# Optical Coherence Correlation Spectroscopy (OCCS)

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A classical technique to monitor dynamical processes at the single-molecule level is fluorescence correlation spectroscopy (FCS). However, FCS requires fluorescent labels that are typically limited by photobleaching and saturation. We present a new method, optical coherence correlation spectroscopy (OCCS), based on noble-metal nanoparticles that overcome those photobleaching and saturation limitations.

OCCS is a correlation spectroscopy technique based on dark-field optical coherence microscopy (dfOCM), a Fourier domain optical coherence microscopy technique. OCCS is based on the amplified backscattered light caused by diffusing nanoparticles. Due to the interferometric principle of OCCS, several sampling volumes along the optical axis are measured simultaneously with high detection sensitivity. This adds the possibility to assess axial flow, which is similar to a lateral flow measurement in dual-focus fluorescence correlation.

Using a mode-locked Ti:Sapphire laser (780nm central wavelength) we performed experiments with nanoparticles down to 30nm in diameter. We present these first experimental results and an associated theoretical fit model allowing the extraction of the particles' concentrations and diffusion parameters. The experimental determination of the diffusion time and concentration of gold nanoparticles based on this method is presented as a proof of principle and shows the potential of this technique.

In the near future, we aim at investigating smaller gold nanoparticles assessing biological phenomena. As a first application we apply this method to membrane receptor interaction using functionalized nanoparticles.