Research Team name: **LASER SPECTROSCOPY**

Presenter name/**Team Leader**: **Mihail - Lucian PASCU**

Number of team members: **11**

STRUCTURE BY FUNCTIONS

1 Professor, PhD head

4 PhD: 1 Senior Research Scientist

3 Research Scientists; 1 with double position: Bucharest and Cornell University

4 PhD Students & variable number of masterands

1 Research scientist

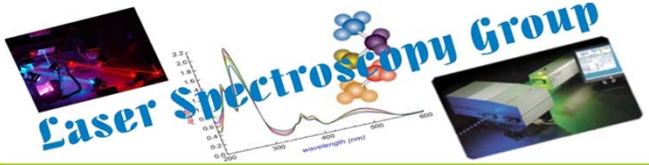
1 Technician

SPECIALITIES

*** 8 Physicists: - 4 Optics, Spectroscopy, Laser**
- 3 Biophysics
- 1 Physics of radio waves

*** 2 Engineers: - 1 Bioelectronics engineering**
- 1Environment engineering

*** 1 Technician, multifunctional: mechanics, optics, electronics**



Other Research Teams

1.OPTHALMOGY CLINIC, UNIVERSITY OF MEDICINE & PHARMACY, BUCHAREST.

Number of team members: **5.** Team leader: **Liliana Voinea**

STRUCTURE

1 Professor, PhD head; 1 Assistant Professor, PhD; 4 medical doctors, ophtalmologists

2. PHYSICS FACULTY, UNIVERSITY OF BUCHAREST, CHAIR: OPTICS, SPECTROSCOPY, LASERS

Number of members: 3 (permanent staff). Team leader: **Mihail Lucian Pascu**

STRUCTURE

1 Professor, PhD head; 2 Associate Professors; 3 -5 students

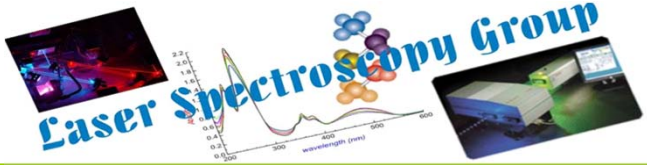
3. NATIONAL INSTITUTE FOR NUCLEAR PHYSICS AND ENGINEERING

Number of members: 4. Team leader: **Mihnea Dulea**

STRUCTURE

1 Senior research scientist; 3 Research scientists

TOTAL: 4 TEAMS; 23 PERSONNEL



Research interests related to MP1106:

WG1. Fundamentals

(V1) single interfaces (e.g. an isolated bubble or droplet), (V2) multiple interfaces (e.g. multi-bubble/droplet systems like clusters, aggregates or clouds)

* The influence of surface properties on the fundamental behavior (hydrodynamics and heat/mass transfer) of single droplets.
* Bubble formation and growth and bubble motion in external fields (e.g., electrical, magnetic, temperature fields) based on new experimental data.

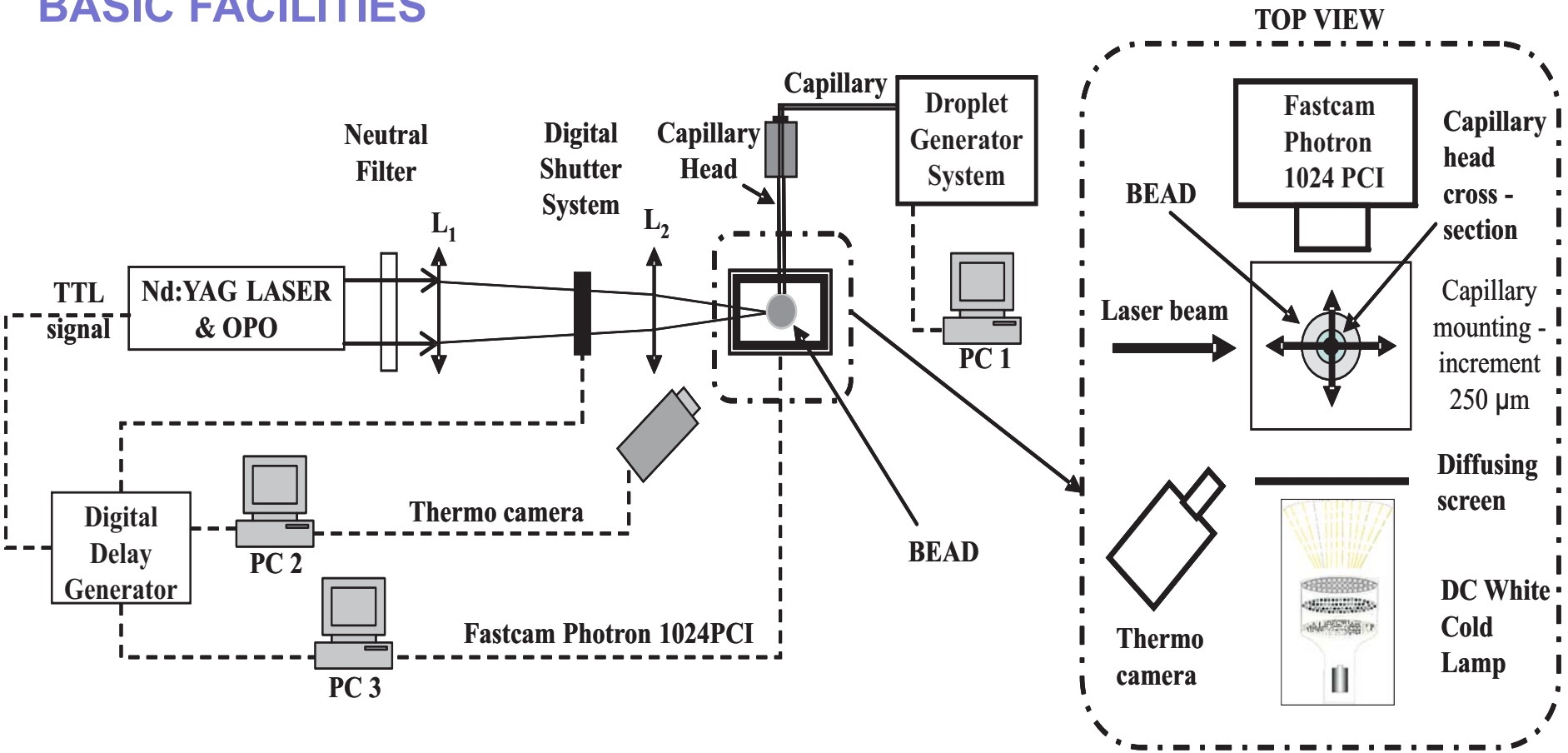
WG2 Materials

* Preparation of aerosols with specific surface properties.

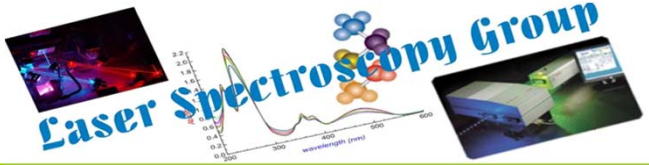
WG3 Diagnostics

* Measuring static and dynamic interfacial tension.
* Determination of droplet size distribution based on improved optical/laser techniques
* **Using the droplets as transport vectors of medicines to biological targets.**

BASIC FACILITIES



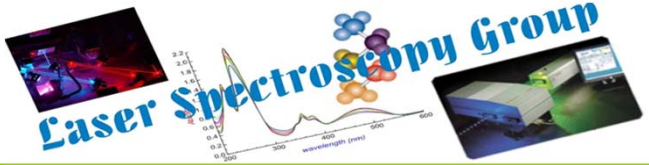
TUNABLE LASERS UV-VIS-NIR; PENDANT DROPLETS GENERATORS; FAST CAMERA (200KFRAMES/S);THERMOCAMERA; SPECTROMETER SYSTEMS FOR REAL TIME LIF AND RAMAN MEASUREMENTS; ASSOCIATED ELECTRONICS; HIGH POWER COMPUTER CLUSTER SYSTEM.



BASIC FACILITIES

*Experimental set-ups for resonant (time resolved LIF) and unresonant laser beam – droplets interactions on pendant micro-droplets including:
-Pulsed tunable laser Panther OPO Continuum (215nm-710nm) pumped by: THG of YAG:Nd laser (120 mJ/pulse, pulse width 5ns, 10 Hz);SHG of the YAG:Nd laser (200mJ/ pulse, pulse width 5ns, 10 Hz)
-Pulsed Mode-Locked Ti:sapphire Laser, Tsunami (790nm, peak power >170kW, pulse width <100fs, 80MHz)
-Spectrograph Acton Research, Spectra Pro, model SP-2750 (optical resolution 0.01nm); ICCD CAMERA with PTG control, Princeton Instr.
-Ocean Optics HR4000 spectrometer;
-Fast camera, Photron, model Fastcam 100k 1024PCI;
-Thermo camera, Flir, model ThermaCAM E45;
-Dual Syringe Dispenser/Droplets Generator, Hamilton, Microlab 500

*Experimental set-ups for Raman Spectroscopy on micro-droplets: the SHG of a YAG:Nd laser (200mJ/ pulse, 10 Hz); Camera ICCD, Princeton Instruments; Spectrograph Acton Research, model SP-2750.



BASIC FACILITIES

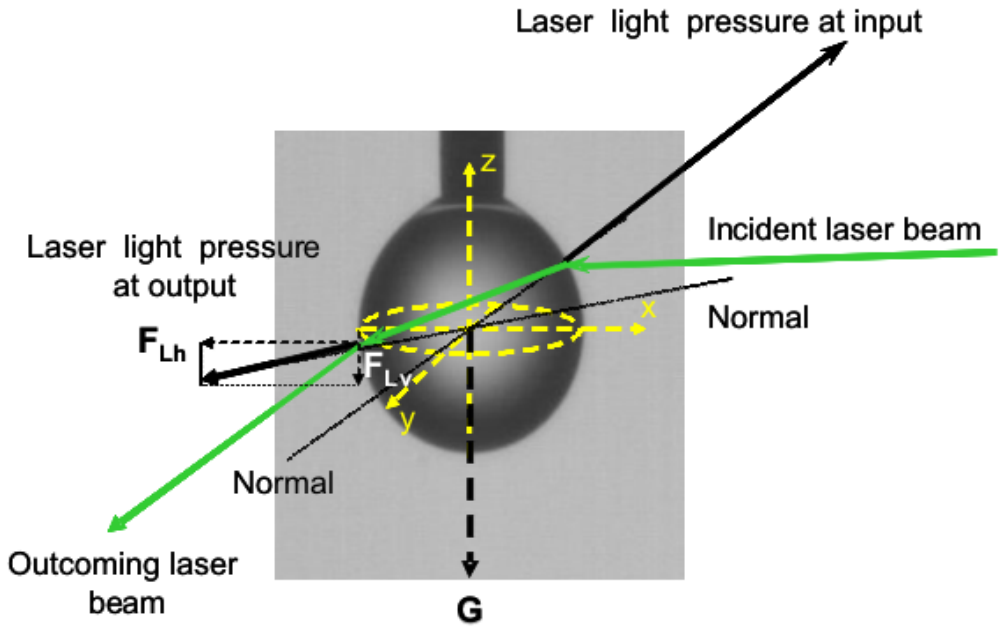
* Profile Analysis Tensiometer, Sinterface, model PAT1, for droplets wetting properties characterization (surface tension and contact angle measurements)
* Spectrophotometer Perkin Elmer, Lambda 950 (spectral range180nm-3.3μm)
* Nitrogen Pulsed Laser (λ=337.1 nm, pulse width 700 psec, adjustable rep. rate 1 … 50 Hz, maximum pulse power 100kW)
* Nitrogen laser pumped dye Laser (spectral range 400 nm – 700 nm, FTW 700 ps, rep.rate adjustable 1 …50 Hz, minimum pulse power 10 kW)
* Digital Oscilloscope Tektronix TDS 724A, (500MHz, 500 p/sampling)
* CW and pulsed flash lamps (Xenon - Hammamatsu)
* Experimental set-ups for laser intensity time series analysis: Photodetector, Electro-optic Technology, model ET 2030A; Digital Oscilloscope, Tektronix, model DPO7254 (bandwidth 2.5 GHz)

PROJECTS

3 RUNNING PROJECTS WHICH ARE RELATED TO THE COST NETWORK MP 1106

1 – 4 NATIONAL PROJECTS UNDER ANALYSIS FOR SUBMISSION

1 FP7 PROJECT IN PREPARATION STAGE (?)



Projects

#1 project :

Title: ***Activity modeling and simulation of efflux pump inhibitors based on advanced laser methods***

Duration: 3 years, beginning August 2012

Funding organization: Romanian Agency for Scientific Research/ Romanian Ministry of Education

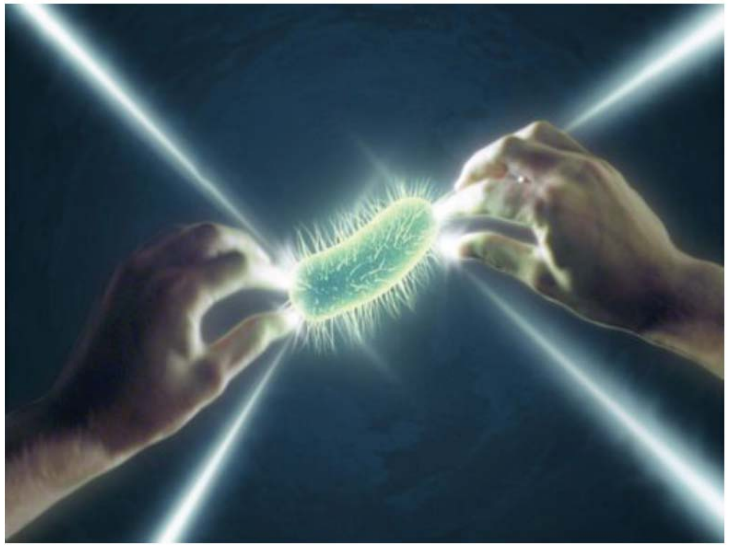
People involved and their function: all members of the research group

Facilities/equipment: as mentioned, with completions

Most interesting results (aims):

*** Modifications of phenothiazines in droplets solutions by exposure to laser radiation**

*** Application of droplets on culture of bacteria; study of the effect on them in cases of the development of multiple drug resistance (MDR)**



#2 project :

Title: Laser beams interaction with milli- and microdroplets

Duration: 4 years, beginning 2010

Funding organization: Institutional financing/Romanian Agency for Scientific Research/ Romanian Ministry of Education

People involved and their function: all members of the research group

Facilities/equipment: as mentioned with completions

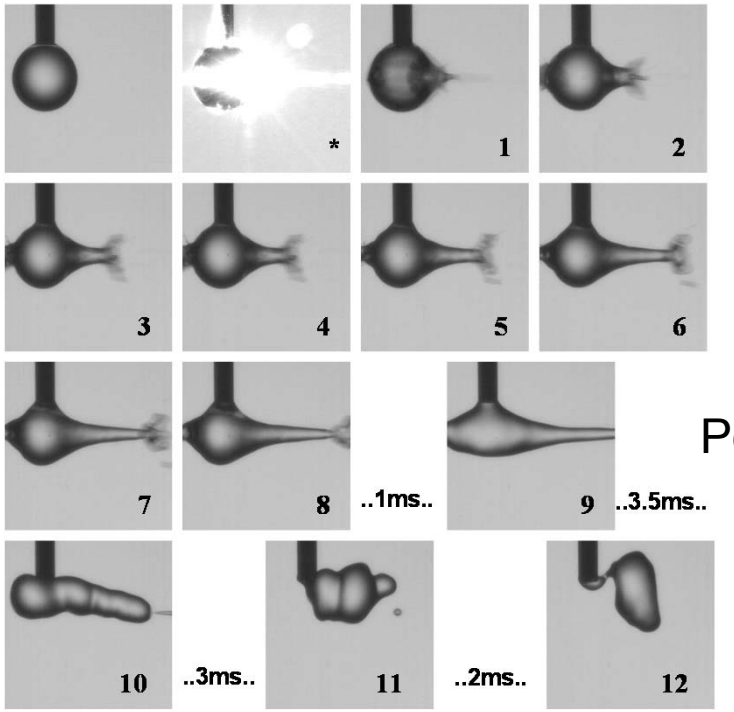
Most interesting results:

*** Laser beam unresonant interaction with droplets and generation of micro and nanodroplets in view of using droplets as vectors to transport medicines to targets**

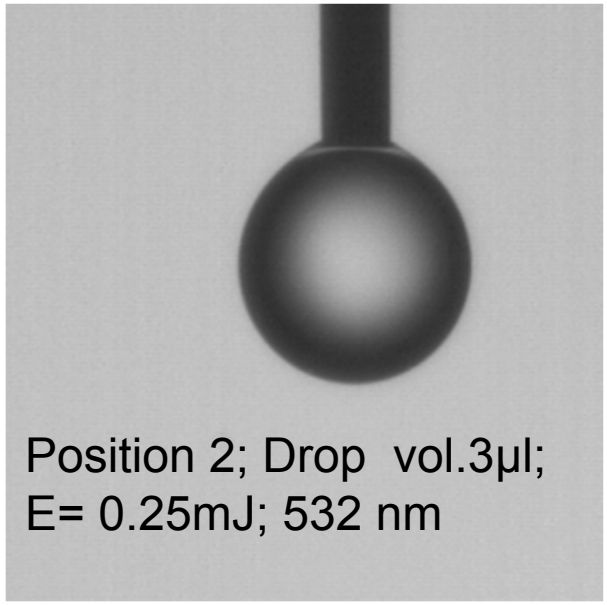
*** Laser beam resonant interaction with droplets: droplet tunable lasers**

Topics for Research Proposal

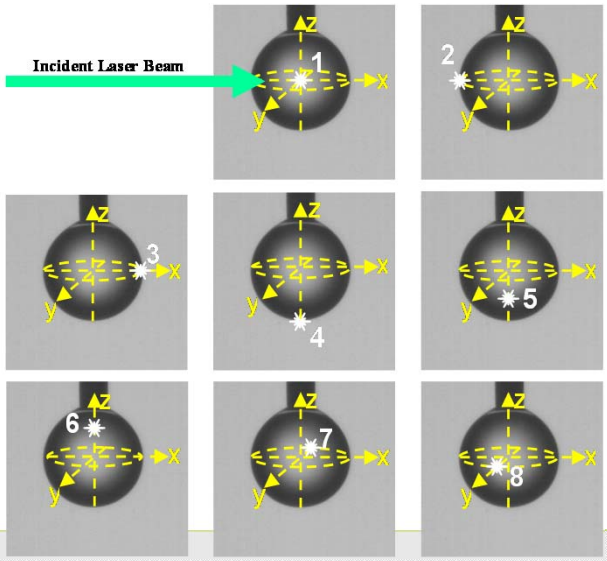
Title: Laser beams interaction with hanging droplets: biomedical and environmental applications



Position 3

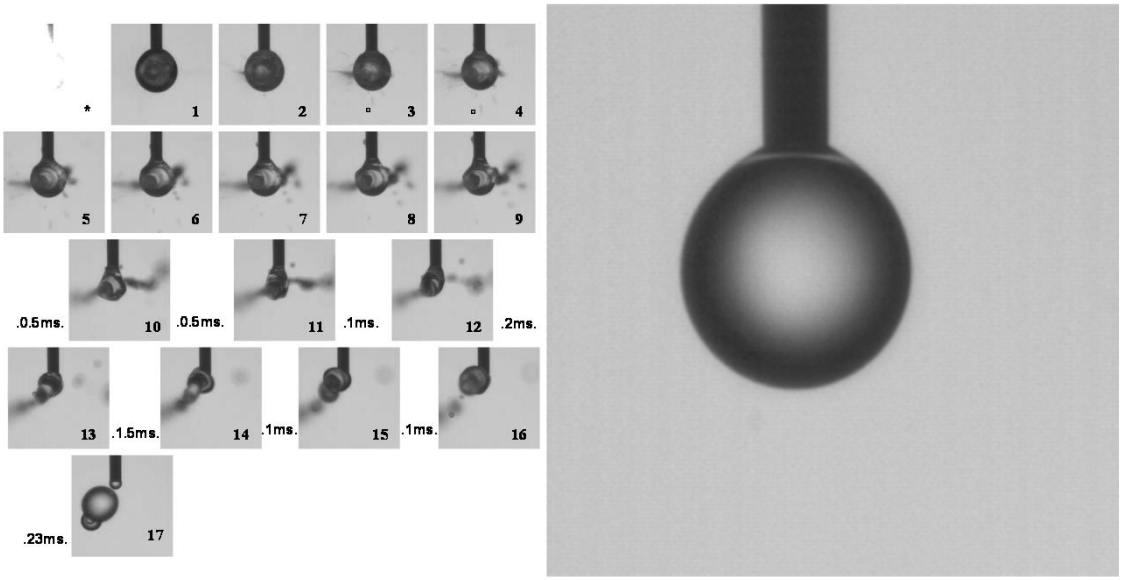


Position 2; Drop vol.3µl;
E= 0.25mJ; 532 nm

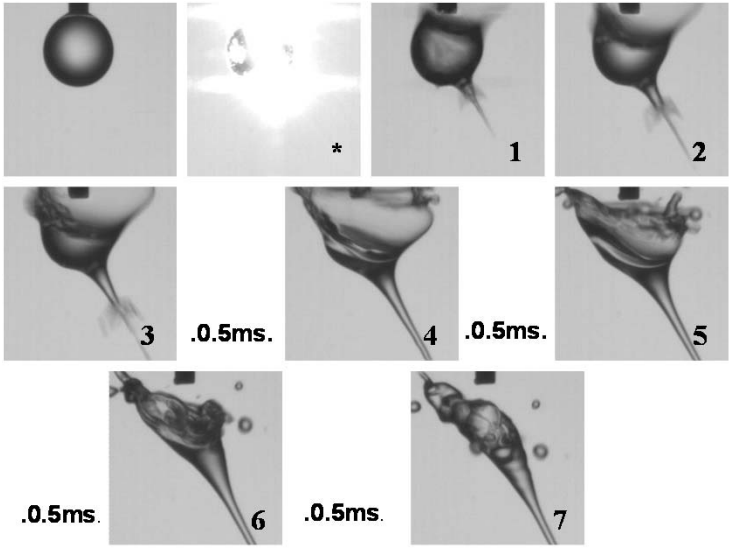


Duration: 3 years
Expertise required:**Cooperation with MP 1106 partners**
Facilities/equipment required: None specifically.

Beam incident on droplet in equatorial plane, on the lateral face located in front of camera. Drop volume 3.5μl; E= 0.7mJ.



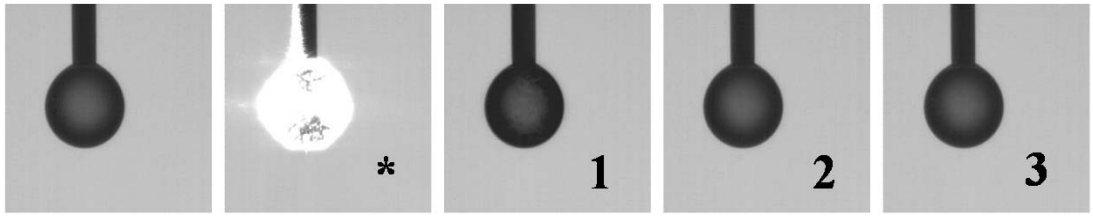
Laser beam interaction with the droplet, when sent horizontally, at the South Pole of it.
Drop volume 3.5μl; E=0.7mJ



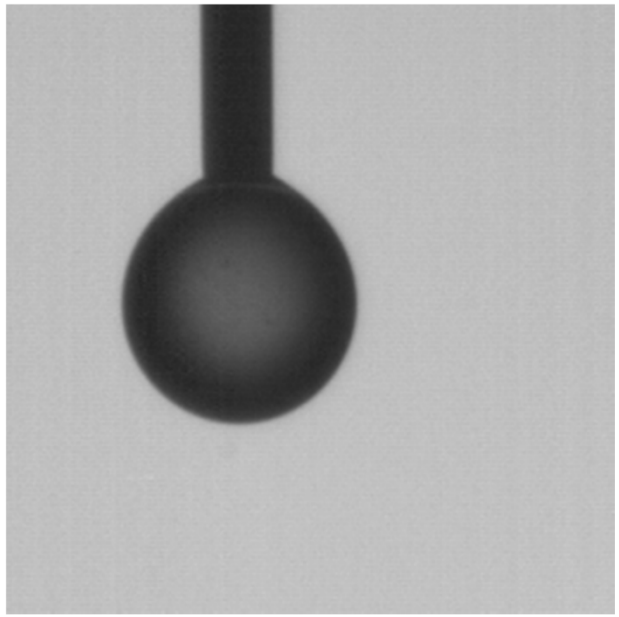
THE LASER BEAM CROSSES THE DROPLET IN psec

Resonant interaction

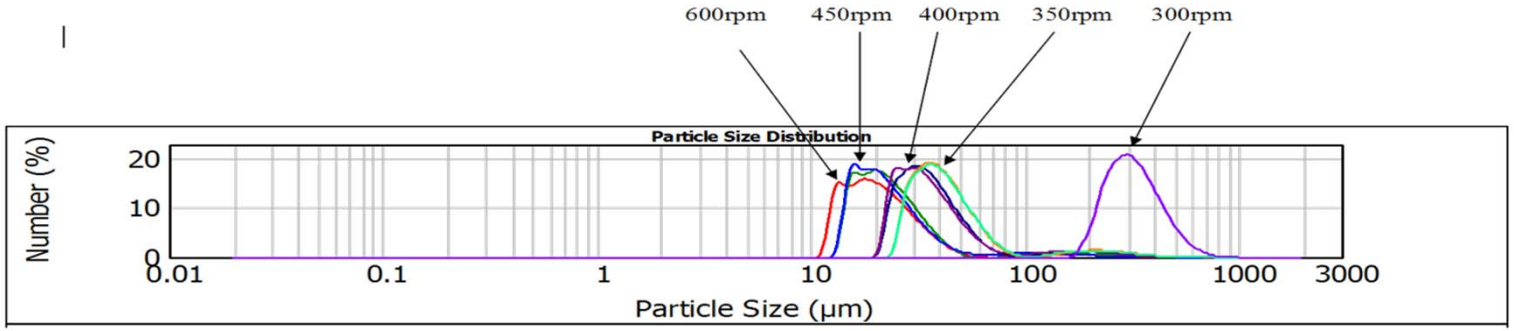
R6G solutions in distilled water at 10^{-3}M concentration

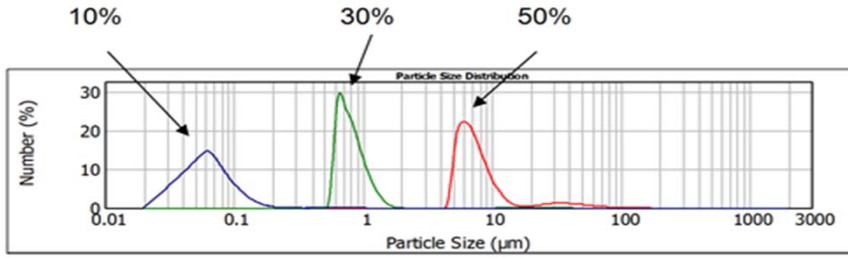


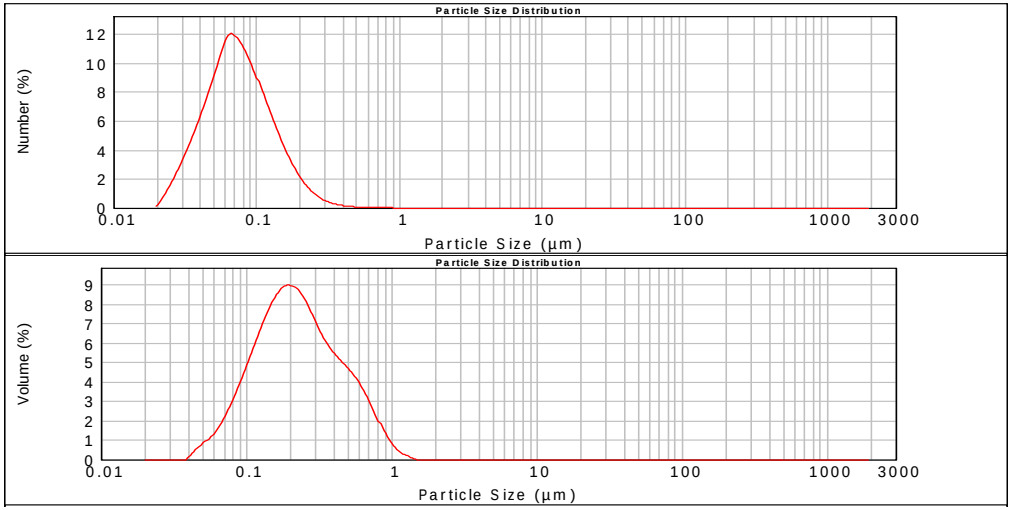
Effects produced at resonant interaction on the droplet containing R6G at 10^{-3}M in distilled water by the laser beam sent in its equatorial plane and focused in its centre . E_1 = 0.25mJ; 532 nm



High numbers of nanometre droplets produced in emulsions of immiscible substances (cooperation with Thodoris Karapanthios)





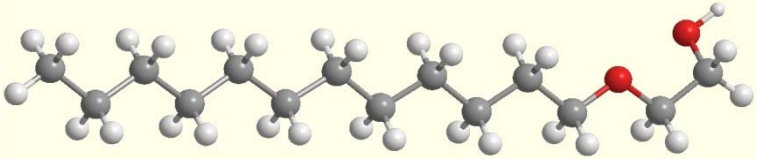


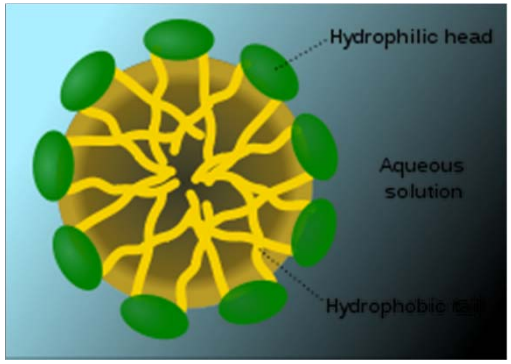
***High speed homogenizer Ultra Turax T25 25000 rpm**
***Homogenizer assuring a high pressure difference: ΔP = 800 bar.**
***Surfactant (TWEEN 80) concentration in water: 2.5*10^{-3}M (3200 ppm).**

10% oil 90% water

Study of commercial grade Aetoxisclerol by optical means, in view of its use in varicose vein treatment

AETOXISCLEROL (Polidocanol)

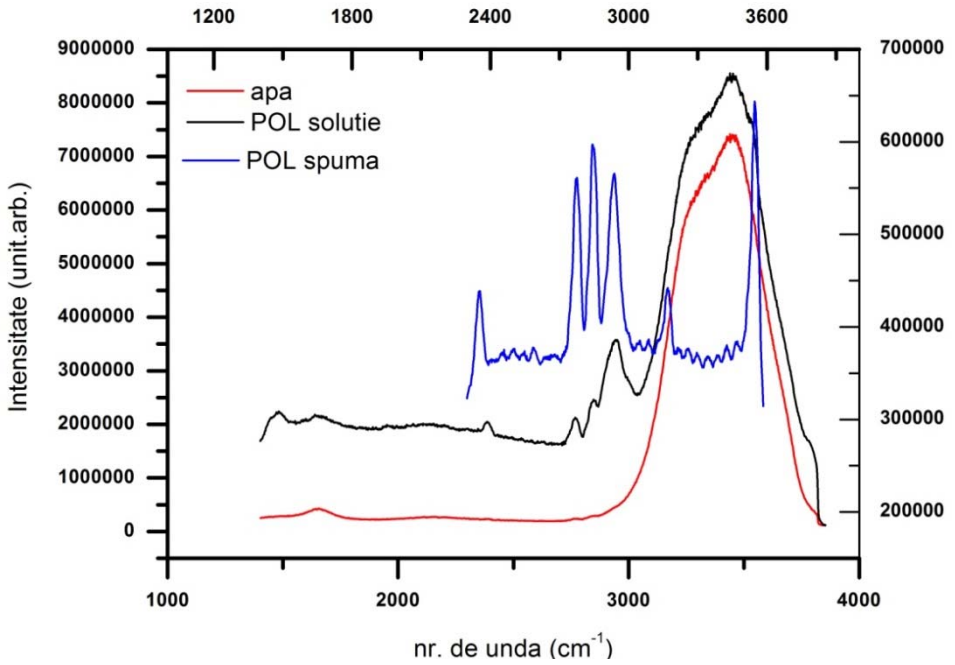


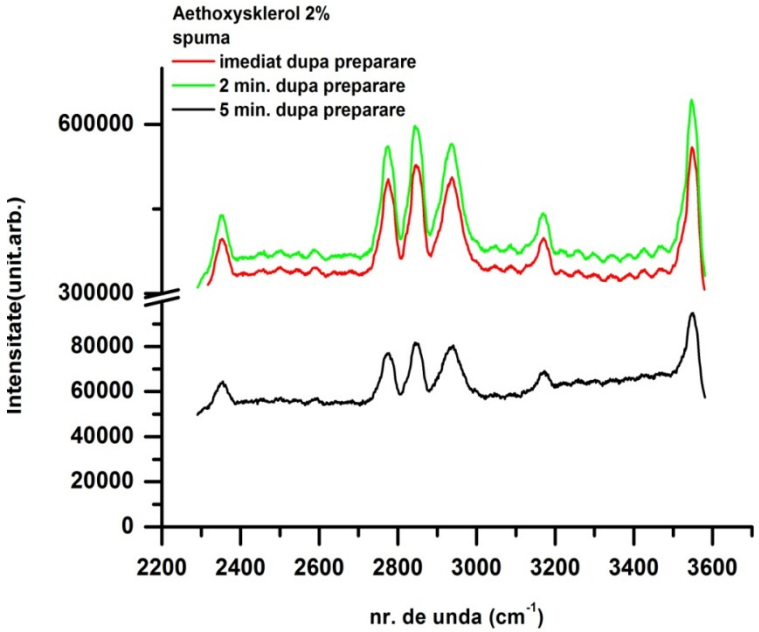


Aetoxisclerol (Polidocanol)

Lauromacrogol 400
Sodium Hydrogen Phosphate
Potassium Dihydrogen Phosphate
Ethyl Alcohol
Pure Water

Aetoxisclerol (Polidocanol) is used to treat varicose veins as foam exposed in the tissue to laser radiation at 1064 nm. The use of foam and the exposed to laser beam makes the POL 3 – 5 times more efficient in destroying the Varicles and assures a better comfort to the patients.





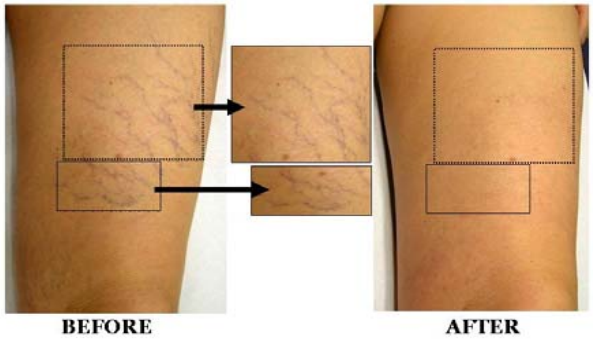


Fig. 7

Thank you for your attention