OPTICS & PHOTONICS
UNIVERSITY OF NOTTINGHAM

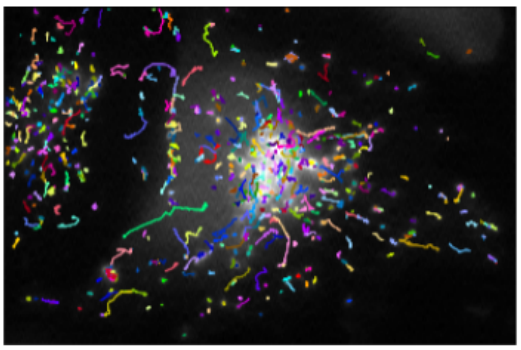
University of Nottingham
UK | CHINA | MALAYSIA

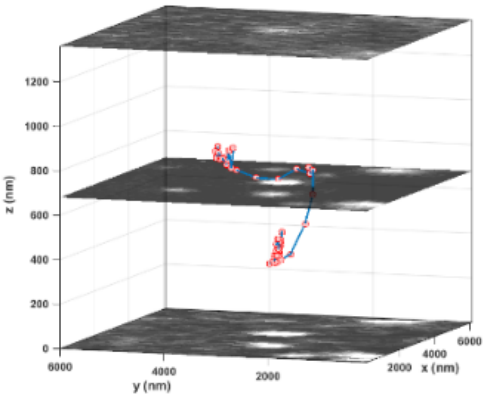
Optics and Photonics Group
Lunchtime Seminar

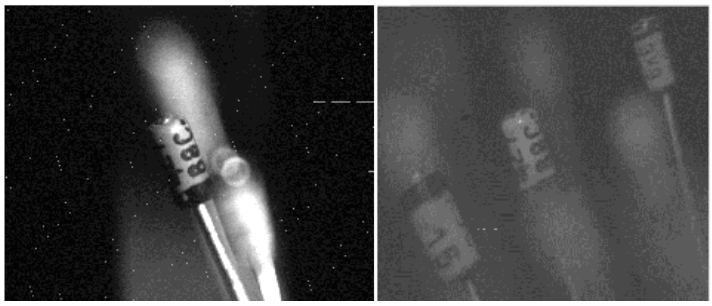
"Multi-plane imaging and its application to 3D live cell particle tracking"

Paul Dalgarno

Heriot-Watt University







12:00pm Thursday 25th May 2017
203 Tower Building
All Welcome

Abstract

http://optics.nottingham.ac.uk/wiki/Talks_2017

"Multi-plane imaging and its application to 3D live cell particle tracking"

Paul Dalgarno

12:00pm Thursday 25th May 2017
203 Tower Building
All Welcome

Despite cellular architecture being inherently three dimensional (3D), most subcellular particle tracking studies are performed in 2D. This is largely because techniques such as epi-fluorescence or confocal microscopy require the sample to be moved incrementally along the optical axis, a time consuming process prohibiting true real time cellular study. We have previously demonstrated a highly accessible and simple microscopy add-on that uses a diffractive optical element (DOE) to image 3 or 9 focal planes simultaneously onto the same camera chip, allowing multi-plane 3D data to be acquired at rates limited only by camera exposure. However, DOE's are inherently chromatic, and the chromatic aberrations when imaging with broadband spectra limit the application of such technology. We therefore developed a post-acquisition deconvolution restoration process and a practical software package to combine analysis, this processing and 3D tracking. Image restoration is highly effective and crucially, the optical efficiency is limited only by the DOE. We show rapid 3D and time imaging of 3 or 9 different focal planes with 500-700nm plane spacing (400x400pixels/plane) at frame rates up to 5-100 volumes/second is demonstrated with precise (sub 100 nm) particle localisation achieved by image-sharpness. We have successfully applied this framework to study the distribution and dynamics of autophagosomes in live HeLa cells.