



The **French-German Research Institute of Saint-Louis (ISL)** situated in the border triangle of Germany, France and Switzerland is an internationally renowned research institute belonging to a global industrial and economic network.

The spectrum of our core activities comprises a variety of topics: aerodynamics, energetic and advanced materials, lasers and electromagnetic technologies, protection, security and situational awareness. Our activities are related to both basic and applied research.

ISL is offering a **PhD Position**

## Research Field: Laser and electromagnetic technologies

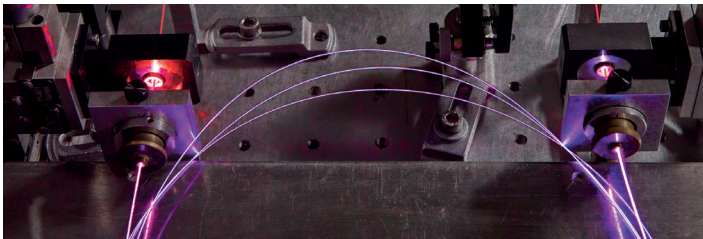
### *Investigation of thulium, holmium and thulium-holmium codoped fiber lasers*

#### Topic description

Two micron fiber-based sources commercially available suffer from very bad wall plug efficiency, huge footprint and poor flexibility in wavelength delivered compared to what would be possible if the physical properties of those ions would be taken into account.

#### References

- M. EICHHORN and S.D. JACKSON, "High-pulse-energy actively Q-switched Tm<sup>3+</sup>-doped silica 2 μm fiber laser pumped at 792nm", *Optics Letters* 32(19), 2780-2782 (2007)
- M. EICHHORN and S.D. JACKSON, "High-pulse-energy actively Q-switched Tm<sup>3+</sup>,Ho<sup>3+</sup>-codoped silica 2 μm fiber laser", *Optics Letters* 33(10), 1044-1046 (2008)
- C. KNEIS, B. DONELAN, A. BERROU, I. MANEK-HÖNNINGER, T. ROBIN, B. CADIER, M. EICHHORN, C. KIELECK, "Actively mode-locked Tm<sup>3+</sup>-doped silica fiber laser with wavelength-tunable, high average output power", *Optics Letters* 40(7), 1464-1467, (2015)



#### Job Description/Objectives

Tasks of this thesis will be to explore the following topics:

- The theoretical efficiency linked to the two-for-one process occurring in Tm-doped fibers has never been reached experimentally yet and it is mandatory to explore new fiber designs and doping methods to avoid clustering effects that currently limit efficiency. Due to no optimal inter-ionic energy transfers, Tm-doped and also Ho-doped fibers showed - so far - reduced lifetimes and upconversion effects. In close collaboration with international fiber experts for Tm and Ho doping ions, special fiber designs and doping will be tested in ISL fiber laser setups. Simulations and experimental demonstrations are foreseen.
- Another task of the thesis is the comparison of two schemes to deliver 2 μm radiation. Especially the cascaded Tm-doped fiber laser pumping Ho-doped fiber laser setup has to be compared to the Tm, Ho codoped fiber laser at high average power in continuous wave and pulsed regime.

You will work in a group of 15 researchers, PhD candidates and engineers in the field of development of new laser sources, including new lasing materials (holmium, thulium, erbium), nonlinear crystals such as zinc germanium phosphide (ZGP), doped fibers, non-planar optical parametric oscillators (OPOs) and innovative diode pumping schemes for lasers from 1.6 μm to beyond 5 μm.

#### Candidate Profile

Qualified diploma or master's degree in photonics or laser physics.

French-German Research Institute of Saint-Louis (ISL)  
Christelle KIELECK / Nicolas DALLOZ – Directed photonics and applications  
5 rue du Général Cassagnou – 68301 Saint-Louis – France  
[christelle.kieleck@isl.eu](mailto:christelle.kieleck@isl.eu) – tel : +33 (0)3 89 69 58 70 / [nicolas.dalloz@isl.eu](mailto:nicolas.dalloz@isl.eu) – tel : +33 (0)3 89 69 50 64

