

## **Single Molecules under Local Probes**

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Single Molecule Spectroscopy is an established technique since the early 90's - it is often used in analytics, chemistry and biology where single fluorophore markers are attached to systems under study. Single molecules allow research on systems without any ensemble averaging and show a digital behaviour in bleaching and photon statistics.

At cryogenic temperatures, below 2K, certain dye molecules show lifetime limited absorption lines and can be detected with high signal to noise ratio via the red-shifted fluorescence they emit. Furthermore, they have the advantage to remain stable in space and frequency for an arbitrary time. Due to the inhomogeneities of their solid environment, each molecule naturally feels a different surrounding, electric fields or stress, which slightly shifts its absorption frequency, and makes it possible to spectrally select a single molecule for further studies.

In this talk I will discuss recent experiments in which we excite a molecule in the optical near field of a subwavelength aperture located at the tip of a metal-coated glass fiber. We can directly observe the extinction of the excitation light caused by a single molecule in front of the aperture, without any further noise suppressing elements or lock-in detection. I will also discuss a different experiment, where a scanning micro-electrode electrode was used to localize single molecules with nanometer accuracy.