PhD fellowship: Nanoplastics Detection Exploiting UV Autofluorescence for Enhanced Sensitivity

Laboratory: Institut Fresnel (Marseille)

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Title of the thesis subject: Nanoplastics Detection Exploiting UV Autofluorescence for Enhanced Sensitivity

Keywords: Optical Fluorescence Microscopy, Nanophotonics, UV photonics, Time-resolved optical detection, Nanoplastics

Description of the PhD thesis topic:

The widespread use of plastic materials has led to a growing environmental crisis, with micro- and nanoplastics posing significant challenges. Nanoplastics, defined as plastic particles smaller than 1 µm, present the greatest threat due to their potential for deeper biological penetration and long-term persistence. While current analysis methods are effective for detecting particles larger than 3 µm, the identification and quantification of nanoplastics remain a major technological hurdle.

The NanoPlasticsDetect project aims to break new ground in the quantitative detection of nanoplastics by exploiting time-resolved ultraviolet (UV) autofluorescence. Plastics emit intrinsic autofluorescence when illuminated in the UV, providing superior sensitivity to current Raman and infrared spectroscopies. The central objective is to improve the detection sensitivity thanks to this autofluorescence, targeting particles as small as 30 nm in diameter. A further original feature is the ability to distinguish between different types of plastic by exploiting their autofluorescence lifetime.

This approach requires the development of advanced characterization techniques, as well as a deeper understanding of the UV photophysics of nanoplastics. The NanoPlasticsDetect project addresses this gap by integrating cutting-edge advances in spectroscopy, nanophotonics, and the synthesis of calibrated plastic nanoparticles. The project builds on the partners' recent progress and preliminary results, benefiting from a highly complementary expertise between the collaborating teams.

This novel UV-based detection approach promises unprecedented sensitivity, the ability to detect nanoscale particles, and a direct, label-free detection method well-suited for in situ applications. By pushing the boundaries of nanoplastic detection, the project will provide critical tools for better understanding and quantifying this invisible yet pervasive form of pollution.

Additional information:
* Salary: according to current CNRS regulation
* Begin/End dates: to be discussed
* Miscellaneous: PhD funding already secured
* About us: 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 nanosciences, biosensing, and nano/biotechnologies. 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.
Web Links www.jeromewenger.com www.fresnel.fr

Gains of this PhD thesis project:

1. Close supervision by an internationally recognized expert.
2. Access to state-of-the-art equipment and technology, allowing to perform cutting-edge research and stay at the forefront of the field.
3. The opportunity to work on groundbreaking research projects that have the potential to make a significant impact in the field of environment monitoring.
4. Personal and professional development training, including leadership and communication skills to prepare for a successful career in academia or industry.
5. The opportunity to develop a diverse set of transferable skills and gain valuable experience that will be highly sought after by employers.

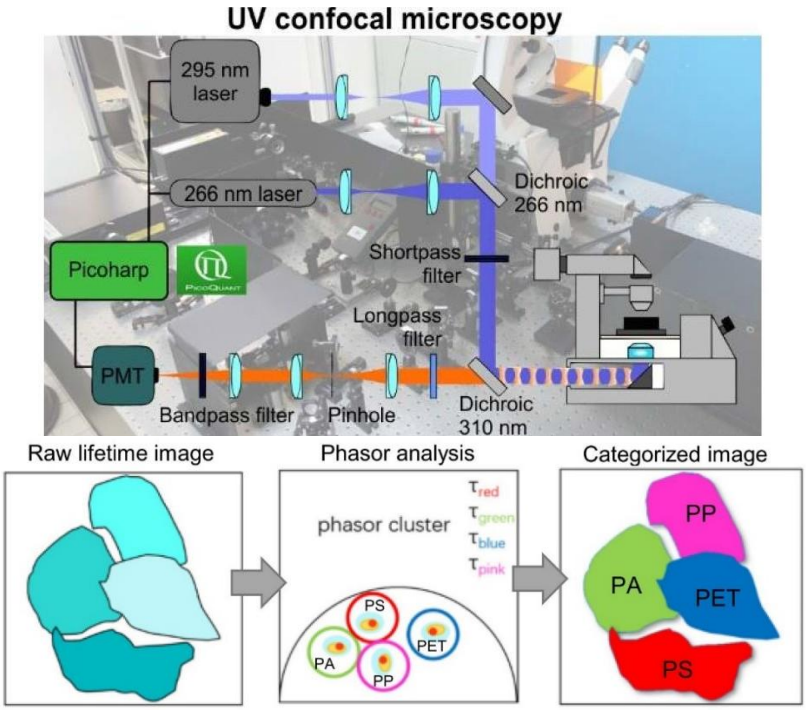

Figure 1. Time-resolved confocal UV microscope to categorize between different nanoplastics