

Nonlinear response of crossing chiral fibers in the focal volume of high NA objectives

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ABSTRACT: Polarimetric Second Harmonic Generation (SHG) microscopy is a promising tool in biological and biomedical imaging. The results provided by this technique have to be interpreted with caution when composite fibers of different orientations cross in the focal volume of high numerical aperture (NA) objectives. In this study, the linear polarization-in polarization-out (PIPO) SHG response of crossing chiral fibers of meso-tetra (4-sulfonatophenyl) porphine (TPPS₄) molecules in giant “sea urchin” (GSU) aggregates has been modeled numerically and described in details; then the results have been confirmed by the PIPO microscopy data from the GSU aggregate samples. These results show that some SHG polarimetry parameters (e.g. achiral and chiral susceptibility component ratios) change in the situation of crossing fibers in the focal volume. Nevertheless, the PIPO measurements can determine the pixels with crossing fibers and enable to reconstruct ultrastructural organization in biological structures, for example, collagen in the extracellular matrix within each focal volume of the tissue . [1,2]

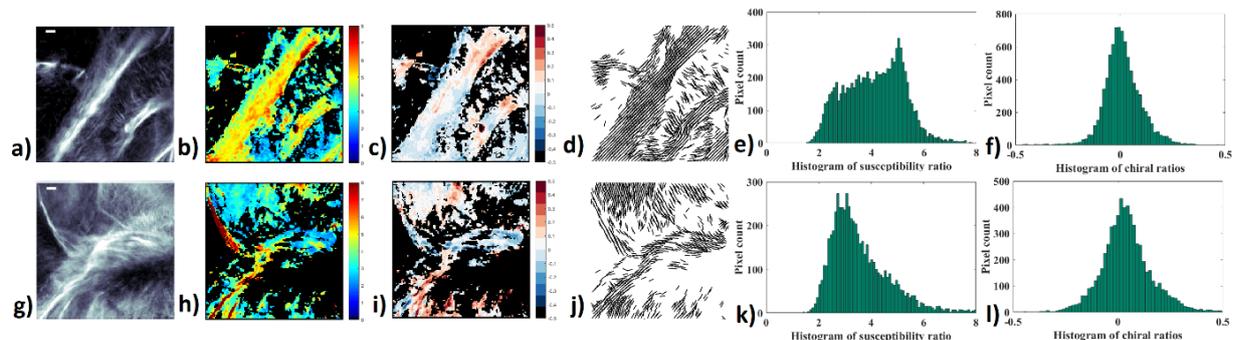


Figure 1: Samples of GSU TPPS₄ aggregates without (upper row) and with (lower row) crossing fibers: Logarithmic SHG intensity map (a, g), achiral susceptibility R ratio (b, h), achiral C ratio (c, i), cylindrical axis orientation map (d, g), histograms R (e, k) and C (f, l) values. Scale bar is 10 μm .

References:

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