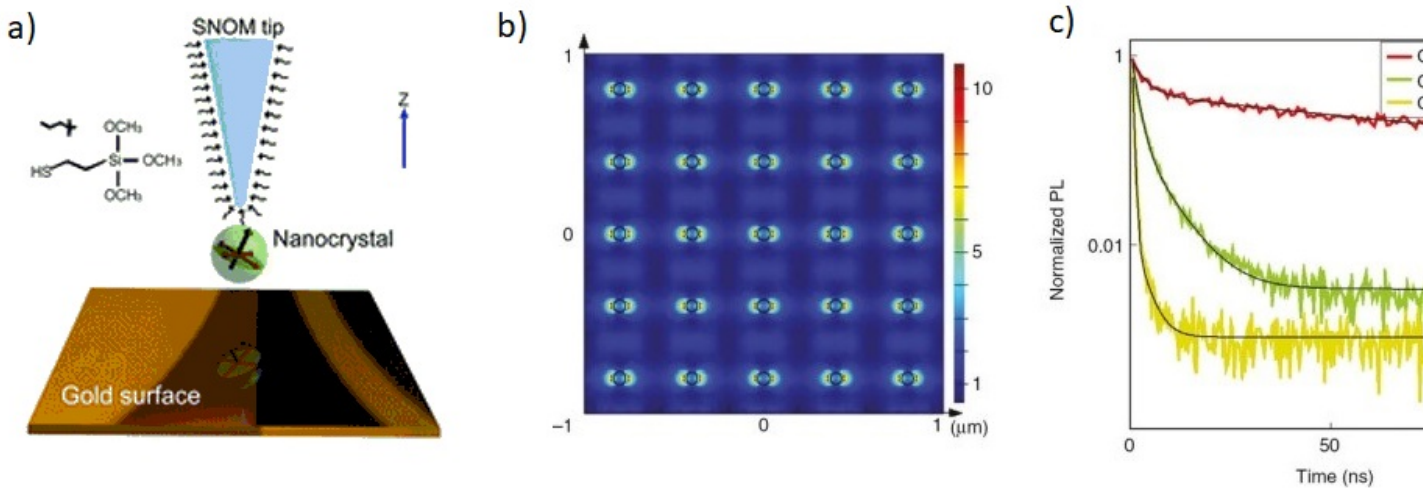
A SINGLE NANOCRYSTAL MAPS CONFINED LIGHT AT THE NANOMETER SCALE

The plasmonic properties of a nanohole array probed by a single nanocrystal grafted at the tip of an optical near-field probe: this work by GEMaC researchers was published in the journal Nanophotonics in February 2020.

An optical near-field probe developed at GEMaC, based on an individual CdSe/CdS nanocrystal, has made it possible to determine the different components of the electric field on the surface of a nano-hole array when this array exhibits plasmon resonances. For this purpose, the dipolar orientation of the nanocrystal was determined beforehand during measurements on a continuous gold surface (R.Jazy *et al*, Chem. Phys. **20**, 16444 (2018)). Once this orientation has been determined, measurements of the fluorescence lifetime of the nanoprobe are carried out at various locations on the nano-hole array, the acceleration of the nanocrystal's emission being linked to the coupling of the dipole with the electromagnetic modes of the array. Depending on the dipole orientation, the various

components of the electric field on the lattice surface can be probed. The results obtained with the nanoprobe have shown that the electric field component perpendicular to the surface plays a major role and is responsible for the strong localization of the electromagnetic field at the edge of the holes at plasmon resonance. Moreover, the results showed that this localization disappears very quickly (a few tens of nanometers) when moving away from the surface. These results are in agreement with numerical simulations of the distribution of the electromagnetic field carried out by FDTD in the team. This work is the result of a collaboration between GEMaC researchers and researchers from the University of Lyon and the University of Burgundy.

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a) Scheme of the optical near field nanoprobe
b) Spatial distribution of the electric field
c) Nanocrystal fluorescence decay in various environment

Reference :
T. P. L. Ung, R. Jazi, J. Laverdant, R. Flucrand, G. Colas des Francs, J.-P. Hermier, X. Quélin, S. Buil,
"Scanning the plasmonic properties of a nanohole array with a single nanocrystal near field probe",
Nanophotonics **9**, 793 (2020) - [HAL]