

Fluorescence Nanoscopy Through Optical Switching

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Since Abbe's discovery of the diffraction limit in 1873 it had long been considered an unalterable fact that the wave nature of light limits the resolution of every far-field optical microscope operating with visible light to $\sim 250\text{nm}$. Nevertheless, fluorescence imaging with resolutions of down to 15nm has recently become a reality. STED microscopy, the first technique to break the diffraction barrier was introduced in 1994 and several other approaches were successfully implemented since then, all based on the same underlying principle: The clever utilization of the fluorescent dye's spectroscopic properties to circumvent the limitations posed by the wave-nature of light. By switching dyes between bright and dark states, time-multiplexed readout of spatial information is achieved, which would otherwise be obscured by diffraction.

I will explain this fundamental principle and its various implementations and give an overview over applications to real-life imaging.