Wide-field real-time non-linear microscopy in living organism

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Non-linear optical microscopy have emerged as a successful tool within the bio-medical research field enabling the possibility to do imaging in intact-live organism. Among all possible applications, we focus on the development of a time resolved technique in the millisecond regime, where the most interesting biological effect occur [1]. In addition, to enable a direct observation of these processes, the nanoparticle tracking method is exploited [2]. Quantitative understanding of these phenomena require images of these kinetics events in a large area, in particular if dealing with in vivo samples having dimension up to the millimeter range. To achieve this goal, the combination of an appropriate marker and the development of a non-conventional microscope setup is required.
In this respect niobate nanoparticles (NPs), such as $KNbO_3$ or $NaNbO_3$, are examined as marker candidate. They are of increasing importance as multimodal nanophotonic probes in biological environments [3] due to their biocompatibility and pronounced electro-optic, piezo-electric, acousto-optic and, in particular, nonlinear optic (NLO) properties.
The microscope setup have to enable high peak intensity to exploit the NLO effect of the marker and a large field of view to ensure a proper imaging of the biological sample. For this purpose, femtosecond pulses are coupled to an inverted microscope and the emitted light is collected by an objective and imaged on a grayscale CCD camera.
As first application, we study the possibility to use NPs for in vivo measurement of the haemolymph flux velocity in larvae of *Drosophila melanogaster*, commonly known as “fruit fly” [4].

References

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