

# LOW-POWER STED MICROSCOPY OF UPCONVERSION NANOPARTICLES DEPOSITED ONTO GRAPHENE-BASED MATERIALS

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## 1. BACKGROUND

Upconversion nanoparticles (UCNPs) can convert near-infrared excitation into visible and ultraviolet emissions, making them promising for optical microscopy imaging. UCNPs have recently been used to achieve nanometre-scale optical resolution through low-power STED microscopy [1]. The combination of UCNPs with suitable materials enables innovative functionality for biology and photonic applications. Here, we report on low-power STED microscopy of UCNPs deposited on graphene-based materials.

## 2. RESULTS AND DISCUSSION

Using a 980-nm excitation beam with a Gaussian shape and an 808-nm depletion beam with a doughnut shape, we imaged UCNPs on graphene-based materials using STED microscopy. We have achieved a saturation intensity of  $\sim 0.4 \text{ MW cm}^{-2}$  and a lateral feature size of  $< 50 \text{ nm}$ , offering new avenues for the nanoscale use of functionalized UCNPs.

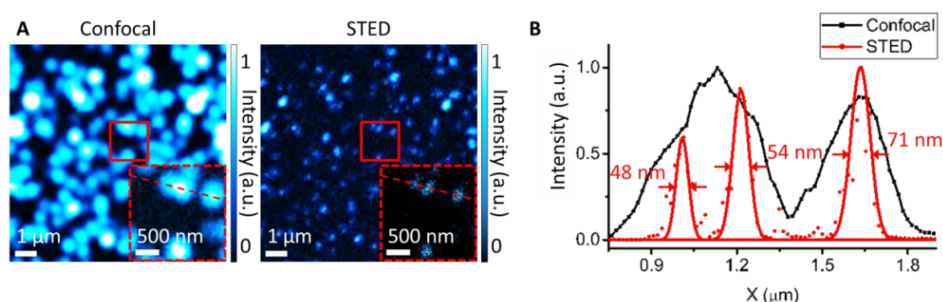


Figure 1: A) Confocal and STED microscopy of UCNPs deposited on graphene-based materials. (B) Intensity profiles along the dashed lines in A.

## 3. REFERENCES

[1] Y. Liu; Y. Lu; X. Yang; X. Zheng; S. Wen; F. Wang; X. Vidal; J. Zhao; D. Liu; Z. Zhou; C. Ma; J. Zhou; J. A. Piper; P. Xi, and D. Jin, "Amplified stimulated emission in upconversion nanoparticles for super-resolution nanoscopy," *Nature*, **543**, 229-233 (2017).