NON LINEAR INTERACTION OF SELF-ACCELERATING LIGHT BEAMS

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Keywords:
Physics, Photonics, Nonlinear optics

Staff:

The thesis will be supervised by Delphine WOLFERSBERGER, Professor at CentraleSupélec. The work will also benefit from the supervision of Marc SCIAMANNA, Professor at CentraleSupélec, and Nicolas MARSAL, Assistant Professor at CentraleSupélec.

Funding:
A grant of the ministry of education and research will provide funding over 3 years.

Workplace:

The scientific work will be carried out in the LMOPS (Laboratory of Optical Materials, Photonics and Systems) laboratory, a joint research unit between CentraleSupélec (one of the top Engineering school in France) and the University of Lorraine.

Deadline for applying and contact:

The candidates should send a CV and a motivation letter to Delphine Wolfersberger delphine.wolfersberger@centralesupelec.fr before **March 31st 2016**

Thesis description:

Our increasing bandwidth requirements for the transmission of information and storage capacity combined with the significant advances in technology integration of fast opto-electronic components, lead to the need for a paradigm shift to an all-optical information processing. Our recent studies suggest new physical phenomena resulting from the interaction of optical accelerating beams (Airy beams) in a nonlinear medium leading to possible generation of dynamic waveguiding structures [1] and optical lens gravitational effect. These results motivate theoretical and experimental work taking into account the complexity of the spatiotemporal dynamics and suggest the use of other unconventional beams such as Mathieu or Weber-type of beam.

These ideas open up new prospects for the physical study of the spatial and temporal properties of light-matter interaction and allow considering the development of all optical systems such as fast optical switches, amplifiers and/or optical memories.

From an experimental point of view, the subject requires the build up of an optical free space experiment in the visible and/or infrared wavelengths range. From a theoretical point of view, the subject requires a physical understanding of equations describing the propagation of an optical beam in a nonlinear medium (partial differential equations). Thanks to this thesis, the PhD student will develop new skills in complex physical systems and in numerical simulations. These skills will be largely recoverable in a wide variety of engineering jobs, researchers and go beyond specialization in physics and photonics.

References:

[1] N. Wiersma, N. Marsal, M. Sciamanna, D. Wolfersberger, Scientific Reports, 5:13463 (2015).