Coherently driven active cavities for sources of ultrashort optical pulses

Open PhD / Post-doc positions in Nonlinear Photonics

Localisation: OPERA-Photonics, École polytechnique de Bruxelles, Université libre de Bruxelles, Belgium.

Contract period: (PhD) 48 months; (Post-docs) up to 36 months.

Expected date of employment: between October and December 2022 (with some flexibility).

Application deadline: 30 September 2022.

Description

This vacancy fits within the framework of the 4-year *Excellence of Science* (EOS) research project "PULSE" (Pattern Formation in Integrated Lasers for Spectroscopy and Terahertz Wave Generation). PULSE is a collaborative project between the Photonic Research Group (PRG) of Ghent University, the OPERA-photonics group of Université libre de Bruxelles (ULB), the MPQ in Germany and the IEMN-CNRS in France.

Pulsed lasers with a comb-like spectrum are fundamental tools for many applications [1]. Despite the appeal of miniaturization, integrating efficient and ultra-stable pulsed laser sources is still very challenging. The PULSE project aims at combining the physics of pattern formation and the technological advances in optical integration to develop the next generation of sources of optical pulse trains for applications in ultra-high precision spectroscopy and low noise terahertz frequency wave generation, among others.

OPERA-photonics is a pioneering group in dissipative nonlinear dynamics [2]. We recently made a breakthrough in this field by demonstrating the formation of low noise, high power cavity solitons (i.e. pulsed patterns) in active fiber cavities [3,4]. While the overall goal of the PULSE project is to apply this concept to integrated pulsed sources, the research projects conducted at ULB will mainly involve fiber active resonators.

In the framework of this project, two positions are open in the OPERA-photonics group either for PhD students or at the post-doc level. The researchers will contribute more specifically to i) the generation of pulsed patterns in active resonators including a semiconductor-based amplifier and ii) the formation of ultra-broadband coherent patterns through intra-cavity spectral broadening of active cavity solitons. Both projects involve strong experimental work and theoretical studies to support the experimental design and results. The individual researchers will be integrated in the larger team, operating in the two universities (ULB and UGent). Intensive exchange and shared outcomes among team members are crucial for the success of the project.

Profile of applicant

At the PhD level, we are looking for a young scientist with a Master of science/ Master of applied science in physics. At the Post-doc level, the candidate should have some experience with experimental nonlinear ultrafast optics. Moreover, both candidates should have a very good background in optics (optical physics, electromagnetism, nonlinear optics, optoelectronics, lasers, …) and a good background in mathematics and general physics. Knowledge in nonlinear dynamics is an asset. They will be able to work independently in a collaborative environment. As part of the OPERA department of the Ecole polytechnique de Bruxelles, the successful applicants will also be involved in student's projects supervision.

Application:

Candidates are requested to send their application to Pr. Simon-Pierre Gorza (simon.pierre.gorza@ulb.be) and Dr. François Leo (francois.leo@ulb.be), including a cover letter describing themselves, their interests in the project, their CV and at least one recommendation letter from a reference person.

[1] T. Fortier and E. Baumann, "20 years of developments in optical frequency comb technology and applications", Commun. Phys. **2**, 153 (2019).

[2] F. Leo *et al.*, "Temporal cavity solitons in one-dimensional Kerr media as bits in an all-optical buffer", Nature Photonics **4**, 471 (2010).

[3] N. Englebert *et al.*, "Temporal solitons in a coherently driven active resonator", Nature Photonics **15**, 536 (2021).

[4] N. Englebert *et al.*, "Parametrically driven Kerr cavity solitons", Nature Photonics **15**, 857 (2021).