METALLIC NANOANTENNAS FOR LIGHT

LABORATORY : Institut Lumière Matière

LEVEL : M2
TEAM(S) : AGNANO

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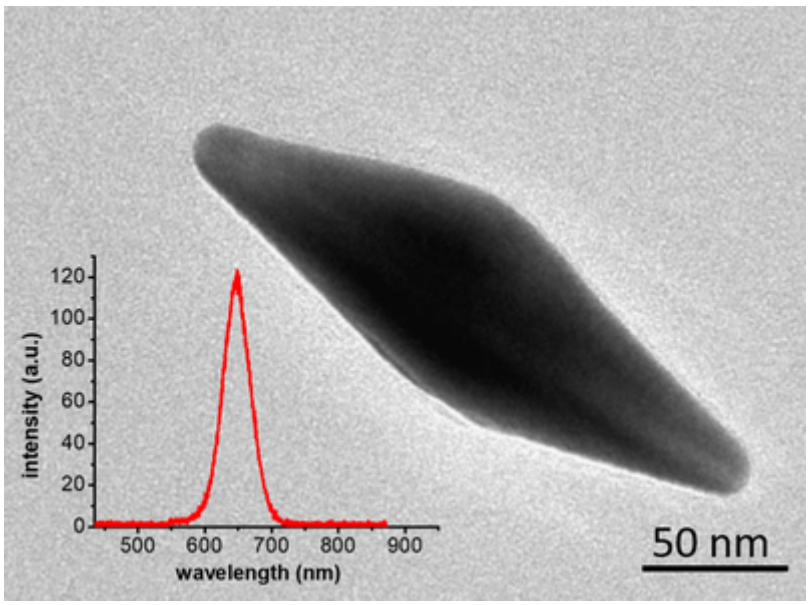
KEYWORD(S) : fluorescence / Microscopy / Nanophotonics

SCIENTIFIC CONTEXT :



TEM image of a gold bipyramid

Energy transfer and redirection over long distances is a keypoint for many applications in nanophotonic. To increase the propagation distance from two points, one way is to create new channels in the environment. For example, a local source of light (fluorescent molecule or Q-Dots) can be controlled by its local environment through the local density of states. In particular, metallic nanostructures are very promising due to the existence of surface waves called Surface Plasmon Polaritons. These waves come from the oscillations of the free electrons from the metal under an optical excitation and can propagate through tens of micrometers onto the surface. Nevertheless, the main limitation of metallic surfaces comes from optical losses but can be overcome by specific structuration. The goal of the internship will be to investigate nanopatch antennas which consist of metallic bipyramids deposited at a controlled distance from a mirror [2]. The gold mirror will be covered by a thin layer of dielectric.One important objective of our work will be to couple fluorescent emitters such as molecules or Q-Dots to control its emission by the nanoantennas.

MISSIONS :

The goal of the internship will be to demonstrate how the silanization of the substrate will control the 3D orientation of bipyramid at the single particle level [3]. In parallel, the student will also be able to characterize fluorescent emitter (spectrum and lifetime) to choose the best for the coupling with the antenna.

OUTLOOKS :

A PhD grants may be obtained through ED PHAST application

BIBLIOGRAPHY :

[1] Link to the proposal :

https://www.researchgate.net/publication/383711404_Master_2_Internship_Metallic_nanoantennas_for_light

[2] R. Esteban et al., Optical patch antennas for single photon emission using surface plasmon resonances, Phys.Rev.Lett.104,026802(2010)

[3] C-N. Vu et al., Single bipyramid orientation measured by scattering polarization spectroscopy. J. Phys. Chem. Letters, 2021,12, 2, 752-757

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