Post-doctoral position

Title	**Development and characterization of integrated nonlinear photonic waveguides**		
Project	EUR EIPHI (https://gradschool.eiphi.ubfc.fr)		
Location	FEMTO-ST institute, Optics department (Besançon – France)		
Supervisor	Pr. Gil FANJOUX		
Start date	2021	**Duration**	1 year
Salary	50 k€ for 1 year	**Grant**	Région Bourgogne Franche-Comté & EUR EIPHI

1. Scientific context

The miniaturization of photonic components, inherent to the development of agile or smart devices and systems that are increasingly complex and environmentally compatible in terms of energy and natural resources, has opened up new areas of research that are very active at the international level due to the scientific, technological, industrial and environmental issues challenges. This miniaturization leads to an increase in the intensity of the interaction between matter and waves and thus exacerbates nonlinear photonic processes in the material due to the confinement of the guided wave field. Furthermore, it entails the amplification of the near electromagnetic field in interaction with the external environment surrounding the components, which allows the development of new integrated sensors or the exchange of information at the nanometric scale [1-5]. Now, the properties of materials with small dimensions and subjected to high optical powers, as well as their manufacturing methods, induce losses and non-linear behaviors that remain difficult to evaluate and integrate in a global approach.

The part of the CIPPIC project implied by this post-doctoral position therefore aims at using these intrinsic properties of miniaturization to develop new functionalities of integrated photonic guides in linear and nonlinear optics, and to strengthen the work in this field in FEMTO-ST [5-9].

2. Objectives

In this scientific context, the postdoctoral researcher will have to get involved in different works.

First, the theoretical and experimental study of new nonlinear photonic components (tapered optical fibers, ridge waveguides, special optical fibers ...) will allow the prediction of their optical behavior in operation according to their geometry and / or the material. The aim is to exacerbate the light-matter interaction thanks to their miniaturization via nonlinear effects (Kerr, Raman, Brillouin), and thus obtain new functionalities impossible to achieve in conventional waveguides.

In addition, the postdoctoral researcher will also take part of the design and assembly of various experimental devices in nonlinear fiber optics in order to analyze the spectral modifications of the guided light induced by the strong interaction with the guide and/or the external environment surrounding the component (generation of supercontinuum, frequency doubling, optical control of acoustic waves, ...). Moreover, we plan to characterize in a global approach and in a fully optical way the new photonic components in operation. For that purpose, we are currently developing a new original

characterization tool based on Rayleigh scattering allowing non-destructive and non-invasive spectral distributed measurements of linear properties as well as nonlinear effects along optical components in operation.

Finally, the postdoctoral researcher will also be involved in theoretical work concerning the study of linear and nonlinear wave propagation in these photonic guides in order to improve the physical understanding of the contributions of the underlying non-linear effects to these new structures.

3. Candidate profile

The candidate have to prove his relevant knowledge in the following disciplines: nonlinear optics, fiber optics, numerical methods (matlab, finite elements method). The candidate should also prove her/him pronounced affinity and mastery for experimental and numerical works.

4. Application

The application consists of ONE pdf-file comprising directly send to the contact:
- Curriculum Vitae (with list of publications)
- Short summary of the PhD thesis
- Suggestion of two referees with contact details
- Provide detailed explanation justifying your choice for this PostDoc project.

5. Contact

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References

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