RESEARCH PROJECT

Tremendous progress in laser technology and the advent of multi-petawatt lasers provide us with the possibility to create in the laboratory conditions resembling those of energetic astrophysical objects such as supernovae remnants, Active Galaxy Nuclei or Gamma-Ray Bursts. Direct access to strong “collision-less” shock waves and plasma jets is now at hand in the laboratory, and will help us shedding light on the kinetic behaviour of charged particles in relativistic shocks, and the resulting emission of high-energy photons, and potential production of electron-positron pairs.

"The purpose of my thesis is to investigate these effects in regimes and configurations, which are characteristic of relativistic astrophysics and accessible with the most intense lasers. Special attention will be paid to laser-plasmas in strong external magnetic field."

SCIENTIFIC RESULTS AND IMPACT

We investigate, through analytic calculation and numerical simulation, the evolution of the kinetic instability that mediates collision-less shocks in magnetized plasma, in regimes and configurations accessible with the most intense lasers. This will provide us with a better understanding of strong electromagnetic field generation and cosmic rays acceleration in astrophysical plasmas.

PRINCIPAL KEY FACTS, COMMUNICATIONS RELATED TO THE PROJECT AND DISTINCTIONS

Poster
- Study of the Weibel Instability in magnetized plasma
A. Grassi, M. Grech, A. Macchi, F. Amiranoff, C. Riconda
Presented at the 7th Forum de la Fédération Lasers et Plasmas, Porquerolles, 14th-19th June, 2015 and at the 42nd European Physical Society, Lisbon, 22nd -26th June 2015.