

**POLARIZATION RESOLVED SECOND HARMONIC GENERATION MICROSCOPY FOR  
INVESTIGATING BIOMACROMOLECULES**

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**ABSTRACT**

We developed a four-channel photon counting based Stokes polarimeter for spatial characterization of polarization properties of Second Harmonic (SH) light. In this way, the critical polarization parameters can be obtained concurrently without the need of repeated image acquisition. Various polarization parameters, including the degree of polarization (DOP), the degree of linear polarization (DOLP), and the degree of circular polarization (DOCP), are extracted from the reconstructed 2D Stokes vector based SH images in a pixel-by-pixel manner. The Stokes vector measurements are further extended by varying the polarization states of the incident light and recording the resulting Stokes parameters of the SH signal. In turn this allows the molecular structure and orientation of the samples including collagen fibers, skeletal muscle fiber, and starch granules. The combination of SHG microscopy and Stokes polarimeter hence makes a powerful tool to investigate the structural order of targeted specimens.

**Keywords:** Polarimetry, Second harmonic generation, nonlinear optics, starch, cellulose