EXPLORING SATURATION PROCESS IN STIMULATED RAMAN SCATTERING MICROSCOPY

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In the last decades, with the development of ultrashort pulse laser sources, non-linear optical (NLO) light-matter interaction has acquired a central role in optical 3D-imaging. The advantages of NLO approaches include the reduction of scattering due to the use of near-infrared radiation, which enables high penetration depth and reduces the aberrations introduced by the sample [1]. One type of NLO techniques, transient absorption has broadened the range of applicable targets and has provided high contrast in weakly or non-fluorescent samples. Utilizing the combination of excited state absorption with ground-state depletion and saturation can help in reaching high- and super-resolution label-free microscopy [2]. Another growing set of methods in the field of NLO is coherent Raman-scattering microscopy, e.g., coherent anti-Stoke Raman scattering (CARS), and stimulated Raman scattering (SRS). Compared to fluorescence-based techniques, CARS and SRS utilizing the inherent chemical vibrational bonds as imaging contrast have emerged as appealing tools for label-free biomolecular imaging in biological and biomedical systems [3-4]. Studying complex biological systems typically demands high speed, sensitivity and spatial resolution imaging techniques to break the diffraction limit of biological imaging. In this context, we aim is to study how to develop a multimode microscope by a combination of microscopy method based on near infrared light and non-linear interaction, i.e., SRS due to its higher sensitivity and stronger signal, and SSRS (saturation of stimulated Raman scattering) methods in order to break the diffraction limit of spatial resolution in SRS [5].

In this work, a custom-built femtosecond-pulsed near-infrared pump-probe microscope is presented in order to exploit SRS interaction. Two femtosecond pulsed laser beams, generated by an OPO pumped by a Ti:sapphire laser (Chameleon Ultra II and compact OPO Coherent) are coupled with a commercial laser scanning confocal microscope (Nikon A1 MP). With the aim of exploring the saturation of stimulated Raman scattering, we used a STED-like approach where a doughnut-shaped beam is used to saturate the pump [2].

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