

Faster and less phototoxic 3D fluorescence microscopy using a versatile compressed sensing scheme.

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Public Summary:

Three-dimensional fluorescence microscopy based on Nyquist sampling of focal planes faces harsh trade-offs between acquisition time, light exposure, and signal-to-noise. We propose a 3D compressed sensing approach that uses temporal modulation of the excitation intensity during axial stage sweeping and can be adapted to fluorescence microscopes without hardware modification. We describe implementations on a lattice light sheet microscope and an epifluorescence microscope, and show that images of beads and biological samples can be reconstructed with a 5-10 fold reduction of light exposure and acquisition time. Our scheme opens a new door towards faster and less damaging 3D fluorescence microscopy.

Scientific Abstract:

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