PHOTONICS - EUROPHOTONICS MASTER COURSE

MASTER THESIS PROPOSAL

Course 2015 –2016

Laboratory: ICFO - Optoelectronics
City, Country: Castelldefels (Barcelona), Spain

Title of the master thesis: CMOS or CCD based lens-free microscopy

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Summary of the subject (maximum 1 page):

The Optoelectronics group at ICFO-The Institute of Photonic Sciences in Barcelona Spain is seeking to hire a software research engineer position. The position involves working on imaging bio-sensor. It is part of several projects involving collaborations with local and international research centers, companies and hospitals. The candidate will collaborate toward the design, construction and validation for the instruments.

In life sciences research, pharmaceutical drug discovery, and clinical diagnostics, flow cytometry is one of the most promising fields for growth and innovation. Flow cytometry is a laboratory analytical technology that can rapidly measure multiple parameters on single cells and particles (i.e. exosomes). One of the most important applications of flow cytometry is clinical diagnostics. However, flow cytometry is facing budgetary constraints from healthcare payers and providers, because they continuously require convincing demonstrations of the impact of such expensive technologies on patient care.

Cost is a significant factor, but advances in CCD technology and its application are reducing the basic equipment cost. Affordability of all aspects of flow cytometry research is a major concern and one that vendors need to address. Unlike flow cytometers, image cytometers don't measure by illuminating the cells with a laser one by one but takes an image of cells arranged on a microscope slide and analyzes thousands of cells in a single picture. For these

reasons image cytometers are entering gradually into the market as they offer similar characteristics and benefits to the classic flow cytometers but at lower cost.

In this project we aim at low cost, low energy consumption, portable cytometer using advanced CCD detection. This will allow cytometers to move out of the lab and find widespread point-of-care applications using such portable device, especially suitable for remote areas. The lens-free CCD based cytometer will be used for slide-plate fluorescence imaging of micrometer-sized particles over an ultra-large field-of-view, thus avoiding complex optical or mechanical-scanning systems. In the lens-free geometry, samples placed on a slide-plate are excited through a pinhole aperture. The diffracted and scattered light from particles is collected onto a wide field-of-view image sensor. Applications on malaria, tuberculosis, water microorganisms, toxicity and cell viability will be mainly explored using the new cytometer.

Keywords :
Lens-free microscopy, cytometry, biology, imaging and diagnosis and decision procedures.

Additional information :
* Amount of the monthly allowance (if it is the case):
* Required skills:
Medium-high level of written and oral communication skills in English.
- Very good communication and team work skills, be proactive.
- High sense of responsibility, very good organizational and documentation skills.
* Miscellaneous: