

# Polarization manipulation boosts STED microscopy

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Nanoscopy based on stimulated emission depletion (STED) employs a raster-scanned excitation beam superimposed by a STED-beam that exhibits a hollow dark line or spot. Here, we discuss novel methods for generating excitation and STED focal patterns that boost the power of STED microscopy and related concepts. Whereas existing devices alter the wave front of the STED beam, our method produces rugged doughnuts by changing the polarization state of the beam in the back focal plane. This approach has many advantages. In particular, it considerably simplifies the STED-setup. Moreover, the STED system permits a unique way to directly investigate molecular orientation in the sample. In this contribution, we will introduce several versions of polarization-based beam-shaping devices and discuss their fabrication and performance. Moreover, we will demonstrate how they readily transform a standard scanning (confocal) microscope into a full-blown STED setup.