

Title: Ultrastable frequency dissemination with optical fiber links: polarization effects and interferometer noise for quantum applications

Scientific description:

In France REFIMEVE is a national network of optical links which is developed and operated by LPL and LITE laboratories. It enables to transfer ultrastable time and frequency references, useful for different scientific communities. See <https://www.refimeve.fr/>

Optical fiber links consist in transmitting an ultrastable laser, which frequency is controlled with atomic clocks, through an optical fiber to the remote lab, with an active compensation of the propagation phase noise.

One of the limitations of the compensation is due to polarisation effects that need to be studied. The intern will contribute to this study with an experiment which enables the propagation of orthogonal polarisation in fiber spools, and analyse the effects of length, temperature and vibrations. This study will have two impacts:

- 1) The propagation noise is due to anthropogenic as well as seismic noise, and its measurement can serve as a geophysics sensor, and retrieving information about polarisation changes would improve information about the geophysical event that caused the deformation.
- 2) The limitations and mitigations strategies developed would also interest the quantum communication community, since quantum key distribution rely on fibers paths and any phase added on the quantum signal deteriorates its quality.

Techniques/methods in use: fiber optics, optoelectronics, frequency measurements

Applicant skills: Optics – Basis in electronics – Modelisation and data analysis

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Internship location: Laboratoire de Physique des Lasers, 99 avenue Jean-Baptiste Clément, Villetaneuse

Possibility for a Doctoral thesis: Yes