MAP-fis Essay Proposal, 2015-2016

(*please write in English*)

Supervisor

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Title

Optical Fiber tweezers: tools for manipulation and sensing

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Photonics

Summary of Proposal

Light driven technologies are nowadays a huge representative of cutting-edge physics discoveries and applications. Optical trapping is a contactless method for the immobilization and manipulation of microscopic and nanoscopic objects (cells, particles, molecules, among others) where light plays the primary role. It is based on simple physical principles, namely the transference of momentum from a laser beam to the trapped object. These effects are obtained by producing a customized light intensity distribution capable of trapping the small objects, push them and even rotate them. Recent developments in these technologies include the miniaturization of the optical systems, for example using nanostructured optical fiber tips which can imprint specific light intensity and phase distributions, with improved performance and capable of being integrated in compact optical systems and applications from physics, to biology and medicine.

This research work represents a step forward into the implementation of tools for simultaneous manipulation and sensing of cells, based on optical fibers. Therefore, within this research project the student it expected to work on the following tasks:

Trapping of microscopic objects using optical fiber tweezers;

Measurement of the applied optical forces;

Computational characterization of the devices;

Experimental implementation of devices for simultaneous sensing and manipulation.

(*continue if necessary*)

References

(*to allow students first look at topic*)

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[3] K. Dholakia and T. Čižmár, "Shaping the future of manipulation," Nat. Photonics, vol. 5, no. 6, pp. 335–342, Jun. 2011.

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[5] S. Ramachandran and P. Kristensen, "Optical vortices in fiber," Nanophotonics, vol. 2, no. 5–6, pp. 455–474, Jan. 2013.