

# SUPER-RESOLUTION ENHANCEMENT BY QUANTUM IMAGE SCANNING MICROSCOPY

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The principles of quantum optics have yielded a plethora of ideas to surpass the classical limitations of sensitivity and resolution in optical microscopy. While some ideas have been applied in proof-of-principle experiments, imaging a biological sample has remained challenging mainly due to the inherently weak signal measured and the fragility of quantum states of light. In principle, however, these quantum protocols can add new information without sacrificing the classical information and can therefore enhance the capabilities of existing super-resolution techniques. Image scanning microscopy (ISM), a recent addition to the family of super-resolution methods, generates a robust resolution enhancement without sacrificing the signal level. Here, we will introduce quantum image scanning microscopy (Q-ISM). Combining ISM with the measurement of quantum photon correlations allows increasing the resolution of ISM up to two-fold, four times beyond the diffraction limit [1]. Relying solely on a quantum phenomenon, photon antibunching, as the image contrast, we were able to obtain super-resolved optical images of a biological sample stained with fluorescent quantum dots. In addition, we have shown that the z-sectioning capabilities of standard ISM are also enhanced by using the photon correlation contrast.

[1] R. Tenne, U. Rossman, B. Rephael, Y. Israel, A. Krupinski-Ptaszek, R. Lapkiewicz, Y. Silberberg and D. Oron, “Super-resolution enhancement by quantum image scanning microscopy,” *Nature Photonics*, **13**, 116–122 (2019).