Plasma Mirrors: Towards Extreme Intensity Light Sources and Compact Particle Accelerators

H V Vincenti[1]

[1] *Commissariat à l'Énergie Atomique et aux Énergies Alternatives - Saclay, Gif Sur Yvette, France*
Contact Email: henri.vincenti@cea.fr

Plasma mirrors are remarkable optical components that can be produced by focusing a high-power femtosecond laser with high contrast on an initially solid-target. In this talk, I will show that plasma mirrors could help solving major physical challenges in high-field Science.

First, I will present a new concept leveraging on plasma mirrors to considerably increase the charge injected in laser-plasma electron accelerators while preserving the electron beam quality. This concept, validated by very challenging simulations, has recently been demonstrated experimentally at Laboratoire d'Optique Appliquée in France.

Second, I will show that PW-class Doppler-boosted lasers, obtained by reflecting a PW-class laser off a plasma mirror, could allow the study of extreme regimes of light-matter interactions dominated by strong-field Quantum Electrodynamics (SF-QED) processes. Using existing facilities, our simulations show that we could approach the fully non-perturbative regime of QED and reach cascaded regimes of electron-positron pair productions (leading to extreme pair plasma densities).