# Plasma Mirrors as a Path to the Schwinger Limit

H Vincenti[1]

[1]*LIDYL, CEA Saclay, 91191, Gif Sur Yvette, France. Contact Phone: +33648101596*
Contact Email: henri.vincenti@cea.fr

Following the advent of PetaWatt (PW) class lasers already capable of achieving light intensities of $10^{23}$ W/cm$^2$, high-field science now aims at solving a major challenge of modern physics: can we produce extreme light intensities above $10^{25}$ W/cm$^2$ beyond which yet unexplored Strong-Field Quantum Electrodynamics (SF-QED) regimes would dominate light-matter or even light-quantum vacuum interactions?

As the required intensities are orders of magnitude higher than the present record held by a 4PW laser, solving this major question with the current generation of lasers requires conceptual breakthroughs that I strived to address with my team during the last 5 years. To break this barrier, we proposed to revive an old concept called the 'Curved Relativistic Mirror' (CRM). Assuming a perfectly reflective and aberration-free CRM, reflecting a high-power laser on such a moving mirror could, in principle, boost its intensities by several orders of magnitude through the Doppler effect. The major obstacle with this simple concept is its actual implementation: how to produce a curved and highly-reflective relativistic mirror of excellent optical quality in experiments? This has remained an open question so far, which has resisted all experimental attempts.

In this talk, I present the theoretical and numerical efforts that my team and I have carried out at CEA to answer this question, starting from the development of the 3D kinetic code WarpX-PICSAR up to the very first numerical experiments of CRM designs performed with the code at very large scale. Leveraging on these first results, we show that high-power PW lasers, boosted by a relativistic plasma mirror, can increase SF-QED signatures by orders of magnitude, potentially giving access to new physics at existing laser facilities. Our theoretical and numerical predictions have already been confirmed in the 100 Terawatt regime at CEA, showing that optically-curved plasma mirrors can spatio-temporally compress a high-power laser with excellent optical quality.