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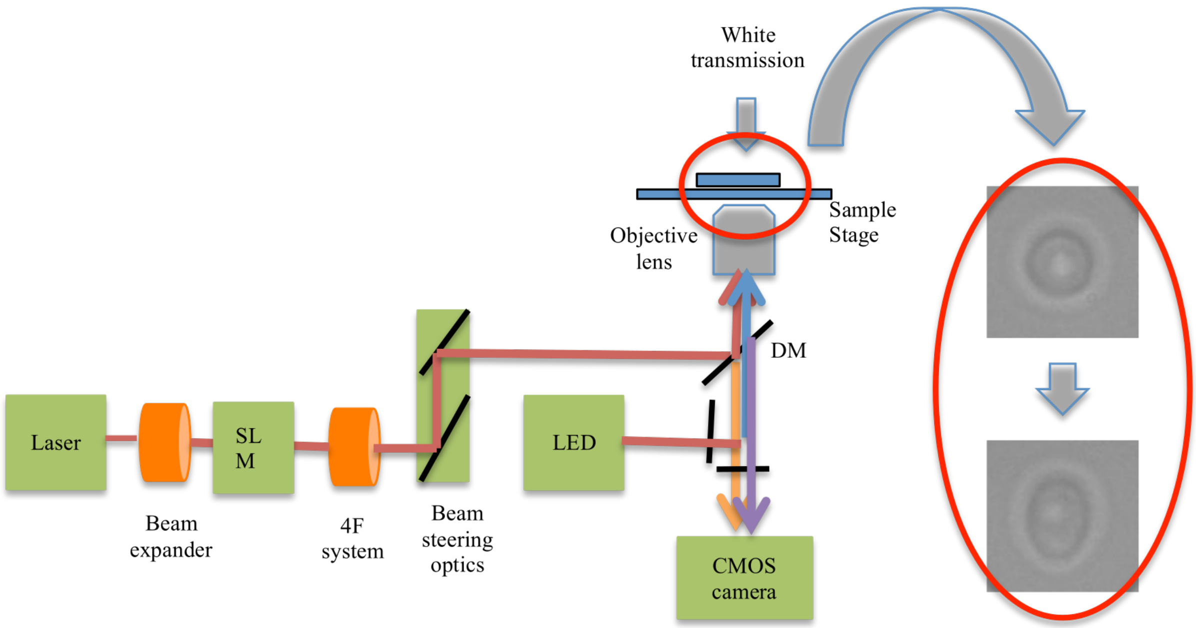
Optics and Photonics Group Lunchtime Seminar

"An optical trapping approach for probing and modulating the mechanical properties of model cells"

Aishah Mustapha



OPTICAL TRAPPING SYSTEM SETUP

Sample stage is moved and trapped liposome is stretched

12:00pm Thursday 16th February 2017
203 Tower Building
All Welcome

Abstract

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

“An optical trapping approach for probing and modulating the mechanical properties of model cells”

Aishah Mustapha

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All Welcome

We propose a new technique for probing and manipulating the mechanical properties of cells using a single beam optical trapping setup and applying an external viscous drag force. Measuring the mechanical properties of individual cells can provide important insights into the state of the cell and the structure of the cell membrane. For example, studying the response of a cell to stress and strain can provide information on the changes of a cell due to aging, help to predict the response of a cell to a pharmaceutical drug or therapy and indicate how easily a red blood cell can travel through small capillaries and blood vessels. Here we focus on studying the deformability of model cell systems, namely liposomes, which consist of a lipid bilayer and an aqueous core, and are commonly used to study membrane processes and lipid-protein interactions. The liposomes were optically trapped in a single-beam gradient force trap operating at a wavelength of 1064 nm. With the liposome held in the trap, the sample stage was moved at a fixed velocity to exert a viscous drag force on the trapped liposome. The velocity of the stage was selected so as to deform the trapped object without knocking it out of the trap. Using this approach we have been able to show that the deformability and circularity of the liposomes is dependent on the magnitude of the external viscous drag force applied, the excess area of the liposome and the concentration of cholesterol present in the lipid composition. We will highlight the benefits of this optical trapping approach for monitoring the mechanical properties of cells, discussing the scaling-up and multiplexing of the technique, the ability to study relaxation rates of a stretched cell and the capability of combining this approach with fluorescent imaging.