Tomographic STED Microscopy

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Far-field optical microscopy represents a well-established method in the life sciences. Due to diffraction, the resolution is limited to lambda/2 in the focal plane. This constraint can be surpassed by nanoscopic techniques [1]. Amongst others, STED microscopy provides a resolution of up to 20 nm [2]. By definition, resolution enhancement in STED microscopy is achieved by narrowing the effective fluorescent area [3]. This reduction of detection volume depends on the factor of resolution enhancement and is directly linked to a decrease in fluorescence signal which limits the acquisition rate in many cases.
Here, we present a STED technique based on a rotating 1D depletion pattern. This novel STED variant can achieve a higher resolution for a given depletion light intensity as compared to the classical implementation. Furthermore, the overall fluorescence signal detected is higher than for conventional STED microscopy working at the same resolution. Consequently, not only identical super resolution conditions can be realized at lower depletion laser powers but also the acquisition can be sped up. Moreover, both aspects have the potential to drastically reduce photobleaching and sample damage.

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