

CONTRACTS DOCTORAUX 2025

Titre du projet de thèse : Génération de peignes de fréquences multiples dans les fibres possédant plusieurs coeurs

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Résumé du projet de thèse (en 20 lignes maximum) :

Optical frequency combs are groundbreaking light sources that have significantly advanced precision measurement science, exemplified by the Nobel Prize in Physics awarded to Theodore Hänsch in 2005. Their applications are diverse, ranging from pollutant detection to autonomous car distance measurement and even exoplanet detection [1].

In this PhD thesis, we aim to develop multiple frequency comb generation starting from a CW laser to assure a high degree of mutual coherence. We will exploit the nonlinear broadening experienced by this CW sources modulated by electro-optic modulators. The aim is to generate multiple frequency combs within an all-fibered system suited for ultra-fast nonlinear spectroscopy investigations. The fiber will exhibit several cores in order to maintain a high degree of mutual coherence. A proof of concept had been already achieved [2], now the motivation is to fully exploit the potential offered by the fiber technology, unpacificaly the longitudinal evolution of the linear and nonlinear parameters, to reach sub 100 fs pulses and 10's THz, performances required for advanced nonlinear spectroscopy systems.

Mots - clés : peignes de fréquence, ondes choc, ultra-fast optics

Compétences requises : optique non-linéaire, électronique, traitement du signal, fibres optiques avancées, simulations numériques (Matlab)

Bibliographie:

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

[2] E.-L. Bancel *et al.*, « All-fiber frequency agile triple-frequency comb light source », *NATURE COMMUNICATIONS*, vol. 14, n° 1, p. 7953, déc. 2023, doi: [10.1038/s41467-023-43734-w](https://doi.org/10.1038/s41467-023-43734-w).

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Remarques/commentaires supplémentaires :