

Manipulating light using plasmas: polarization control, slow & fast light

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“Plasma photonics” aims at manipulating light at extreme fluences using plasma, thus alleviating constraints from optics damage. In this talk we will review some recent results from our group in this field. A first sub-area concerns manipulating the polarization of light using plasma. We recently proposed¹ and then experimentally demonstrated² the new concepts of plasma-polarizer and plasma-Pockels cell. In these concepts, a plasma is turned anisotropic and birefringent by introducing an auxiliary laser into it. Our most recent development is to propose a solution that should enable to manipulate the polarization of a high-intensity laser using a lower intensity auxiliary beam.

The presence of an auxiliary laser can also be used to manipulate the refractive index of the plasma experienced by another “probe” beam. This idea recently led to the first demonstration of “slow light” and “fast light”³ in a plasma. By adjusting the laser and plasma conditions (including small wavelength shifts between the probe and auxiliary lasers), we were able to reduce the group velocity of the probe beam by an order of magnitude (“slow light”), as well as reverse the sign of its group velocity (“fast light”).

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¹ P. Michel et al., *Phys. Rev. Lett.* 113, 205001 (2014).

² D. Turnbull et al., *Phys. Rev. Lett.* 116, 205001 (2016); D. Turnbull et al., *Phys. Rev. Lett.* 118, 015001 (2017).

³ L. V. Hau et al., *Nature* 397, 594 (1999); R. W. Boyd and D. J. Gauthier, *Science* 326, 1074 (2009).