Upconverting nanoparticles and z-axis sectioning.

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Multiphoton microscopies have opened a whole field of research. One of the most useful characteristic of multiphoton excitation is the z-axis sectioning power: the capability of excite the sample only at the focus without acting on the vicinity below and above the focal plane.

This characteristic allows MP microscopy to precisely manipulate in 3D systems as tissues or even whole organisms. However, the main drawback of MP techniques is the high cost related with the use of femtosecond Ti_Sapphire lasers needed to generate the extremely high instantaneous power density to elicit MP response in most materials.

In this talk we present an alternative for MP excitation based in upconversion nanoparticles. In our approach we show that it is possible to achieve sectioning using power densities many orders of magnitude lower than with traditional MP techniques. In this way it is possible to have true 3D addressing in microscopy or uncageing techniques with inexpensive solid state laser diodes as depicted in Figure 1.

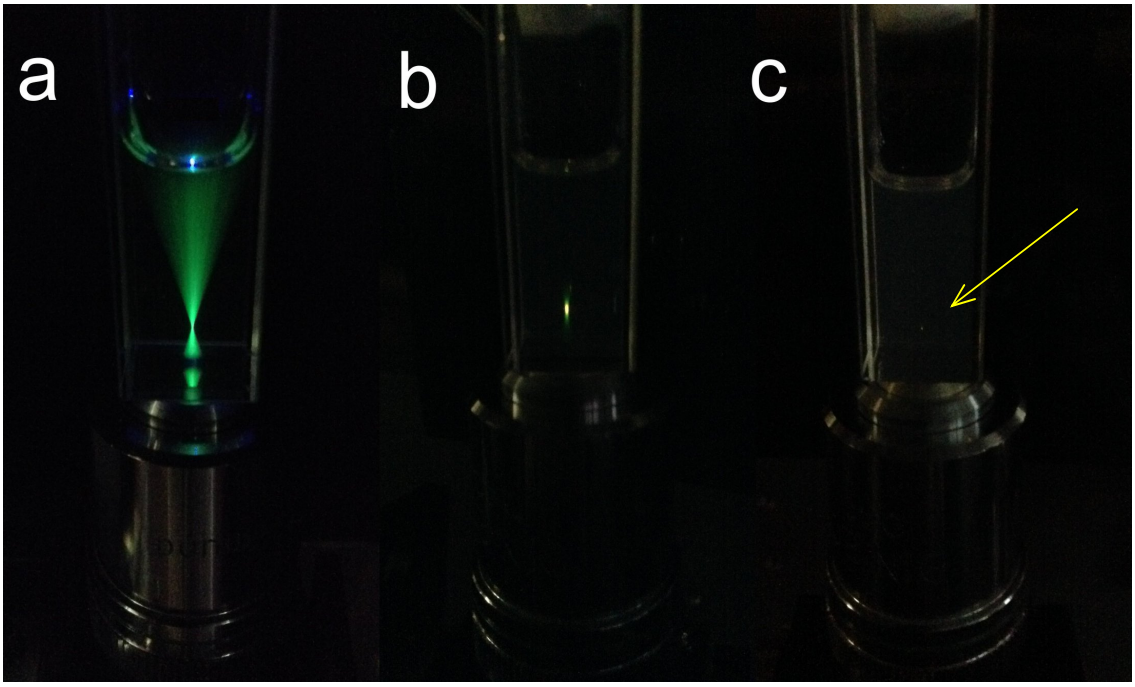

Figure 1. Comparison between 1-photon and multiphoton excitation. a) a solution of the fluorescent dye Pyranine, excited in 1P regime. b) a suspension of Er-Yb UCNPs in cyclohexane excited by means of a focused 980 nm beam in continuous regime. c) The same suspension excited in a low duty cycle pulsed mode in order to avoid saturation of the intermediate states, showing full sectioning capabilities.