ENERGY COUPLING BETWEEN HIGH-POWER LASER BEAMS IN MAGNETIZED PLASMAS

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Magnetized Inertial Confinement Fusion (ICF) is an alternative scheme for achieving fusion where the fusion pellet is immersed in a magnetic field. By increasing the ion temperature, this scheme would allow *a priori* higher fusion gain while reducing the required input energy. Although it has been evoked theoretically in the past, it has re-emerged recently [1] in the light of the difficulties of ignition at the National Ignition Facility (NIF) [2]. However, to implement it, crucial questions must be answered, e.g.: How is laser propagation in a plasma affected when magnetic fields are involved?

We will here report on investigations of the propagation of focused high-power laser beams through magnetized low-density plasmas. The conditions investigated here are representative of the low-density medium tampering the interior of a hohlraum indirect-drive ICF target. These investigations are in particular based on our earlier work [3] where we showed that high-power laser beams could be strongly and non-linearly coupled in low-density plasmas; the aim here being to investigate whether magnetizing the plasma can reduce such detrimental coupling.

The experiments have been performed at Ecole Polytechnique on the LULI2000 laser facility with the use of the pulsed magnetic system we have developed recently [4]. In the experiments, we used two neighbor laser beams (pulse duration 1.5 ns, wavelength 1 μm, energy 50 J) focused on a pre-ionized 1 mm diameter gas jet in a presence of strong external quasi-homogeneous magnetic field (up to 20 T). The coupling between laser beams has been studied with space- and time-resolution using the HISAC diagnostic technique [3], revealing clear magnetic field influence on the laser beam patterns. We also measured time-resolved backscattered Brillouin and Raman emission from the plasma that was characterized through as optical gated interferometric measurements. The magnetic field was also observed to modify the growth of the stimulated scattering instabilities.

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