# VECTORIAL SECOND-HARMONIC GENERATION IMAGING WITH BESSEL BEAMS

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Bessel beams, the so-called non-diffractive beams, exhibit a very long depth of focus [1]. This unique property was found to be useful for imaging extended materials in three-dimensions without the need for sequential axial scanning. So far, the earlier imaging techniques have focused on volumetric imaging of samples and neglected the vectorial character of the focal fields [2, 3]. As the nonlinear optical response of nanostructures is strongly polarization dependent, the character of the driving fields become especially important [4, 5].

Here, we demonstrate SHG microscopy using linearly polarized Bessel beams. We synthesized a quasi-Bessel beam by displaying an axicon phase on a spatial light modulator. The resulting beam was then directed toward a microscope objective (NA=0.8) to generate a Bessel beam at the focus. Using vertically-aligned GaAs nanowires (length ≈ 2 µm, diameter ≈ 55 nm), we found that the spatial distribution of the longitudinal electric fields of a focused Bessel beam is similar to a Gaussian beam. Additionally, we found that the Bessel beam excitation is more robust in the longitudinal (z) direction than standard SHG microscopies that rely on focused linear polarizations.

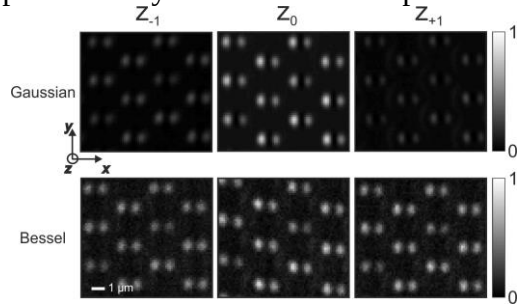


*Figure 1. SHG intensity maps of GaAs nanowires using linearly polarized (x) Gaussian (top row) and Bessel (bottom) beams for different axial (z) positions. Scale bar = 1 µm.*

Our results open new ways for efficient excitation of axially extended nonlinear nano-objects.

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