as limits of a single model. Furthermore, we will discuss the application of tilted intensity front pulses to improving THz generation efficiency and directionality.

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[2] M. Kolesik and J. Moloney, Phys. Rev. E 70, 036604 (2004).
[3] Y. S. You, T. I. Oh, K. Y. Kim, Phys. Rev. Lett. 109, 183902 (2012)

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