**Co-fund DGA Thesis**

Armaments Procurement Agency

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**Title**: Management of the thermal effects for the power scaling of fiber laser systems based on all-solid Large Pitch Fibers operating at 2µm. - http://s2i.ed.univ-poitiers.fr/spip.php?article1006&lang=fr

**Full description** -

Over the last decade, rare-earth doped optical fibres have shown outstanding potential in increasing the average optical power (for instance more than 10kW in CW operation) and energy (in the pulsed regime) delivered by fibre laser systems at 1 µm. As these sources currently face the onset of nonlinearities, degrading the temporal and spectral beam properties, a reduction of the optical power density and/or a shortening of the fibre length is required so as to push them away. Consequently, the achievement of high-power fiber lasers has been based on the development of new architectures of Very Large Mode Area Photonic Crystal Fibres (VLMA- PCFs) exhibiting a Mode Field Area (MFA) larger than 5000 µm². Nevertheless, the intrinsic nature of PCFs, as well as the presence of a pump cladding, do not allow a strictly singlemode operation. The latter is then achieved thanks to an efficient delocalization/leakage of High-Order Modes (HOMs) out of the doped core while the Gaussian-like fundamental mode experiences a strong interaction with the gain region, being by this way preferentially amplified. One of the major challenges of the coming decade is the transposition of this know-how at wavelengths close to 2 µm, which is a spectral range where many military and civilian applications (countermeasures, atmospheric pollutant detection, bio-defense by LIDAR…) are in a pressing need for having such high power compact and versatile IR fiber laser sources. To complete this research work, some problems including undesirable thermal effects must undoubtedly be overcome. The PhD position proposed here is driven by this context and its main objective is to develop experimentally the first low-cost, highly-compact high-power fiber laser system operating at 2µm based on a recent fibre design breakthrough (pioneered by XLIM) whose design take into account these thermal effects.

The candidate will be in particular involved in the fabrication and characterizations steps of VLMA-PCFs. The successful candidate will be highly motivated, creative, with demonstrated abilities to work in a collaborative environment. The project in which the position is related gathers two partners: XLIM lab (University of Limoges, CNRS) which is a world pioneer and leader in the field of PCF, including the design of novel class of PCF for laser applications upon which this thesis project is built on and IPHT lab (Leibniz Institute of Photonic Technology) which is internationally renowned for its expertise in material science and its competence for the manufacture of special optical fibres. A theoretical and/or an experimental background in optics or lasers areas are welcomed. The candidate should have a Master's degree in physics, applied physics, laser technology or related discipline. The position is a three-year appointment founded in particular by the French "Direction Générale de l'Armement" (French National Defence and Security).

**Keywords:** Photonic Crystal Fiber, high-power fiber laser, fabrication process of optical fibres, thermal effects

**Funding**: DGA (Direction générale de l'armement - Armaments Procurement Agency)

**Conditions of access**:

- Citizen of the European Union or Switzerland;
- Not having started their professional career;
- In preparation of a Master degree in the year of submission of the application;
- Or hold a Master or equivalent allowing them to enroll in thesis;

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**Laboratory:** XLIM research Institute - **www.xlim.fr**