Abstract Submitted
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Slow and fast light in plasma[1] C. GOYON, M. R. EDWARDS, T. CHAPMAN, L. DIVOL, N. LEMOS, G. J. WILLIAMS, D. A. MARISCAL, LLNL, D. P. TURNBULL, A. M. HANSEN, LLE, P. MICHEL, LLNL — Extreme manipulation of light's group velocity in optical media leads to "fast" and "slow" light, where pulses propagate superluminally or slow to an almost complete stop. Both phenomena have been found in a range of nonlinear optical media, including atomic gases, photorefractive crystals, and optical fibers. Plasmas are attractive for extreme non-linear optics as they tolerate fluences many orders of magnitude beyond the damage thresholds of traditional optical media, but high required powers and the complexity of the laser-produced plasma make precision control of group velocity difficult. We report the first experimental demonstration of slow and fast light in a plasma. We control the group velocity of light between 0.14c and -0.27c in a fully-ionized He/H2 plasma via optical wave mixing of an auxiliary pump laser and the manipulated probe beam, mediated by the wavelength-detuning-dependent ion-acoustic plasma response. Besides unveiling the potential of plasmas to generate slow and fast light at extreme fluences, these results might also impact inertial confinement fusion or high-energy density physics experiments, where complex wave-mixing processes between dozens of laser beams may impact the group velocities and temporal profiles of these beams.

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