BIO-TALK: Super-liner emitters enable sub-diffraction imaging on conventional confocal microscopes, challenging traditional imaging concepts

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12:00 to 13:00
Seminar Room

Sub-diffraction (super-resolution, SR) microscopy has revolutionized bio-imaging and the understanding of life at the nanoscale. Yet, its broad uptake remains constrained by complex and costly setups, image reconstruction artifacts and need for high laser powers. Additionally, most methods are limited to 2D.
To address these limitations, we realize an alternative SR approach that achieves 3D super-resolution on standard confocal microscopes, available in most bio-labs, without the need for hardware modifications or image post-processing (Denkova et al, Nat. Comm 2019).
Remarkably, the resolution improves when reducing the excitation power. We term the method Super-linear Excitation-Emission (SEE) microscopy, as it leverages fluorescent probes - specifically, upconversion nanoparticles - whose emission increases super-linearly with excitation intensity, contrasting standard fluorophores, which exhibit linear-to-sublinear emission response. We demonstrate the method in a 3D bio-sample at near-infrared wavelengths (980nm), where SR methods are sparse, yet often desired for reducing phototoxicity, avoiding autofluorescence, and increasing imaging depth. Overall, SEE microscopy democratizes sub-diffraction imaging, enabling SR for a broader scientific community.
Furthermore, we explore how such non-linear light-matter interactions yield other exotic imaging effects, that challenge traditional imaging concepts, and how these effects can be exploited for advanced imaging applications. We will discuss potential integration of the SEE microscopy concept with other imaging techniques such as light-sheet microscopy - particularly for studying neural activity.
This talk is aimed at sparking curiosity towards a novel, and very practical, imaging method in the general community; enabling productive discussions and feedback regarding future work on this topic and initiating collaborations with colleagues from biology, synthesis and physics disciplines.

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