A way to improve magnetic-light and matter interactions : a plasmonic antenna

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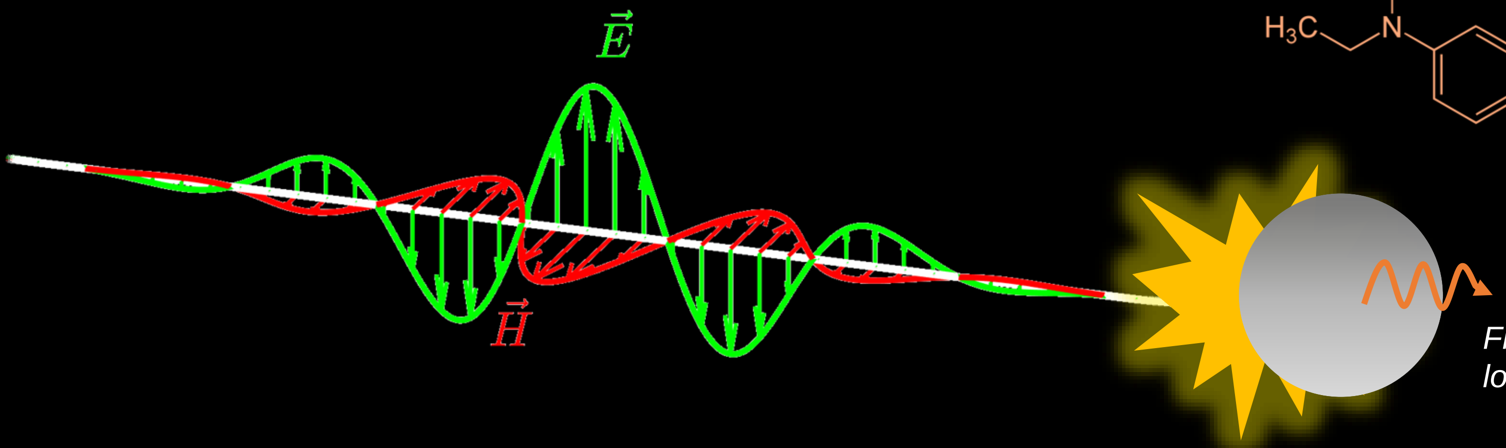
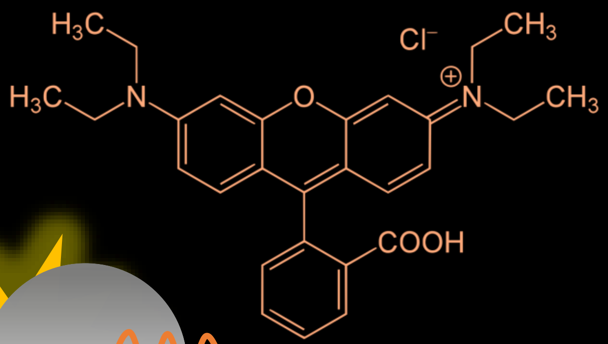
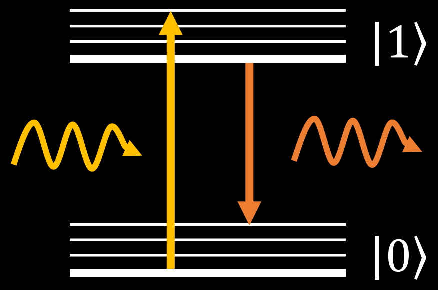
Light and matter interactions





Fluorescent beads,
loaded with Rhodamine B



$$\hat{H}_{int} = \underbrace{-\boldsymbol{p}\cdot\boldsymbol{E}}_{} \quad \underbrace{-\boldsymbol{m}\cdot\boldsymbol{H}}_{}$$

Electric Dipole (ED)
energy given by $\boldsymbol{E}$

Magnetic Dipole (MD)
energy given by $\boldsymbol{H}$

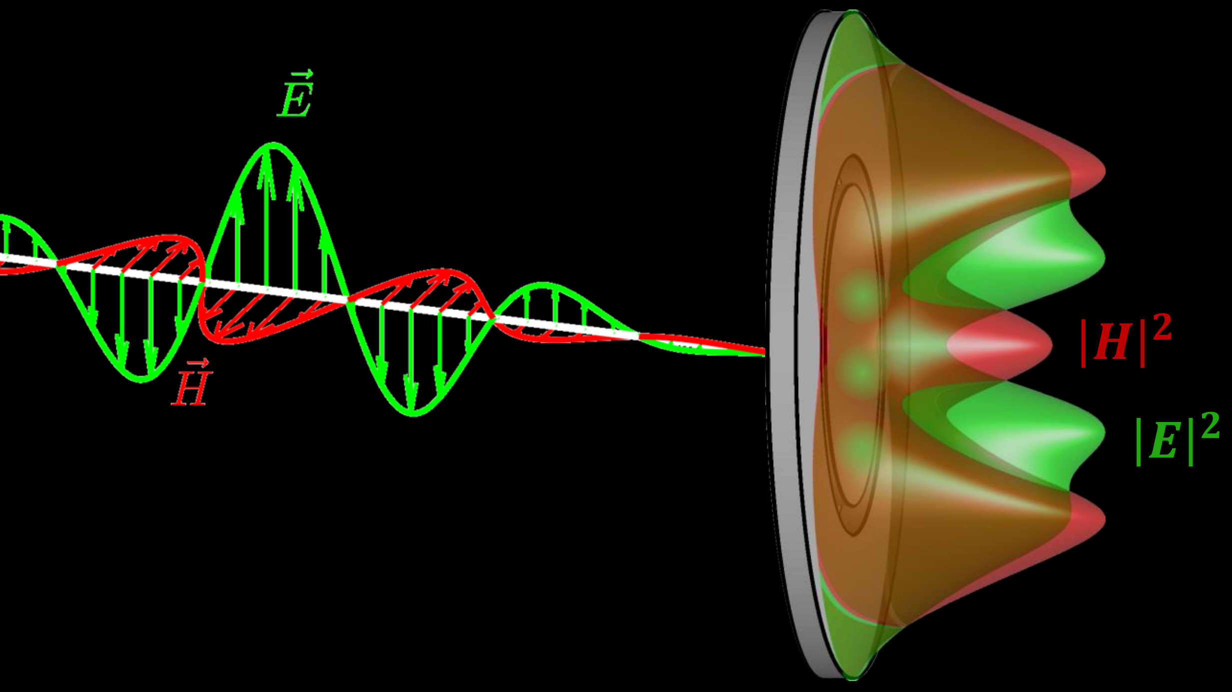
$$\frac{\boldsymbol{m}\cdot\boldsymbol{H}}{\boldsymbol{p}\cdot\boldsymbol{E}} \simeq 10^{-4}$$

ED interactions are often prevailing **BUT** MD interactions can be interesting

How to **enhance** the magnetic-light and matter coupling?

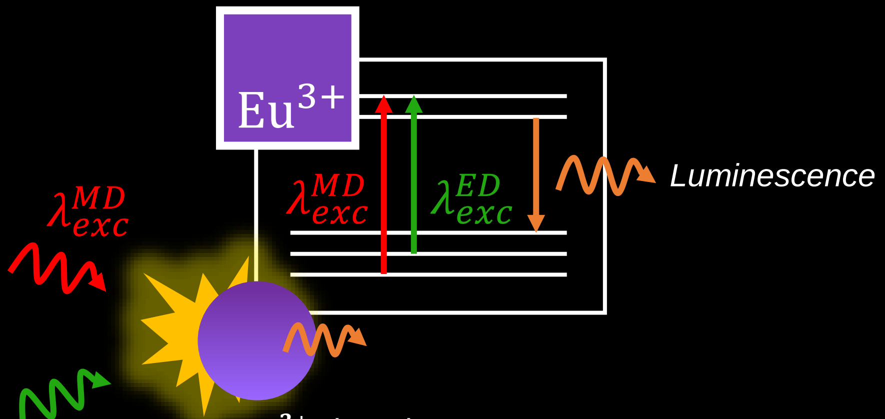
Find the two best candidates

Light : create a strong magnetic-light hot spot



Aluminum antenna

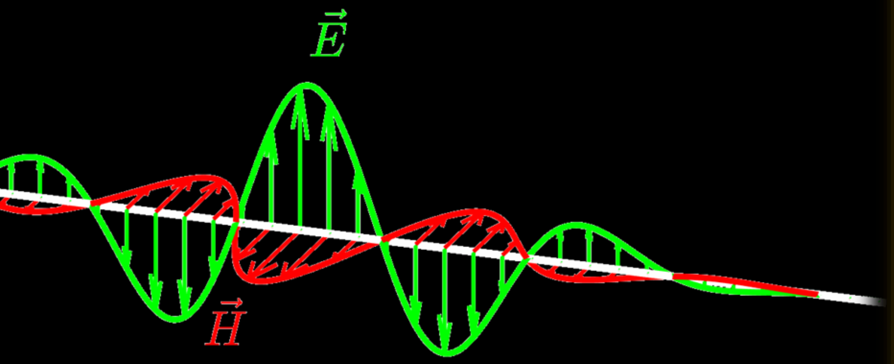
Matter : select the best magnetic-light sensor

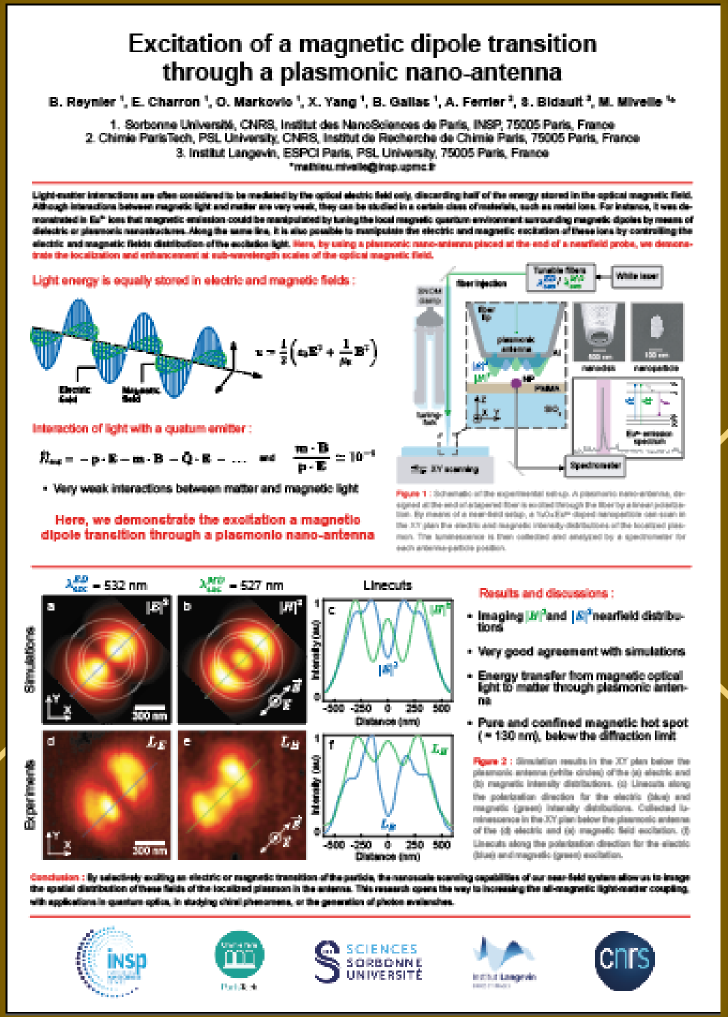


$\boldsymbol{Eu^{3+}}$ *doped* Y_2O_3 *nanoparticle*

Let's them interact !

“Excitation of a magnetic dipole transition through a plasmonic nano-antenna”





Dealing with objects smaller than chance of finding a place in academia

Distinguishing magnetic and electric coupling ?

Understanding why nearfield techniques are a true nightmare