KEY WORDS: Stokes vector, Second harmonic generation, Nonlinear optical microscopy.

Abstract: We have developed a polarization resolved four channels Stokes vector polarimeter to work with second harmonic generation microscopy. The four channels Stokes-polarimeter can measure all four Stokes parameters of arbitrarily polarized light and reconstruct the corresponding images of degree of polarization (DOP), degree of linear polarization (DOLP), degree of circular polarization (DOCP) and polarization anisotropy. By applying the Stokes parameters based image analysis techniques SHG images of skeletal muscle, we are able to quantify the polarization state of SH light and the corresponding molecular orientation of the skeletal muscle fiber. The SHG polarization images clearly indicate the presence of birefringence and reflect the samples’ structural information from their polarization properties. The DOLP indicates the crystalline alignment of fiber and molecules parallel to the linear polarization states. The DOCP is a measure of how effectively the medium flips the helicity of the scattered light. The observation from the polarization parameters reveals that muscle fibrils is highly anisotropic, coincides with the known pitches of distinct helices within the coil structures of fibers.

Figure 1. (a) shows the SHG intensity images; and in (b) and (c) shows the reconstructed 2D Stokes vector images and DOP, DOLP, DOCP, polarization anisotropy images of SHG light from skeletal muscle fiber, respectively. The color scale shows the values of each parameter.

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