*Résumé Conférence 15 décembre 2014*

# Holographic optical tweezers: Principle, some results and perspectives

***Jean-Pierre Galaup***
*Laboratoire Aimé Cotton, Bât. 505, Centre d'Orsay 91405 Orsay cedex*
*jean-pierre.galaup@u-psud.fr*

Since 1986, the use of a highly focused laser beam through a high numerical aperture microscope objective has revolutionized the optical trapping and control of micron or sub-micron sized particles [1,2]. Principal applications involving optical tweezers have been particularly developed for the control and manipulation of micron sized functionalized spherical beads as probes in biological environment and cells.

By diffracting a Gaussian laser beam on computerized phase holograms imprinted on a liquid crystal spatial light modulator, versatile optical tweezers experiments can be designed for multiple optical trapping or control by acting on the light beam shape. For instance, multiple traps can be simultaneously created or different spatial laser modes can be generated and fully controlled by software. Examples of the generation of hollow laser beams like Laguerre-Gauss beams will be illustrated and discussed [3].

In the frame of our work, we have particularly studied the trapping of organic single crystals which have a simple parallelepiped shape. By using a circularly or elliptically polarized light beam, a high speed rotation of such micro-crystals has been achieved [4]. This observation and other from literature opens great perspectives for micro motors or devices fully powered and controlled by light [5]. As a challenge, another point will be considered and discussed: it concerns the search of the best and "economical" way to efficiently control and orient a unique nano or micro object with an erratic shape.

[1] A. Ashkin, J.M. Dziedzic, J.E. Bjorkholm and S. Chu, "*Observation of a single-beam gradient force optical trap for dielectric particles*", Opt. Lett. **11** (1986) 288-290.

[2] A. Ashkin, "*History of optical trapping and manipulation of small neutral particles, atoms and molecules*" in Single Molecule Spectroscopy, R. Rigler, M. Orrit and T. Basché *Eds*. Springer (2001) 1-31.

[3] Justin Rouxel, "*Montage et mise au point d'une expérience de pinces optiques holographiques, manipulation de nano et de micro objets*", Rapport de stage 4ème année Polytech'Orléans (2011).

[4] M. Rodriguez-Otazo, A. Augier-Calderin, J.-P. Galaup, J.-F. Lamère and S. Fery-Forgues, "*High rotation speed of single molecular microcrystals in an optical trap with elliptically polarized light*", Applied Optics **48** (2009) 2720-2730.

[5] Shoji Maruo, Akira Takaura and Yohei Saito, "*Optically driven micropump with a twin spiral microrotor*", Opt. Express **17** (2009) 18525-18532.