



Project title: *Real Time Label Free Nanoscopy Using Infra Red Absorption*

Grant agreement no.: 280804-2 LANIR CP-TP

Romanian team leader: Prof. George STANCIU

The LANIR project proposes to develop a ground-breaking **nanoscope** based on infra red (IR) absorption which is widely used in chemical and structural imaging of biological and non biological materials.

We propose to break away from the diffraction limit of IR and achieve **70 nm lateral resolution** on a routine basis in a **table top configuration** with a compact and novel IR laser source. This **novel imaging tool**, the Infra Red Nanoscope (IRN) achieves a significant improvement over the resolution that can be achieved currently with table-top IR microscopes (~100 μm) and or synchrotron-based IR microscopes (~2 μm). IRN will also incorporate 3Dimensional (3D) imaging, which is currently not possible in IR microscopy.

Proposed LANIR Instrument Features

- **70 nm lateral resolution in Infra Red**
- **Label free 2D and 3D imaging with chemical fingerprinting**
- **500 nm depth resolution**
- **High signal intensity in a Table-Top set up**
- **High throughput due to fast imaging**
- **Significant improvement in 'precision, resolution, cost, ease of operation'**
- **Non-destructive analysis** of subsurface and 'buried nanofeatures'
- **Open and flexible design** allowing **integrated metrology** for quality control
- **Multimodality**: integrates with near field probe-based contemporary approaches

List of Beneficiaries						
Beneficiary Number	Beneficiary name	Beneficiary short name	Country	Beneficiary Type	Date enter project	Date exit project
1	<i>Materials and Surface Science Institute (MSSI), University of Limerick</i>	UL	Ireland	RTD Performer	1	42
2	LaserSpec	LaserSpec	Belgium	SME	1	42
3	MultiTel ASBL	MultiT	Belgium	SME	1	42
4	GNR Srl.	GNR	Italy	SME	1	42
5	NT-MDT Ireland, Ltd.	NT-MDT	Ireland	SME	1	42
6	PlasmaChem GmbH	PlasmaC	Germany	SME	1	42
7	LEMI	LEMI	France	SME	1	42
8	<i>Centre for Microscopy-Microanalysis and Information Processing</i> Universitatea Politehnica din Bucuresti	UPB	Romania	RTD Performer	1	42

9	<i>Superresolution Microscopy Laboratory</i> Fondazione Istituto Italiano di Tecnologia	IIT	Italy	RTD Performer	1	42
10	<i>Bioengineering and Medical Informatics Laboratory,</i> Università degli Studi di Genova Via Balbi	UniGe	Italy	RTD Performer	1	42
11	SOLEIL Synchrotron	SOLEIL	France	RTD Performer	1	42

Role of CMMIP-UPB in the project.

- To develop an optical nanoscope working in visible and near infrared
- To develop the software for image processing;
- To integrate IRN in a multimodal system.

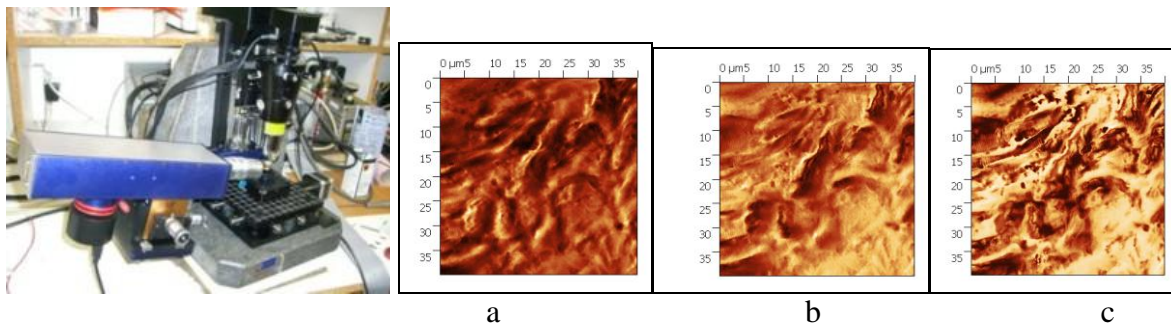
CMMIP- UPB is the leader of the workpackage 2.

In the project there will be three microscopes built in **UL**, **UPB** and **IIT**.

Research infrastructure involved in the project (CMMIP-UPB): laser scanning microscope, scanning probe microscopes, Ti:sapphire laser.

Results (CMMIP- UPB)

- In the frame of UPB was built a new laser scanning microscope which will be upgraded in a nanoscope working in visible and near infrared;
- CMMPI upgraded a commercial atomic force microscope with a module for apertureless – near field optical microscope and a confocal scanning laser microscope (multimodality);
- Image post processing



Multimodal nanoscope in UPB Rabbit cornea images in multimodal nanoscopy: a)AFM; b) s- SNOM; c) SHG in SNOM

Human resources: George Stanciu (professor), Radu Hristu (post doc); Stefan Stanciu (postdoc), Denis Tranca (Ph. D student), Alecs Matei (Master student), Dumitru Vragneanu (technician)

Expected impact

- **Non-destructive imaging of the structure and chemistry of buried nanoscale features and defects** is possible for the first time in tribological coatings, dye-sensitised photovoltaics and other industry relevant 2D and 3D samples;
- **Non destructive tomography of biological samples** and organic/inorganic interfaces with nanoresolution;
- Applications to disease detection and therapeutic control in the areas of medicine (**Alzheimer's Disease** and **chemotherapy of lung cancer**). Label free imaging of activities of subcellular components;

- Novel concept of IR nanoscopy permits **imaging cellular and nanomaterials with high resolution and chemical fingerprinting**;
- Provides tool to enables **new investigations** in the area of nanomaterials, cellomics and medicine;
- **Integrated metrology** provides tools that were previously unavailable for monitoring nanomaterials processes;
- Innovation for new products with high added value.

Romanian team will be very well integrated in the European research networks working in the field of microscopy techniques as well as biological and nanomaterials fields. In the present project CMMIP-UPB continue research activity from the previous FP 7 project : *Electrically Modified Biomaterials' surfaces: From Atoms to Applications (Bioelectric Surface)*