Graduate Research School

Collège des écoles doctorales
École doctorale **Sciences Physiques et de l'Ingénieur**

Call for PhD position

High power laser amplifiers for high energy postcompression

Keywords : picosecond and femtosecond lasers, power laser amplifiers, spatial beam shaping, nonlinear optics, pulse compression
Location : Centre Lasers Intenses et Applications (**CELIA**), Bordeaux, France (www.celia.u-bordeaux1.fr)
Funding : full 3-years, starting on october 1st 2019
PhD supervisor : Dr Stéphane Petit (stephane.petit@u-bordeaux.fr, tel +33 (0)5 40 00 37 49)

Context : The last ten years have seen the strong rise of high energy picosecond laser systems based on ytterbium ion with average powers higher than 1 kW from fiber or solid-state lasers [1]. This technological and scientific challenge opens the way to many application fields such as aerospace, medicine, plasma physics at a high repetition rate, long distance filamentation. Moreover, nonlinear post-compression of ytterbium systems at several hundred watts with capillaries or Herriot cells has shown a wide interest by demonstrating impressive time compression ratios [2] annoucing an imminent technological break with current Ti: sapphire systems at 1 kHz.

PhD subject: LEAP-HORIZON project aims to produce picosecond pulses of 1 Joule at the rate of 1 kHz (average power 1 kW). A Gaussian-mode 200W 1kHz thin disk-based regenerative amplifier is in development but these pre-amplifiers suffer from a poor spatial overlap between top-hat pump profiles and Gaussian cavity mode affecting the optical performance and requiring the use of large aperture components. An alternative way is the design of flat mode amplifiers [3]) but adapted to the case of Yb: YAG thin discs. This spatial beam shaping will enable a new post-compression scheme based on self-phase modulation of flats beams in thin films [4] or Herriot cells. The PhD work will consist in combining flat-mode thin-disk regenerative amplifier development and the postcompression :

- Design and realization of beam shaping adapted to thin-disk amplifiers.
- Realization of high-power flat-mode thin-disk Yb :YAG amplifier in different regimes (CW, ns, ps),
- Post compression by self-phase modulation in thin films or Herriot cell.

This subject has a high potential for publication in high-ranked international journals and international conference meeting insuring a high-level training in laser physics for industrial or academic R&D.

[1] Nubbemeyer et al. Opt. Lett. **42**, 1381(2017), [2] Kaumanns et al. Opt. Lett. **43**, 5877 (2018),
[3] Ribeyre et al ; Opt. Lett. 28,1374 (2008), [4] Mourou et al., Eur. Phys. J. Special Topics223, 1181(2014)

Profile: For this innovative project, we are seeking a motivated candidate with a Master's degree and a good knowledge of optics, lasers and nonlinear optics. An experience in ultrafast pulses optics would be a beneficit. Simulations and design will be performed but the work will be mainly experimental.

Applications: Application must be sent directly to the PhD supervisor. It includes a CV with academic results (2 pages max), one letter of motivation, one or two letters of recommendation for external student of University of Bordeaux, a copy or certification of the last degree, transcripts from Master 1 and 2 (or equivalent).

Deadline of application: May 30th 2019