CONTRACTS DOCTORAUX 2024

Titre du projet de thèse : Nonlinear optics in multimode gas-filled hollow core antiresonant fibers

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

Since their first report in the late nineties, hollow core fibers have been a platform of interest to study the nonlinear interaction of light and gases, because they offer a much longer interaction length that standard bulk gas cells and much lower attenuation than capillaries [1]. For instance, gas-filled antiresonant hollow core fibers have been exploited to generate UV radiations as dispersive waves emitted from high power solitons. Because the fiber dispersion is extremely sensitive to the gas pressure, it is possible to tune the dispersion curve of the fiber simply by tuning the gas power in the fiber core, therefore tuning the wavelength of the radiation emission. This process has been studied extensively in single-mode antiresonant hollow core fibers [1].

Our project is to explore the potential of few mode and highly multimode antiresonant hollow core fibers to study light-gas nonlinear interactions [2]. Also, topographic antiresonant fibers – with optical properties evolving longitudinally in a controlled way – will be considered as a new platform for those studies. All fibers will be designed, manufactured and characterized at the FiberTech platform. Nonlinear optics experiments will be done using our available tunable high-power ultrashort pulse laser systems. Numerical simulations will be used as a predictive tool but also to further analyze experimental results. The project, which is therefore half experimental and half numerical, is highly prospective, which requires a highly autonomous PhD student with excellent background in experimental and/or numerical nonlinear optics.

[1] J. C. Travers *et al.*, "Ultrafast nonlinear optics in gas-filled hollow-core photonic crystal fibers [Invited]," J. Opt. Soc. Am. B **28**, A11-A26 (2011).
[2] F. Tani *et al.* "Multimode ultrafast nonlinear optics in optical waveguides: numerical modeling and experiments in kagomé photonic-crystal fiber," J. Opt. Soc. Am. B **31**, 311-320 (2014).