SAMOVAR lab,
Telecom SudParis

RIPPLE

Resonant Illumination Platform for Precise Liquid Evaluation

#MultimodalMeasurements #LightResonance #NanoPlasticsDetection

TELECOM SudParis

INSTITUT POLYTECHNIQUE DE PARIS

THE PROBLEM ADRESSED

Probing the quality of liquid samples can be daunting: a dedicated instrument is required for each type of measurement, either field deployable basic probes, or complex and highly sensitive laboratory equipments. Still, characterizing nano-objects remains unreachable for the most part: nano-plastics in water, molecular assembly, protein-protein interactions.

Our project tackles those very issues. We have invented a simple-to-use, compact instrument capable of achieving laboratory levels of sensitivity for a multitude of multimodal measurements in a single experimental setup: turbidity, chemical pollutants, nano-plastics, or bacteria in water. Benefiting from light resonance, it unlocks measurements on minute signals at the nanoscopic scale.

The Telecom SudParis Computational Optics team from SAMOVAR has a rare expertise in both deep-learning and experimental physics. Combining know-how for material fabrication, a strong knowledge of fundamental optics, and experience in industrial R&D, they are uniquely positioned to tackle this challenge.

TECHNOLOGY

The technology consists in a highly reflective Lambertian cavity allowing for the precise, multimodal probing of solutions: scattering spectroscopy, ring-down absorption spectroscopy, ultra-weak fluorescent light detection.

- Record high 99.94% albedo
- 62m sample mean free path
- 10500 interferometric Finesse
- 2.7pm à 1kHz noise floor
- 8 to 10 decades dynamic ranges up to 100MHz
- 25pm sensitivity to colloid motion
- 100 to 1000 amplification compared to conventional methods

COMPETITIVE ADVANTAGES

- First 3D stochastic spectrometer, unlocking new types of measurements for nano-objects
- Compact, deployable, laboratory-grade instrument
- Multimodal instrument combining all major liquid probing methods

APPLICATION

- Quantification of molecular interactions (protein-protein interactions, ADCs)
- Detection of plastics, bacteria and pollutants (water quality testing)
- Vaccine stability during transport

DEVELOPMENT STATUS

TRL 3
Each measurement mode can be performed in laboratory conditions

INVENTORS & CONTACTS

- GRACIANI Guillaume, Associate professor
  guillaume.graciani@ip-paris.fr
- PORTIER Pauline, Development Project Manager
  pauline.portier@telecom-sudparis.eu

PUBLICATIONS

- Graciani, G. Nature Communications Physics, 5(1), 239.
- Graciani, G. ACS nano, 16(10), 16796-16805.
- Graciani, G. In SPIE Applied Optical Metrology III (Vol. 11102, pp. 167-172). SPIE.
- Khaoua, I.*, Graciani, G.* Scientific Reports, 11(1), 3530.

LOOKING FOR

- Industrial co-development partners
- Broadening use-cases