Master internship position with funded PhD available

Internship location: Institut de Physique de Nice (INPHYNI) https://inphyni.univ-cotedazur.fr
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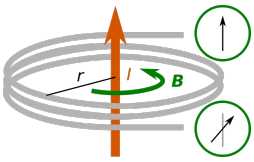
Salary: ~ 600 €/months
PhD thesis possibility after internship: **YES** Thesis funding: granted through an **ANR** contract

Light transport in optical fibers and reciprocity breaking

Context Reciprocity in optics is often seen as a property responsible for the fact that "if I can see you, you can see me". In multiple scattering coherent wave transport, i.e., if interferences within the scattering region are taken into account, reciprocity is known to reduce the transmission of the medium with respect to a situation where interferences are absent. This phenomenon is known as localization. It is possible to break reciprocity for instance in the presence of materials showing some magneto-optical Faraday effect. There are situations where reciprocity breaking might be desirable: For instance in radiative-energy harvesting devices, one might want to increase the absorption without increasing the emissivity. In laser systems, Faraday-isolators are commonly used to reduce noise. On top of the potential applications of non-reciprocal optical systems, breaking of reciprocity gives new insight to the fundamental understanding of coherent wave transport.

Research program In this master project, we propose to develop an original setup to measure the influence of reciprocity in coherent wave transport in multimode optical fibers. Using optical fibers allows to reduce the dimensionality of the very general light scattering problem, and therefore the complexity. A schematic view of the experiment is shown in the figure below.



Principle of the experiment: the magnetic field $\vec{B}$ induced by the electrical current I (up to 1.5 kA DC to reach the desired Faraday effect) is constant along the optical fiber that is coiled around the electrical conductor. In a polarization maintaining monomode fiber, due to the magneto-optical Faraday effect, this would result in a rotation of the linear polarization.

The objectives of this master thesis is build the setup, characterize it on monomode fibers, and then start to measure the effect on multimode fibers. This master thesis will pave the way toward a new experimental platform to study multiple light scattering using disordered optical fibers—that will be fabricated using a direct laser writing setup developped at INPHYNI—and different coherent wave transport properties like Anderson localization or universal conductance fluctuations. In a nutshell, we propose to study light transport in optical waveguides by inducing on demand scattering, scattering which will be induced by laser-writing scatterers with controlled properties within the core of the fiber, and to use reciprocity breaking as a tool to characterize the transport properties.

Profile We are looking for candidates with a broad outlook and a strong interest in **wave physics** and **experimental optics**. The candidate will work within the Waves in Complex Systems group at INPHYNI, and have the opportunity to pursue in the group by doing a PhD thesis.