METAL INDUCED ENERGY TRANSFER (MIET) IMAGING

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Recent years have seen a tremendous development in high- and super-resolution techniques of fluorescence microscopy, such as STED, PALM or STORM. However, for nearly all of them, the axial resolution is typically a factor 3-5 worse than the lateral resolution, similar to most diffraction-limited optical microscopy techniques. I will present our recent work on Metal Induced Energy Transfer or MIET imaging [1] which achieves nanometer resolution along the optical axis. It uses the effect that by placing a fluorescent molecule close to a metal, its fluorescence properties change dramatically. In particular, one observes a strongly modified lifetime of its excited state (Purcell effect). This coupling between an excited emitter and a metal film is strongly dependent on the emitter's distance from the metal. We have used this effect for mapping the basal membrane of live cells with an axial accuracy of ~3 nm [2,3,5]. The method is easy to implement and does not require any change to a conventional fluorescence lifetime microscope; it can be applied to any biological system of interest, and is compatible with most other super-resolution microscopy techniques which enhance the lateral resolution of imaging. Moreover, it is even applicable to localizing individual molecules, thus offering the prospect of three-dimensional single-molecule localization microscopy with nanometer isotropic resolution for structural biology [4,6]. I will also present recent application of MIET for leaflet-resolved imaging and spectroscopy of lipid bilayers, using indium tin oxide (ITO) and graphene monolayers as the quenching substrates, which allows as to achieve even sub-nanometer axial resolution.

References

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