

Thesis subject

Laboratory : Institut Fresnel

Thesis supervisor : Dr Jérome Wenger jerome.wenger@fresnel.fr

Co-supervisor :

Title of the thesis subject :

Detection of nanoplastics with ultraviolet nanophotonics

Description of the thesis subject :

The intensive use of plastic materials has given rise to an alarming pollution linked to the presence of micro- and nanoplastics. The latter have dimensions of less than 1 μ m, making them an even greater threat to biodiversity and human health. While current analysis methods are limited to particles larger than 5 μ m, the detection of nanoplastics remains a major challenge.

This PhD 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 detection sensitivity thanks to this autofluorescence property, targeting particles as small as 30 nm in diameter. A further original feature is the ability to differentiate between types of plastic by exploiting their autofluorescence lifetime.

Developing this approach requires the development of suitable characterization methods, as well as a deeper understanding of the UV photophysics of nanoplastics. The project aims to fill this gap by exploiting joint developments in spectroscopy, nanophotonics and the synthesis of calibrated plastic nanoparticles. The project builds on our recent progress and preliminary results.

This novel UV approach promises enhanced sensitivity, the ability to detect nanoscale particles, and a direct, label-free application ideal for in situ scenarios. The project will open up new perspectives for the detection of nanoplastics, helping to better understand and quantify this invisible pollution.

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 project

- 1. Close supervision by an internationally recognized expert in the field of nanophotonics and single molecule fluorescence techniques.
- 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 nanophotonics.
- 4. Attendance at weekly seminars and opportunities to present at major international conferences, giving a platform to showcase their research and make valuable connections.
- 5. Personal and professional development training, including leadership and communication skills to prepare for a successful career in academia or industry.
- 6. The opportunity to contribute to the advancement of knowledge in the field and make a meaningful impact on the world through their research.

