



PhD position (36 month) for the development of nonlinear microscopy in the field of cancer diagnostics

A PhD position is available from beginning of September 2024 at the Institut Fresnel in Marseille, France, an academic joint laboratory of Aix-Marseille University, CNRS and Ecole Centrale.

Our mission

Our recent advances in coherent Raman microscopy allow for the real-time generation of artificially stained images of cancer samples which previously required time-consuming histopathological staining procedures. These images serve as feedback for surgeons to guide cancer surgery. As the main challenge, the examination of thick cancer samples is currently impossible, as all excitation light in coherent Raman microscopy is scattered forward and must pass through the sample. Within this project, you will develop a new coherent Raman technique called coherent Stokes Raman scattering (CSRS) microscopy. As the game-changer, CSRS will send the signal photons directly into the backward direction and, therefore, enable the investigation of thick, non-transparent cancer samples. Moreover, we will use CSRS' backscattering property to record the CSRS spectrum of tissue at unprecedented speed levels using novel spectrometer concepts and multi-focus or wide-field illumination approaches. From these CSRS spectra, a precise diagnosis of the cancerous tissue will be derived by machine learning algorithm. Your mission is to set up and characterize these novel microscopy techniques and evaluate their functionality on cancer tissue. Specifically, this means

Construction - You will build from scratch one or more new coherent Stokes Raman microscopes.

Simulation - You simulate your experiments in Matlab or Python. We work in close cooperation with theoretical physicists.

(Optional) experiments - You will examine cancer samples with your microscope and predict the malignancy of the tissue with the help of our machine learning experts at the institute.

Your profile

Attitude: For you, research is a vocation and not just a source of income. High levels of initiative, creativity and curiosity are expected from you.

Willingness to perform: Within your university education you were among the top 25%.

Qualification: You have completed a degree in the field of photonics, e.g. physics, physical chemistry or similar. Asset but is not required: You have developed microscopy techniques or other imaging methods during your master's thesis.

Language: The communication between scientists happens in English. Knowledge of French for everyday use can be acquired when you have started your position.

The offer

Resources & interest: Your project is funded by an ERC consolidators' grant (sCiSsoRS, 2.4Mio€). You will work with state-of-the-art equipment and your results are of high general interest. You will have a postdoc at your side for general support.

Multitasking: You can focus 100% on research. No distractions.

Team spirit: You will be part of a high-performing, multinational group of 10 independent scientists working in a team with 30 postdocs and PhD students to advance cutting-edge research in biomedical imaging.

Supervision: You will be in close contact with your supervisor. Upcoming challenges are addressed on the same day.

Salary: You will benefit from a competitive European salary level starting from $\geq 1700\text{€}$.

Related Publications

1. Sandro Heuke et al. "Coherent Stokes Raman scattering microscopy (CSRS)." Nat. Commun. 14, 3337 (2023).
2. Sandro Heuke et al. "Shot-noise limited tunable dual-vibrational frequency stimulated Raman scattering microscopy," Biomed. Opt. Express 12, 7780-7789 (2021).
3. Eric M. Fantuzzi, Sandro Heuke et al. "Wide-field coherent anti-Stokes Raman scattering microscopy using random illuminations. " Nat. Photon. (2023).

Homepage: <https://www.fresnel.fr/>

Curious? Please send a letter of motivation, a detailed CV, a reference letter and 1 academic references to Sandro.Heuke@fresnel.fr.

