



Ultrasensitive Linear and Non-linear Optical Microscopy

by

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Abstract:

During the last decade, ultrasensitive microscopy has become one of the most important tools in biophysics. Most prominent among the various techniques is fluorescence microscopy. It is a very widespread technique with which sensitivities down to the single molecule detection limit can be reached. An important recent development is its application to the tracking of dynamic processes in biological samples, e.g. intracellular transport of organelles or nanoscopic particles. Here, I will present examples from intracellular tracking of various types of DNA particles.

The necessity to label the samples and photobleaching, however, limits the scope of fluorescence microscopy in this field. Coherent anti-Stokes Raman Scattering (CARS) microscopy as a label free approach is an attractive alternative. While it does not feature the high sensitivity of fluorescence microscopy, its contrast generation on vibrational molecular spectra circumvents both the labeling and the photobleaching problem. After a comparison of CARS microscopy to fluorescence microscopy as tools for following intracellular dynamics, this talk will present the current state-of-the art of experimental equipment for CARS microscopy. Applications to the tracking of intracellular transport of DNA and of lipid metabolism and lipid droplet trafficking will exemplify the potential of CARS microscopy.

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