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Manipulating the polarization state of an intense laser beam in a plasma using a less intense auxiliary laser.[1] P. MICHEL, LLNL, E. KUR, M. LAZAROW, UC Berkeley, T. CHAPMAN, L. DIVOL, C. GOYON, LLNL, M.R. EDWARDS, Princeton University, G. MARCUS, L. FRIEDLAND, Hebrew University of Jerusalem, J.S. WURTELE, UC Berkeley — Manipulating the polarization of intense laser beams in plasmas was recently proposed [1] and subsequently achieved in proof-of-principle laboratory experiments [2,3] that demonstrated the feasibility of plasma-based photonics devices such as plasma-Pockels cells or polarizers. However, both the theory and experiments were carried out in the linear regime of polarization mixing, whereby the "pump" beam that was used to introduce birefringence in the plasma was much more intense than the "probe" beam whose polarization was being manipulated. The absence of a means of surpassing the linear regime is the major hurdle that has to date prevented the practical applications of these concepts. In this presentation, we propose a novel solution to this fundamental problem. Our method enables the practical application of plasma-based photonic devices in a regime where the intensity of the probe beam significantly exceeds that of the pump. This is achieved by taking advantage of a particular geometrical arrangement that preserves the polarization state of the pump while allowing the polarization of the probe to be manipulated arbitrarily. We present a non-linear, two-dimensional analytical solution for this interaction geometry, and discuss the implications of this non-linear regime for the plasma-polarizer and plasma-Pockels cell concepts. [1] P. Michel et al., PRL 113, 205001 (2014). [2] D. Turnbull et al., PRL 116, 205001 (2016). [3] D. Turnbull et al., PRL 118, 015001 (2017).

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P. Michel
Lawrence Livermore Natl Lab

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