Master 2 "Systèmes Complexes, Optique, Lasers (SCOL)": Research Training 2022-2023
Master 2 "Matter Molecules and their Environment(MME)": Research Training 2022-2023

Appel à sujet de stage recherche / Call for research training subject

Laboratory: Phlam

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Collaborator(s): Randoux Stéphane and Copie Francois

Topic: Nonlinear Dynamics

Master 2: select the master and the most appropriate option

X Master 2 SCOL	□ Master 2 MME (GP-SCP)
X Option Complex Systems (GP-IKS)	□ Option Condensed Matter
	□ Option Condensed Matter/Pharma
	□ Option Dilute Matter and Spectroscopy
	□ Option Atmospheric Sciences
	□ Option Modeling at the molecular & atomic scales

Ultrafast measurement of optical turbulence

Turbulence is one of the most complex and fascinating natural phenomena and of fundamental physics. In recent years, our research group has developed optical experiments at the Phlam laboratory to observe phenomena comparable to those observed in certain hydrodynamic experiments. More precisely, we observe the temporal structures and statistics that emerge during the so-called integrable turbulence propagation in an optical fiber. As part of an international collaboration with specialists in hydrodynamics (Miguel Onorato, univ. Turin, Italy, Eric Falcon, Paris), we compare experimental data in optics and hydrodynamics [R. El Koussaifi et al, Phys. Rev. E 2018, Suret et al, Phys. Rev. Lett., December 2020]. The objective of the thesis is to carry out an optical experiment allowing the observation of wave turbulence. The internship includes both experimental and theoretical aspects and numerical simulations. The challenges are very ambitious in terms of fundamental physics because the objective is the first observation in optics of phenomena that have been very extensively studied theoretically since the 1960s (Kolmogorov-Zakharov cascade).

Experiments will use recent ultrafast measurement devices called "time microscopes" that allow the recording of fluctuations of light having timescales of the order of 10^{-13} seconds. Beyond the fundamental challenge in turbulence and statistical physics, the PhD will provide important breakthrough in the field of ultrafast measurement in optics. Note that the student may also contribute to experiments in hydrodynamics within international collaborations

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Key words: Turbulence, Optical fibers, ultrafast measurement in Optics, hydrodynamics