

**PhD GRANTS 2021**

PhD project title: **Doped silica and optical fibers for pulsed radiotherapy dosimetry**

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Co-supervisor(s) (if any): Hicham EL HAMZAOU

Laboratory/ies: Physics of Lasers, Atoms and Molecules, University of Lille

Research program(s) concerned: ANR project Fidelio

Cotutelle (Y/N): N

Any other relevant information: Funding 100% secured, net salary ~1500 €/month, 3 years

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**PhD project summary**

Modern radiotherapy (RT) techniques increasingly require spatial and time-related preciseness in the measurement of the dose received by a targeted tumoural area in order to limit damages at the neighbouring safe cells. In this context, some scintillating optical fibers should have a role to play as submillimetre-dimension dosimeters, exhibiting a quick and linear response in a very large range of dose rates. The ANR project FIDELIO aims at developing this type of optical fibers dedicated to in-vivo dosimetry of X-ray or proton beams, especially for pulsed beam characterization in Flash-RT and HEPT (High-Energy Proton Therapy) techniques. Hence, the material used to fabricate those fibres should be both dose-resistant and dose-sensitive. It also needs to show a rapid luminescent response (response time shorter than 10  $\mu$ s). Silica doped with Ce<sup>3+</sup> ions meets these criteria. However, to enhance the material proton sensitivity, we also consider doping silica with Gd<sup>3+</sup> ions.

The thesis work will consist in characterizing silica glasses in the shape of small rods doped with Gd and codoped with Ce/Gd, but also the optical fibres drawn from these materials. The characterization techniques will be essentially from the spectroscopy domain (Raman, absorption, photoluminescence) but from the dosimetry too (radioluminescence under X-ray). All these techniques will be used in collaboration with the FIDELIO consortium (French labs in Saint Etienne, Nice). We search for a student profile in the domain of Physics, with solid knowledge in materials science and more specifically in rare-earth ions spectroscopy. The candidate will certainly have spectroscopic measurements to perform on place, but several measurement campaigns in St Etienne and Nice are planned, for complementary characterizations in spectroscopy and in dosimetry under X-ray or under proton beams.