Autumn 2023

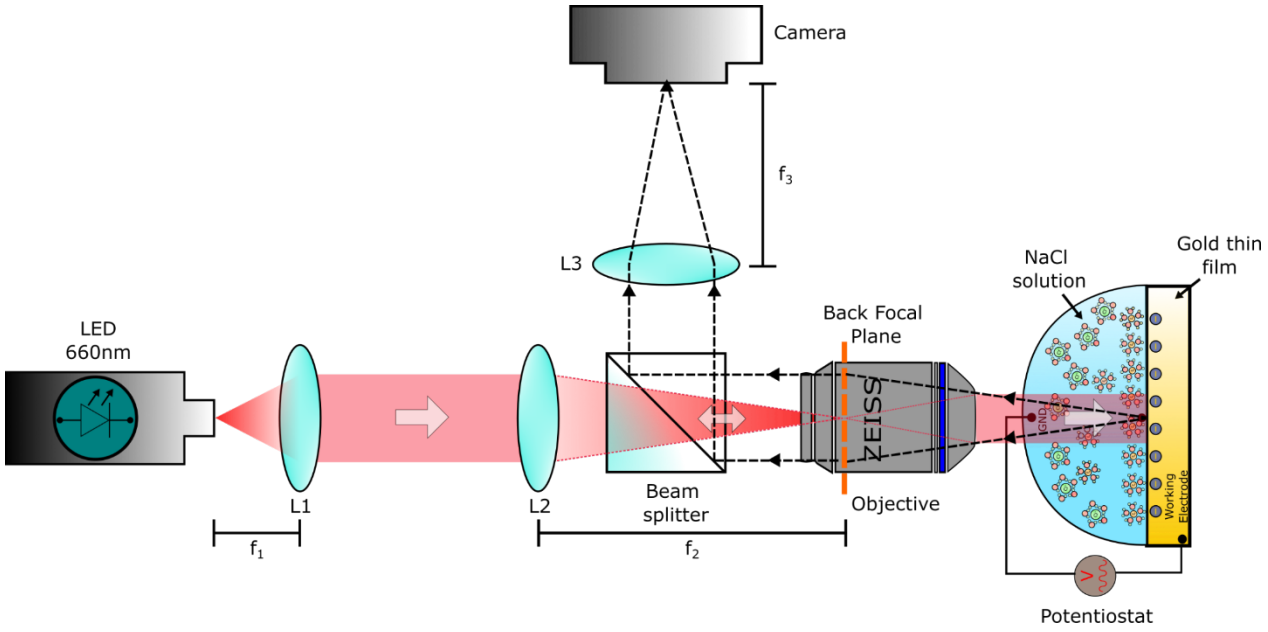
Optics & Photonics Group Lunchtime Seminar Series

University of Nottingham

Illuminating Micro-Worlds: Advancements in voltage detection through Reflection Interference Microscopy

Oscar Barajas Gonzalez

University of Nottingham



13:30 Wednesday 6 December 2023

Life Sciences Building - B3

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Oscar Barajas Gonzalez

Illuminating Micro-Worlds: Advancements in voltage detection through Reflection Interference Microscopy

This study presents a novel impedance microscopy method for single-cell bioelectrical property measurement. It uses a label-free optical technique, leveraging metal dielectric constant sensitivity to voltage-induced electron density changes in thin metallic films. These changes are detected via variations in metal optical transmission or reflection intensit]. This method, a new application of electrical impedance microscopy, employs a simple optical setup, promising broad utility in living organism studies and material characterisation.

Understanding sub-cellular electrical signals is vital, yet current imaging technologies fall short. Our initial results show a unique electrical impedance microscopy method using an uncomplicated optical sensor system.

We designed a compact optical arrangement with a collimated LED light source, ensuring uniform gold film illumination. The light, directed through a beam splitter and objective, reflects off the film, is recollimated, and captured by a high-speed camera, allowing precise light interaction analysis with the gold surface.

In our experiment, a gold-coated coverslip, partially insulated with polystyrene spheres, was subjected to a sinusoidal voltage in NaCl solution. This revealed electron density changes in the metal, visible in its optical properties and colour-mapped to distinguish active from insulated areas. This approach holds potential for exploring cellular electrical properties, like in neurons, adding a new perspective to biological and material science research.

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All are welcome

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