Hyperspectral mapping of $\chi^{(3)}$ from a single type I collagen fibril by CARS microscopy

A. Muschielok, M. Kovaleva, A. Kovalev, S. Busch, and A. Volkmer
3rd Institute of Physics, University of Stuttgart, Pfaffenwaldring 57
70550 Stuttgart, Germany

E-mail: a.volkmer@physik.uni-stuttgart.de

Collagen, one of the most abundant proteins in the extracellular matrix of animals, is important for the stability of tissues. Furthermore, because of its ability to self-assemble into fibrils, it is used as a model system for the formation of biopolymer structures. We have employed coherent anti-Stokes Raman scattering (CARS) microscopy in order to study the vibrational properties of individual in-vitro grown type I collagen fibrils. CARS microscopy allows the non-invasive imaging of collagen fibrils with high sensitivity, with three-dimensional sectioning capability, and with high spatial resolution. Beyond imaging, a multiplex CARS scheme was employed for the fast acquisition of CARS spectra in the region of the C-H stretching vibration. A detailed spectral analysis will be presented, which yields a three-dimensional representation of characteristic Raman line shape parameters, directly revealing the chemical and physical properties of a single collagen fibril under physiological conditions.