PostDoc Proposal 2024

School - Location: Ecole Centrale Marseille	
Laboratory: Institut Fresnel	Web site: www.jeromewenger.com
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Title: Deep UV optical nanoantennas to enhance the ultraviolet autofluorescence of single proteins
Scientific field (one among the list- remove other choices): Natural & Life sciences: Physics & Astronomy
Free Key words: nano-optics, nanophotonics, plasmonics, autofluorescence, single molecule

Details for the subject:

The Institut Fresnel is a research state laboratory based in Marseille / France, devoted to research and higher education with affiliation to both CNRS and Aix Marseille University. Institut Fresnel is seeking to recruit talented, enthusiastic young scientists who are highly motivated to boost their research career in the areas of nano-optics and/or biophotonics.

Motivation

The interaction between light and single fluorescent molecules is limited by the size mismatch between their wavelengths and dimensions, leading to weak fluorescence signals in diffraction-limited microscopes. Plasmonic optical nanoantennas offer powerful solutions to enhance the light-matter interactions at the deeply subwavelength scale. However most nanoantenna designs have so far focused on the visible and near-infrared regions. Today, there is a growing interest in extending the plasmonic nanoantennas operating range deep into the ultraviolet (UV) region, to take maximum benefit of the strong molecular absorption bands occurring in the UV range.

Research description

Jerome Wenger's group has acquired a wide expertise in the nanoscale control of light fields in plasmonic nanostructures and its application to enhance fluorescence spectroscopy applications. Since 2017 the group has pioneered the domain of single molecule autofluorescence detection in the UV enhanced by photonic nanostructures.

We are seeking candidates to join our team for an exciting project focused on the efficient monitoring of single proteins using their enhanced autofluorescence through optical nanoantennas. This cutting-edge approach harnesses the power of resonantn plasmonic optical nanoantennas in the UV range 250 – 400 nm to enable analysis of individual label-free proteins at physiologically relevant concentrations by localizing and enhancing UV light-matter interactions at the nanoscale.

The primary objective of this project is to extend the capabilities of conventional optical microscopes by employing optical nanoantennas to enhance single molecule fluorescence detection in the ultraviolet range. This research area represents a new and promising field of study. By manipulating ultraviolet energy at the nanoscale, the nanophotonic optical antenna elements go beyond the limitations of diffraction-limited microscopes, enabling us to achieve single molecule resolution without the need for external fluorescent labels.

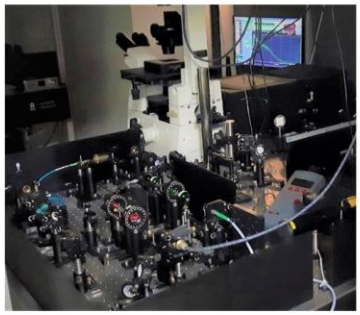
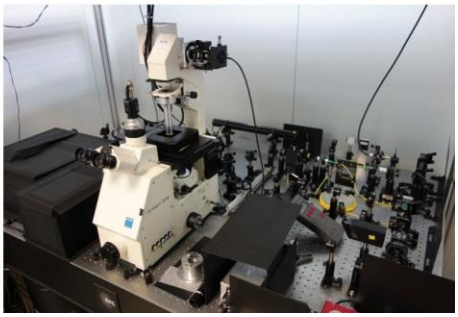
This interdisciplinary project will explore the interfaces between nanophotonics, biophysics, and fluorescence spectroscopy. The synergistic combination of these fields will lead to groundbreaking applications in the analysis of single proteins, providing unprecedented insights into the behavior of individual molecules. The outcomes of this project will have far-reaching implications empowering structural biology and drug discovery.

If you are passionate about pushing the boundaries of scientific research, this position offers a unique opportunity to contribute to cutting-edge advancements in the field. Join our dynamic team and be at the forefront of innovation in nanophotonics, biophysics, and fluorescence spectroscopy.

Selection of recent relevant publications:

- P Roy, JB Claude, S Tiwari, A Barulin, J Wenger, *Ultraviolet Nanophotonics Enables Autofluorescence Correlation Spectroscopy on Label-Free Proteins with a Single Tryptophan*, Nano Lett. 23, 497-504 (2023). ArXiv 2301.01516
- Barulin, P. Roy, J.-B. Claude, J. Wenger, *Ultraviolet optical horn antennas for label-free detection of single proteins*, Nature Commun. 13, Article number: 1842 (2022). HAL 3632294
- Barulin, P. Roy, J.-B. Claude, J. Wenger, *Purcell radiative rate enhancement of label-free proteins with ultraviolet aluminum plasmonics*, J. Phys. D: Appl. Phys. 54, 425101 (2021). ArXiv 2107.06357
- Barulin, J.-B. Claude, S. Patra, N. Bonod, J. Wenger, *Deep Ultraviolet Plasmonic Enhancement of Single Protein Autofluorescence in Zero-Mode Waveguides*, Nano Lett. 19, 7434-7442 (2019). ArXiv 1909.08227



Supervisor Dr Jerome Wenger

Google Scholar https://scholar.google.fr/citations?user=K3ujBLwAAAAJ&hl=fr

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