# Proposition de Sujet de Stage de Master 2 (2023/2024)

**Type de projet :** **Recherche**

**Durée, y compris la rédaction du rapport :** **6 mois (Salaire : 615 €/mois)**

**Début du projet : 1 Février 2024**

**Fin du projet : 31 Juillet 2024**

**Titre du projet** : Next generation photonic crystal fibers for noise-free supercontinuum light source

**Institut : FEMTO-ST** **Département : Optique** **Equipe : Optique non linéaire**

**Contact :** Thibaut Sylvestre (Directeur de Recherche CNRS, HDR 2006)- Batiment Témis, Bureau N1-35

**Adresse :** Institut FEMTO-ST, Université Bourgogne Franche-Comté, 15 Avenue des Montboucons, 25000 Besançon, France

**Courriel :** *thibaut.sylvestre@univ-fcomte.fr*

**Tél : +33676353156**

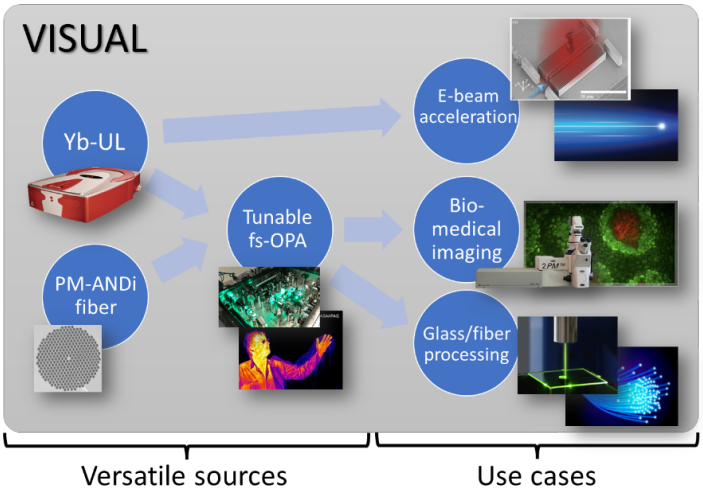
**Domaine :** Photonique, Optique Non Linéaire, Fibres optiques, Génération de Supercontinuum, Laser

| **Connaissances préalables :** | Requises : Physique optique, Optique guidée, Simulation numérique (Matlab) |
|---|---|
| | Utiles : Montage Optique, Expérimentation, Fibres optiques |

**The scientific goal of the project :**

The physics and applications of fiber-based supercontinuum (SC) sources have been a subject of intense interest over the last decade, with significant impact on both basic science and industry [1]. New uses for SC sources are also constantly emerging due to their unique properties that combine high brightness, multi-octave bandwidth, fiber delivery, and single-mode output.

This master project aims to design a novel polarization-maintaining all-normal dispersion (PM-ANDi) photonic crystal fiber for high-brightness SC light source with unprecedented stability and noise properties [2]. Tasks will first consist of modeling the fiber using Lumerical mode solutions software then the SC generation and its noise properties using Matlab. Second is the experimental SC generation and characterization using an ultrafast optical parametric oscillator in the lab. The experiment will be based on a full time-frequency analysis of femtosecond pulses propagating PM-ANDi fibers, both of which are already available in the lab. Ultimately, this master's internship will lead to a 3-year thesis scholarship in the framework of the European project VISUAL, which includes several groups in France, Germany and Poland. The final objective is the development of a **tuneable femtosecond (fs) OPA source** in the 600-1400 nm range that will not only come in a compact package but also outperform the state-of-the-art systems in terms of power, wavelength tuneability, and control of the pulse energy for different applications such as E-beam acceleration, bio-imaging and glass processing (See figure below).




References :

1. T. Sylvestre, E. Genier, A. N. Ghosh et al., "Recent advances in supercontinuum generation in specialty optical fibers," J. Opt. Soc. Am. B 38, 90-103 (2021).

2. E. Genier, S. Grelet, R. D. Engelsholm, P. Bowen, P. M. Moselund, O. Bang, J. M. Dudley, T. Sylvestre, Opt. Lett. **46**, 1820 (2021).

Co-directions: Charbel Khallouf (FEMTO-ST), Doctorant, Prof. J. M. Dudley, Univ. de Franche-Comté

Collaborations: Laboratoire INPHYNI, Nice, Laboratoire PHLAM, Lille for fiber fabrication.