Praktika in Cambridge (Bereich Laseranalytik und Automation)

Ausschreibung vom 26/06/2013

Die Laser Analytics Group der University of Cambridge bietet ab sofort interessante Praktikas fuer Studenten aus Regensburg an.

Falls Dein Interesse geweckt wurde, dann melde dich direkt bei
Dr. Eric Rees: ejr36@cam.ac.uk

UNIVERSITY OF CAMBRIDGE

Project: Automation of advanced optical microscopes and spectral imaging systems

Supervisor: Prof. Clemens Kaminski
Second Supervisor: Dr Eric Rees

Introduction:

The Laser Analytics group at CEB (the Department of Chemical Engineering and Biotechnology at the University of Cambridge) develops advanced optical microscopes and spectroscopic instruments. These instruments support several applied research programmes as well as technology development and theoretical studies [1-3].

In order to support simple and efficient operation of the microscopes that we have developed in-house, which is important for applied research projects that involve experts other than the microscope designer, there is a need for automation.

One of our systems is a “Super-Resolution microscopy" system which which uses the principle of Localisation Microscopy [4,5] to study features far smaller than the diffraction limit of light – the technique of super-resolution imaging was named the Nature Method of the Year in 2008. This instrument allows us to image static biological (or polymeric) materials with a resolution as fine as 20 nm, and it is among the first such optical “super-resolution” instruments that have been applied to study such specimens in their native environment [1,2]. The principle of Localisation Microscopy is that individual fluorescent molecules can be imaged separately by applying a photoswitching technique: the position of each fluorescent molecule can then be precisely determined computationally from the centre of its image, and an underlying fluorescent-labelled specimen can then be visualised in high resolution (far better than the optical diffraction limit) using a computational image reconstruction technique.

1. The Localisation Microscope is in need of some additional automation. Some Labview control of laser power and automated image acquisition are already implemented. This project would involve the design and implementation of an automated mirror-controller which would allow users to switch illumination between different angles ("Epi" and "TIRF" illumination modes [6]) without manual beam alignment. The design and implementation of simple, low-cost laser shutters would also minimise the need for manual alignment of laser beams, important for a widely-used system.

2. A second microscope system in the group is the Automated Spectral Imaging Microscope. This microscope is being developed to enable the (a) fast, (b) automated scanning of multiple XY positions on a specimen, combined with (c) acquisition and (d) analysis of fluorescence spectra from each area. A complete microscope setup with an electronically-controllable XY stage, laser illumination, and spectrograph are already assembled – the remaining task is to provide automation and control to enable (a-d) listed above.

[1] Rees et al. (2012) *Optical Nanoscopy* **1**:12, http://www.optnano.com/content/1/1/12
[2] Kaminski et al. (2011*) J Am Chem Soc* 133 12902–12905 http://pubs.acs.org/doi/abs/10.1021/ja201651w
[3] Elder et al. (2007), *Journal of Microscopy*, **227**:203-215
[4] Shim and Zhuang PNAS 2012 www.pnas.org/cgi/doi/10.1073/pnas.1201882109
[5] Linde and Sauer (2011) Nature Protocols doi:10.1038/nprot.2011.336
[6] Tokunaga, M.; Imamoto, N.; Sakata-Sogawa, K., Nat. Methods 2008, 5, 159