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Single Molecule Fluorescence and Supercontinuum Lasers

Studying single molecule fluorescence in the presence of metallic nanoparticles with a FYLA SCT supercontinuum laser

Today we have a chat with Dr. María Sanz, a postdoctoral researcher at the “Photonics Nanosystems” group led by renown Prof. Guillermo Pedro Acuna at the University of Fribourg (Switzerland).

María tells us about the research carried out at the Photonics Nanosystems Group at the University of Fribourg.

What is the main research focus of the Photonics Nanosystems Group?

The group works on exploring the potential of DNA nanotechnology to precisely position single molecules and different metallic nanoparticles, to be able to fabricate tailored optical antennas capable of controlling light at the nanoscale and couple them to of single molecules.

Thus, our research combines wet-lab chemistry work for the sample preparation, with different **optical and electron microscopy techniques** for their characterization.

What is your role in the Nanosystems group?

As one of the physicists in the group, I take care of maintaining and developing our **home-built optical microscopes** so that the can be used for new applications, and I exploit them to **characterize our samples**. Furthermore, I investigate new **optical nanosystems** and explore their possible applications.

Which experiments require the supercontinuum laser from FYLA?

We perform fluorescence lifetime measurements to characterize the coupling of hybrid nanoparticle-single molecule samples, and for this we need a **pulsed laser with high repetition rate**. To perform this characterisation, we use our **picosecond FYLA SCT supercontinuum laser** which delivers 450 – 2300nm with 40MHz repetition rate. We couple the FYLA SCT to an AOTF for selecting the different wavelengths we need, and we further filter it spectrally with different clean-up filters, since having sharp spectral lines is very important for **single molecule experiments**. Then we input the **FYLA SCT fiber laser** directly into the excitation arm of our home-built confocal fluorescence microscope.

Image of the Photonics Nanosystems Group setup. The fiber-coupled FYLA SCT white laser is guided to the excitation path of a home-built optical confocal microscope. Two additional laser lines were already present in the setup. The setup is being used for different projects, so it has several optical components to allow for more flexibility.

FYLA SCT is a **1W pulsed supercontinuum picosecond fiber laser** with an extraordinary level of average power stability, delivering an extensive spectrum from 450 nm up to 2300 nm range, and with a visible average power exceeding 30 mW. The technical specifications of the FYLA SCT makes it the perfect laser for studying ingle Molecule Fluorescencein the presence of metallic nanoparticles.

How and why is the use of a FYLA supercontinuum critical in your experiments?

To optimize the output from our samples, we need to match the resonance of the nanoparticles with both, the spectra of the dye and the excitation wavelength. Having a supercontinuum laser gives us a great level of flexibility since in combination with the AOTF, we can select the laser wavelength that optimizes the interaction of the system under study. This gives us an extra degree of freedom, compared to having a single wavelength laser.

Also, each person in the group is working on a different project an these require different spectral ranges. It is very useful that we can have a single laser that everyone can use by simply filtering the spectrum and matching it to their application requirement. This also avoids re-alignment of the setup since only one laser needs to be coupled into our microscope, compared with the option of having to align multiple lasers.

Where is your research heading to?

I think there is still plenty of room for new developments in our field, ranging from using different types of emitters to introducing new nanoparticles. Each of them will come with new applications.

Where do you expect you will find the main scientific challenges?

The main challenge will be to extend the application of plasmonic devices in different fields of research and understand all the physical principles behind new observed effects.