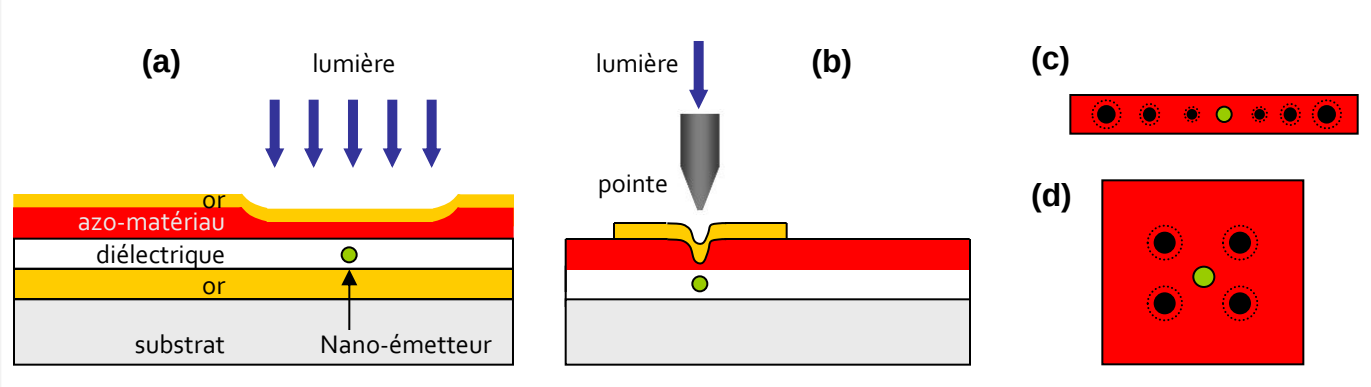
Nanostructuration optique et manipulation optique de nano-objets

Jacques PERETTI
Laboratoire de **P**hysique de la **M**atière **C**ondensée, CNRS – Ecole polytechnique (Palaiseau)

Projet **N O I S E**

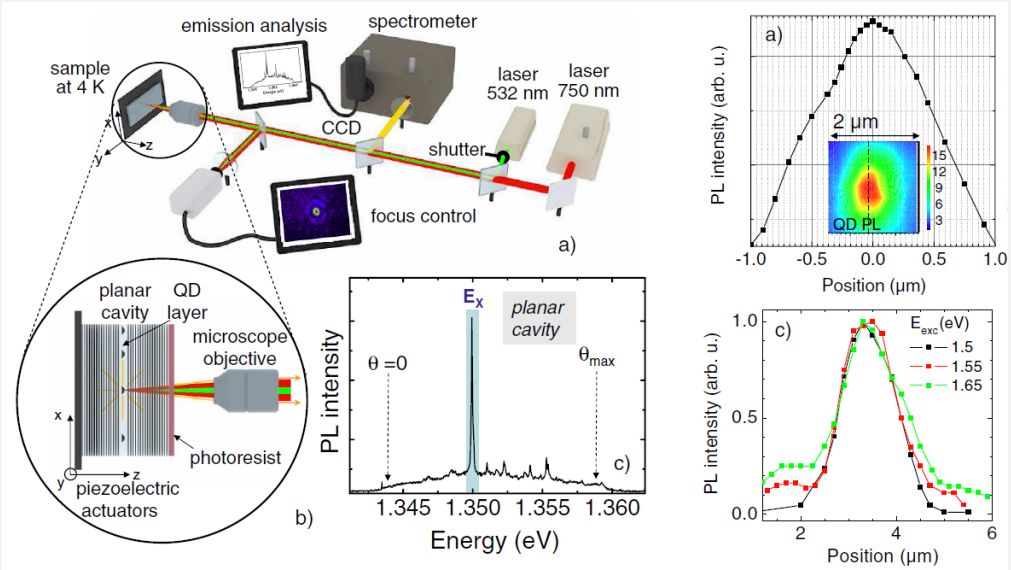
Nanostructuration **O**ptique **I**n **S**itu de l'**E**nvironnement électromagnétique d'un émetteur unique

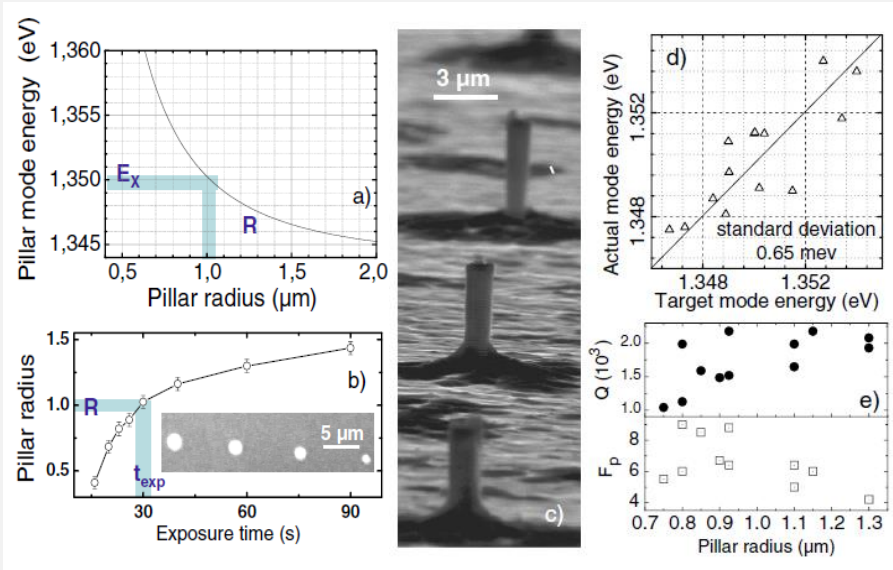
- LPMC - X (T. Gacoin, J. Peretti)
- LPN (P. Senellart)
- LCF - IOGS (J.-J. Greffet)



Controlled Light-Matter Coupling for a Single Quantum Dot Embedded in a Pillar Microcavity Using Far-Field Optical Lithography

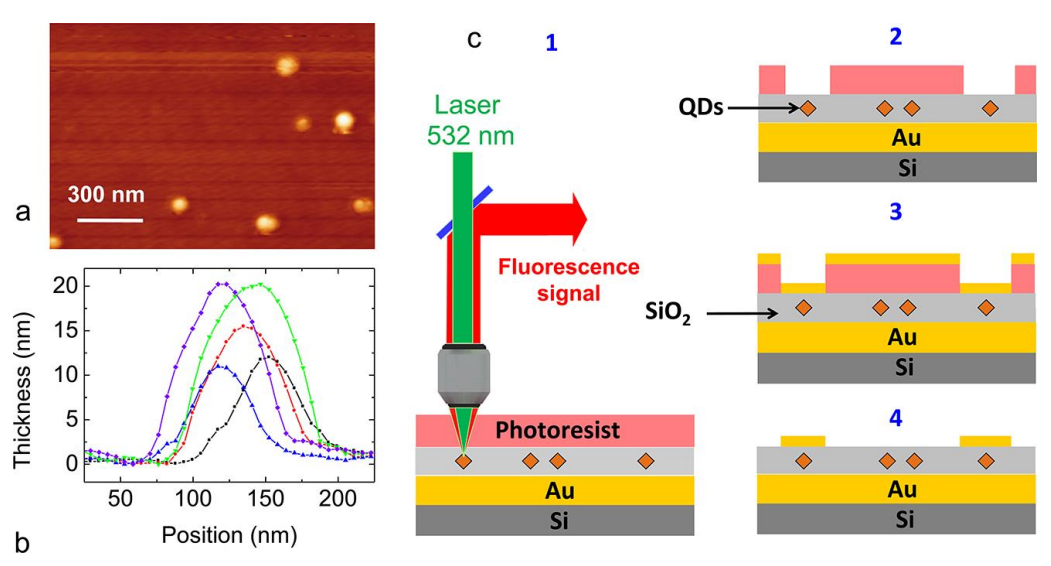
*Dousse et al., PRL **101**, 267404 (2008)*

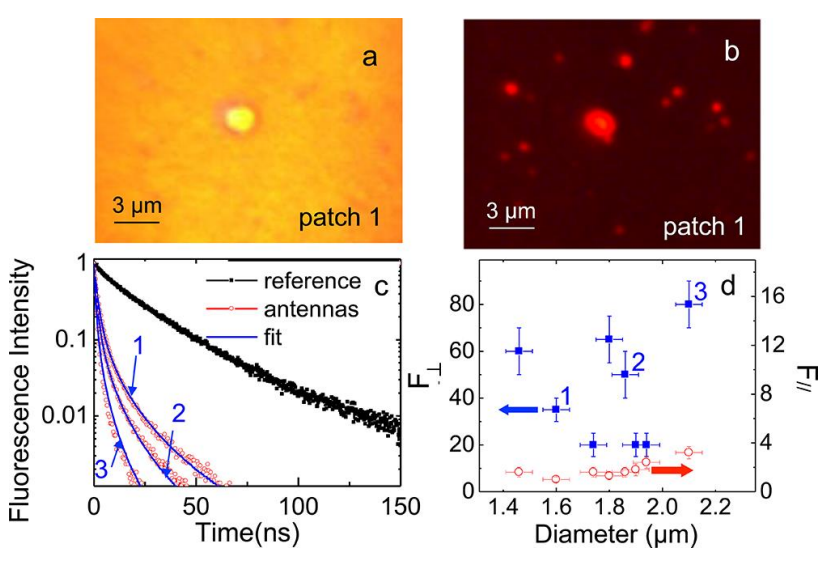




Controlling Spontaneous Emission with Plasmonic Optical Patch Antennas

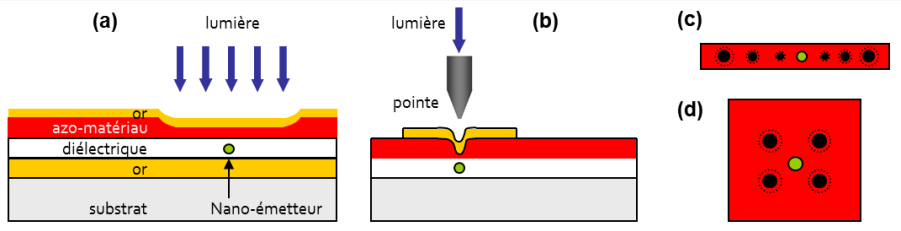
Belacel et al., Nano Lett. ***13****, 1516 (2013)*





Projet **N O I S E**

Nanostructuration **O**ptique **I**n **S**itu de l'**E**nvironnement électromagnétique d'un émetteur unique

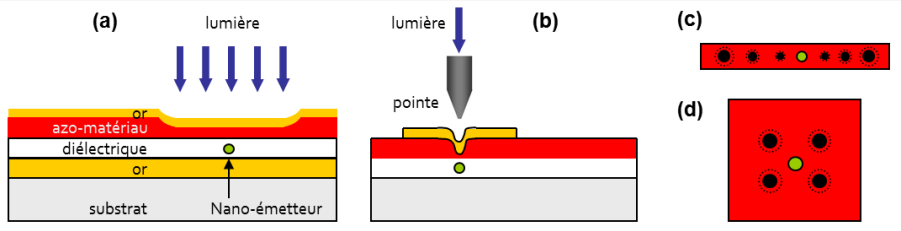


- Exploiter les propriétés photomécaniques des azo-matériaux

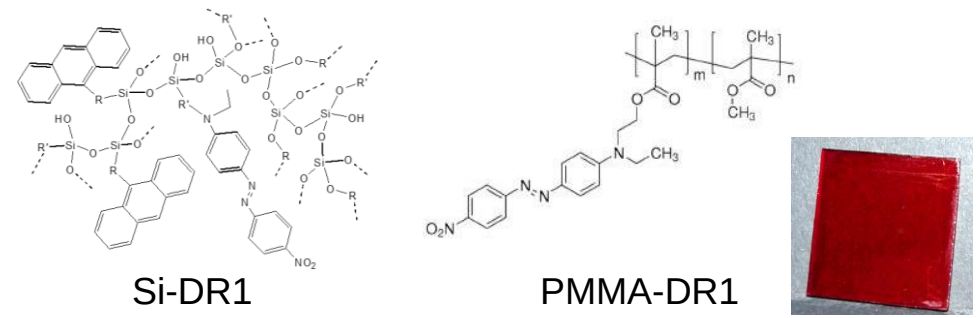
- Utiliser les techniques de microscopie à sonde locale

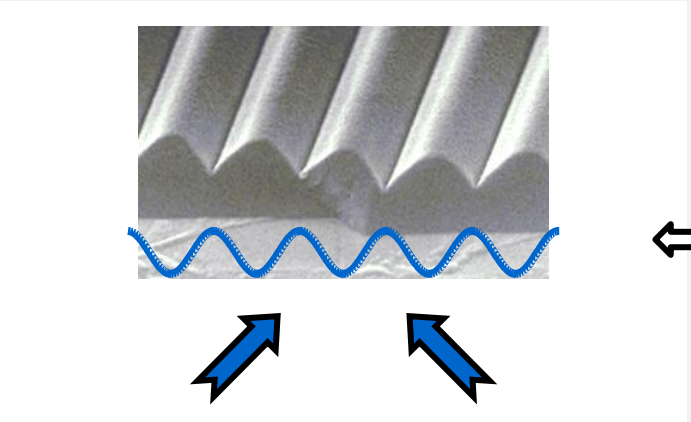
Projet **N O I S E**

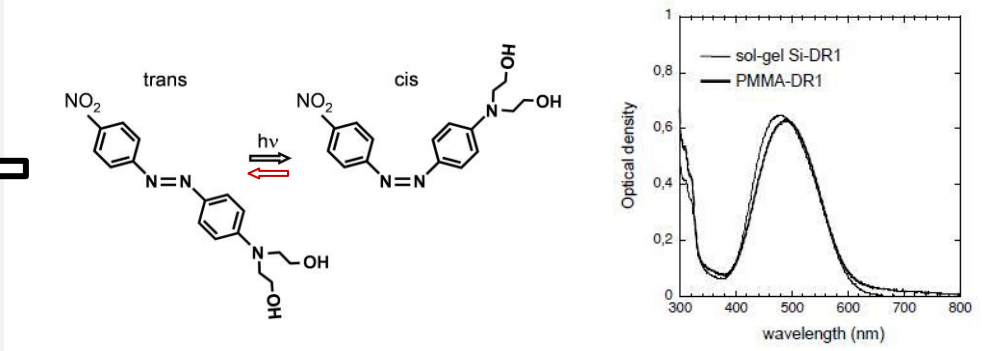
Nanostructuration **O**ptique **I**n **S**itu de l'**E**nvironnement électromagnétique d'un émetteur unique



- Exploiter les propriétés photomécaniques des azo-matériaux

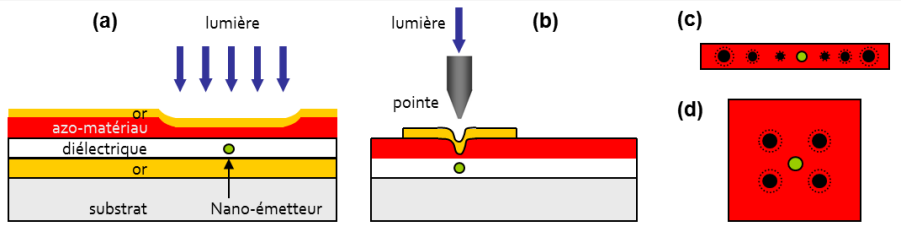




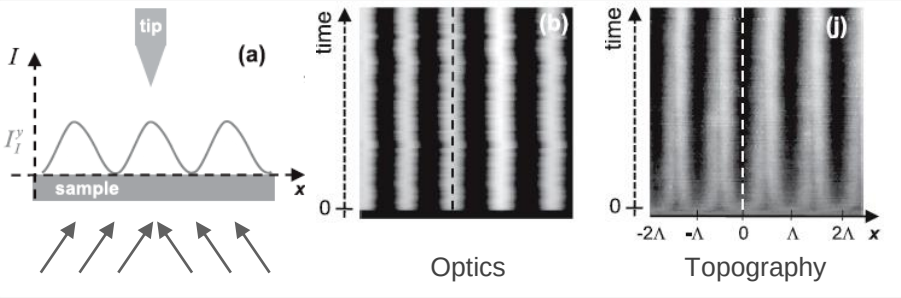


Projet **N O I S E**

Nanostructuration **O**ptique **I**n **S**itu de l'**E**nvironnement électromagnétique d'un émetteur unique

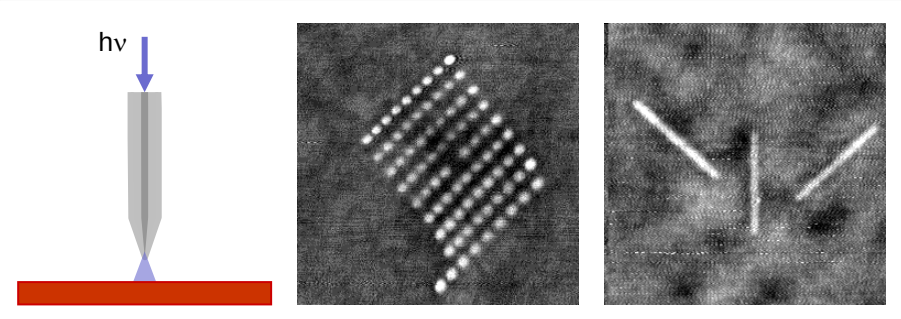


- Exploiter les propriétés photomécaniques des azo-matériaux



*Fabbri et al., PRB **86**, 115440 (2012)*

- Utiliser les techniques de microscopie à sonde locale

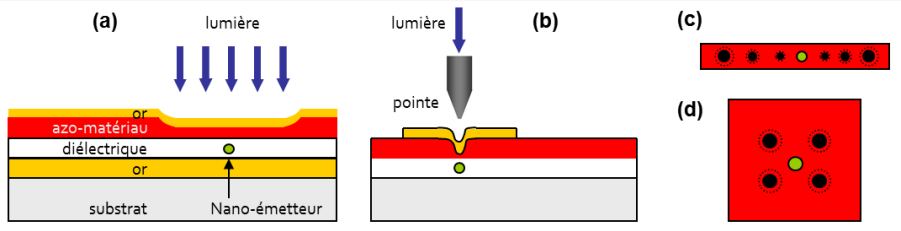


*Landraud et al., APL **79**, 4562 (2001)*

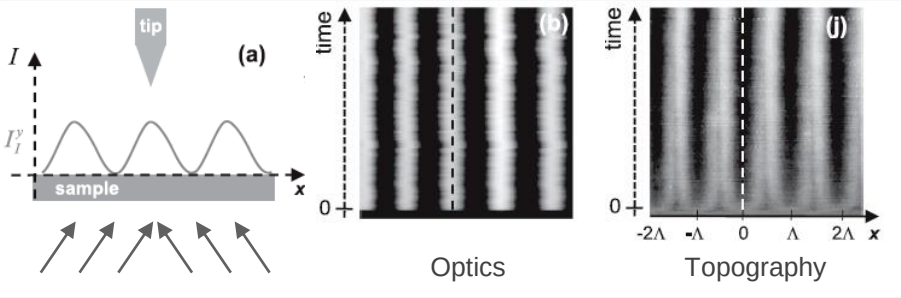
Projet **N O I S E**

Nanostructuration **O**ptique **I**n **S**itu de l'**E**nvironnement électromagnétique d'un émetteur unique

- Photo-structurer des empilements métal / diélectrique
- Contrôler la photostructuration locale / contrôler la position des nano-émetteurs

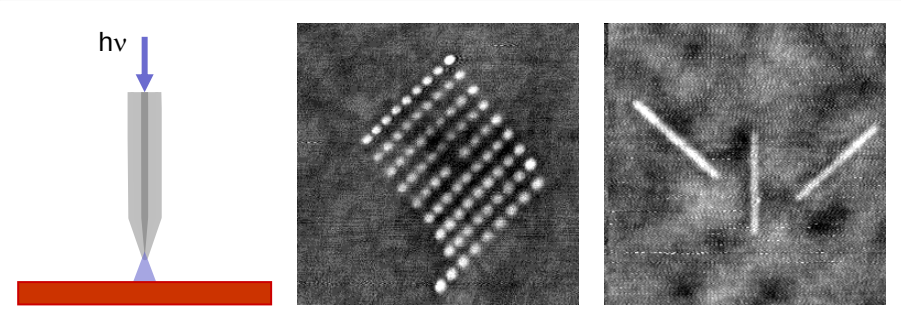


- Exploiter les propriétés photomécaniques des azo-matériaux



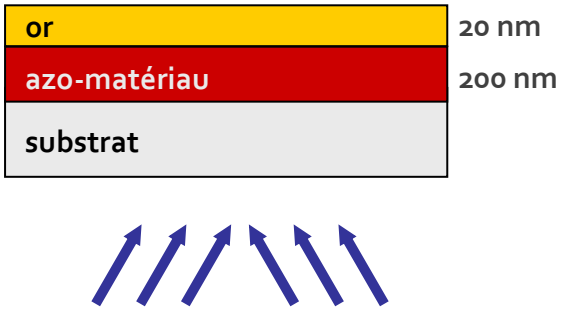
*Fabbri et al., PRB **86**, 115440 (2012)*

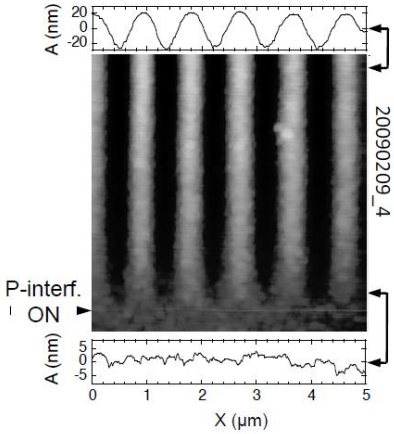
- Utiliser les techniques de microscopie à sonde locale



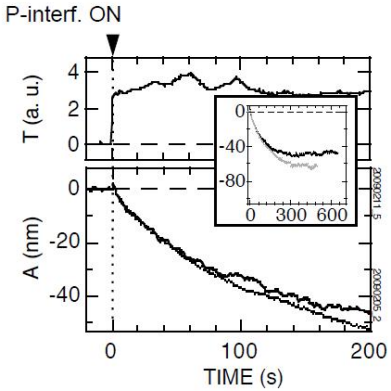
*Landraud et al., APL **79**, 4562 (2001)*

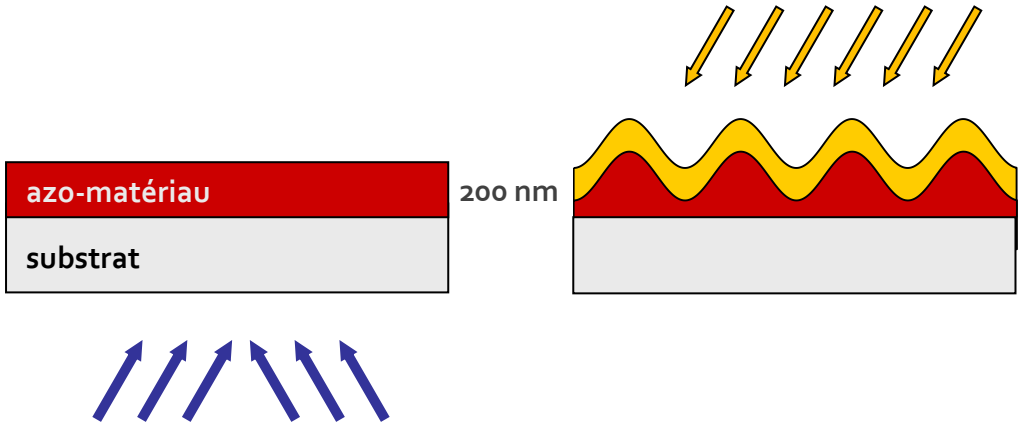
Photo-structuration optique d'empilements métal / diélectrique

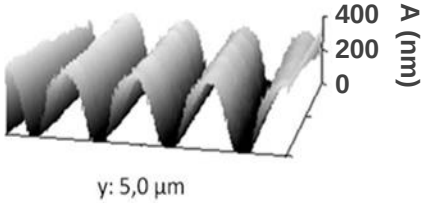


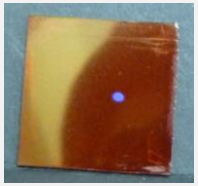


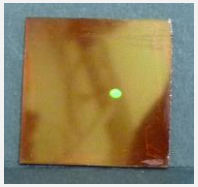
TOPOGRAPHY











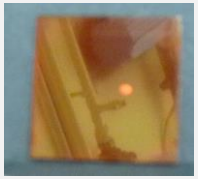
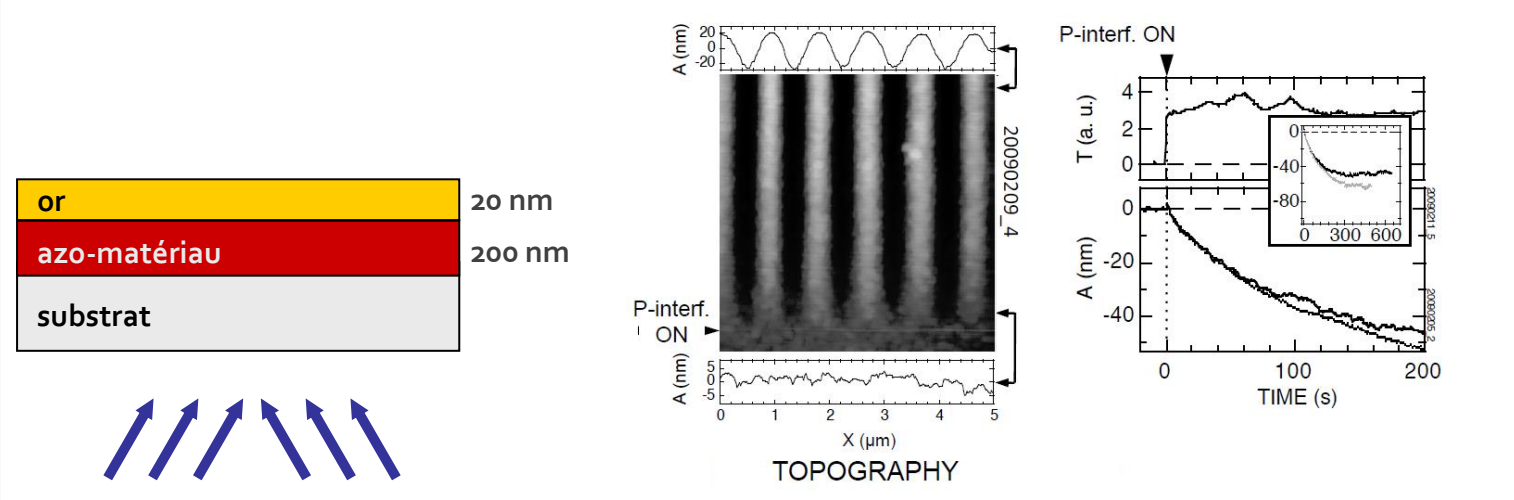
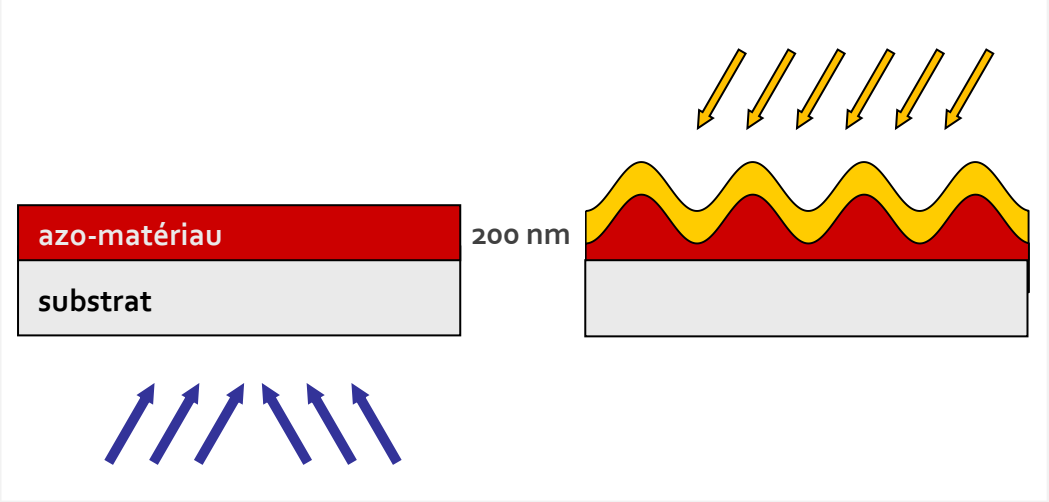


Photo-structuration optique d'empilements métal / diélectrique





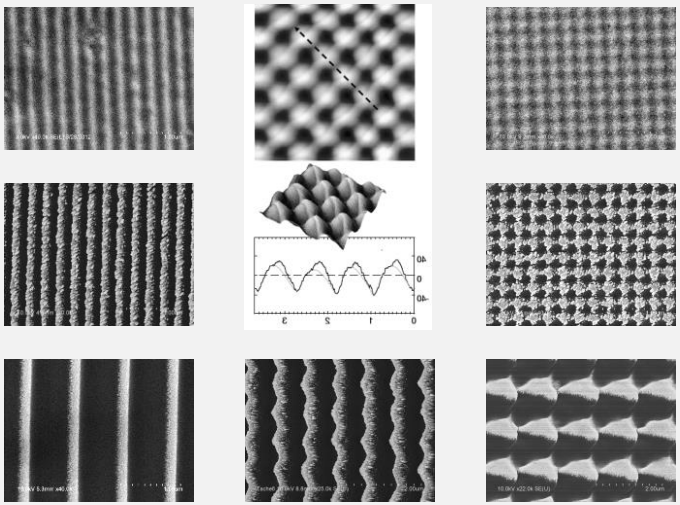
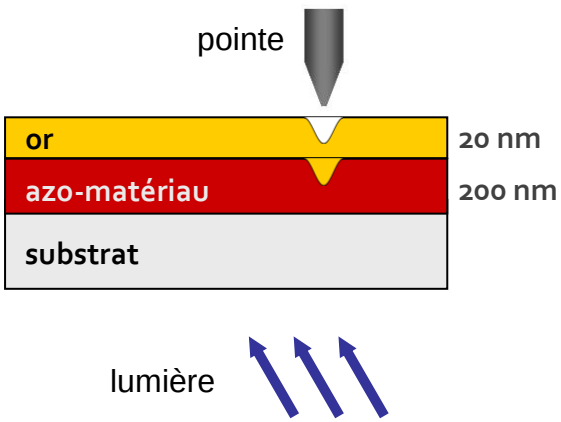
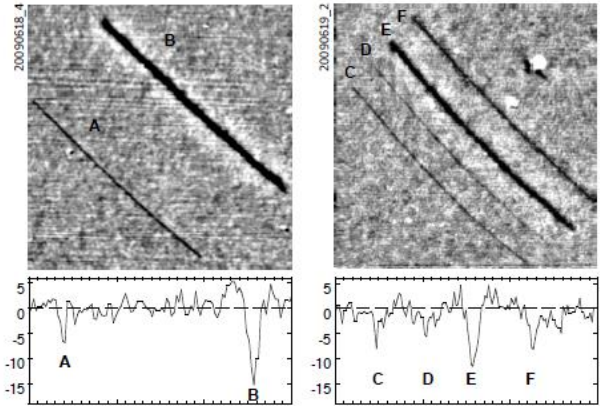


Photo-structuration optique d'empilements métal / diélectrique **en champ proche**

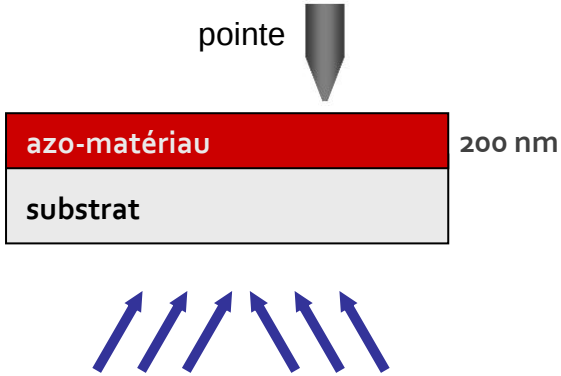


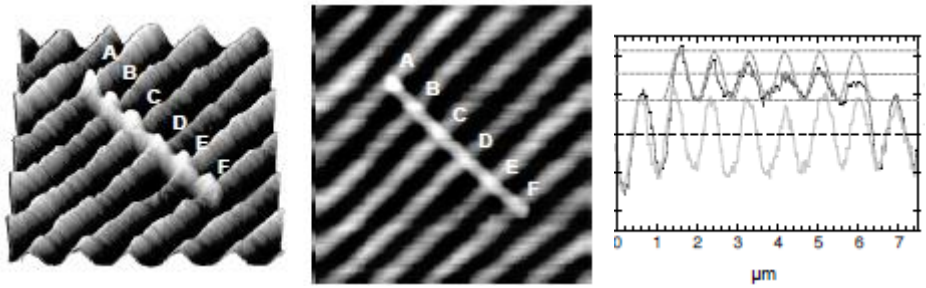
5 µm x 5 µm



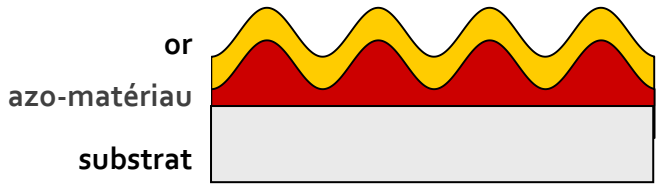
topographie

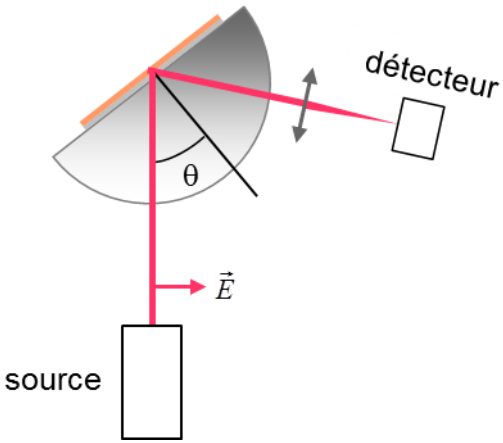
nano-usinage assisté optiquement

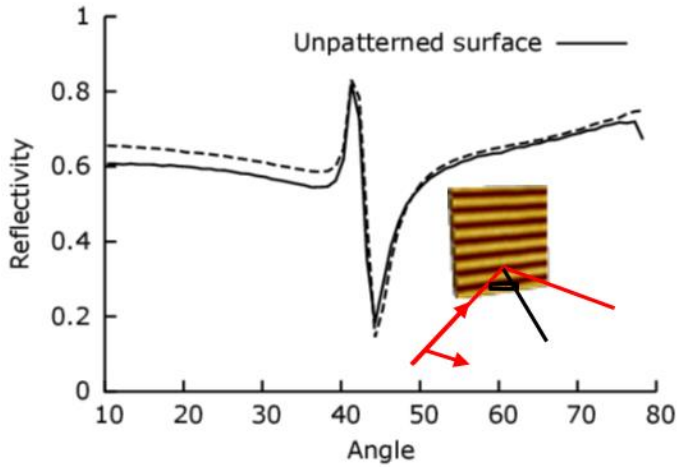




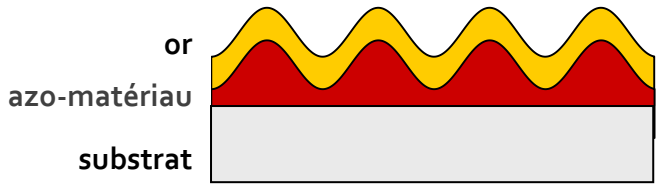
Plasmons dans les empilements métal / diélectrique nano-structurés

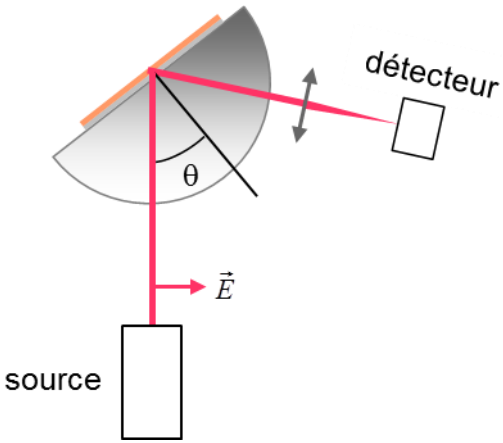


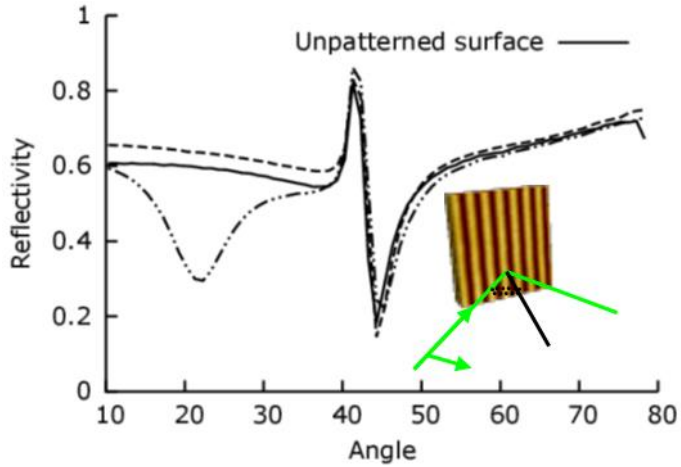




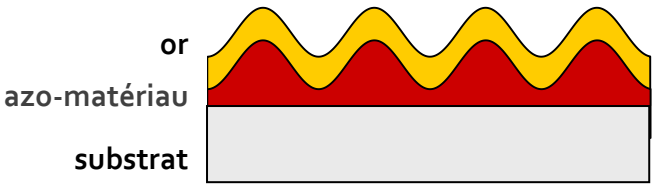
Plasmons dans les empilements métal / diélectrique nano-structurés

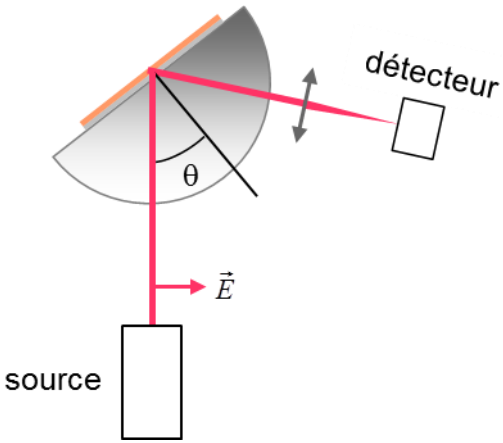


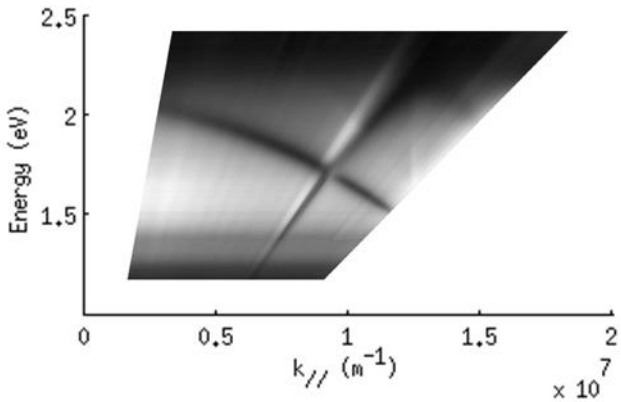


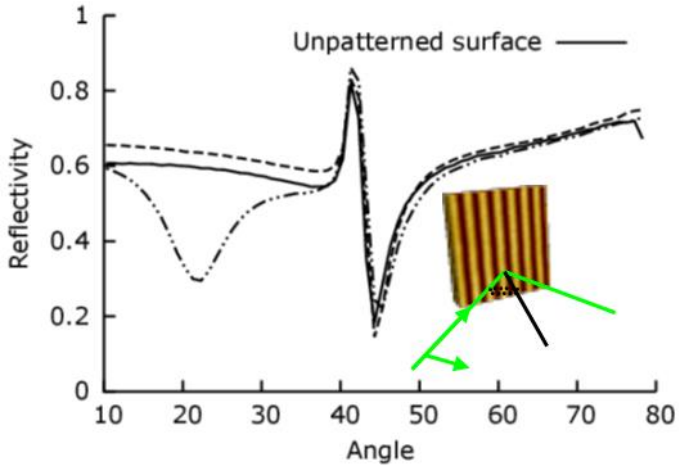


Plasmons dans les empilements métal / diélectrique nano-structurés

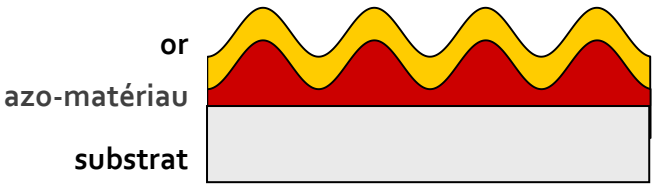


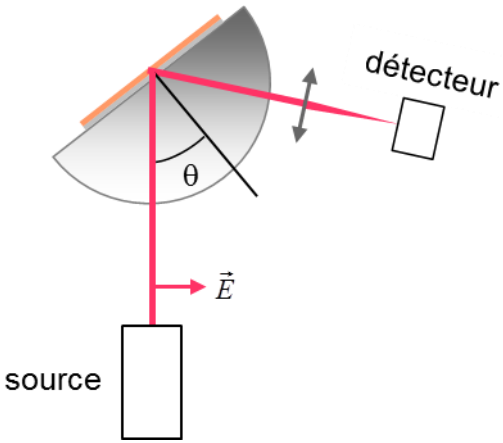


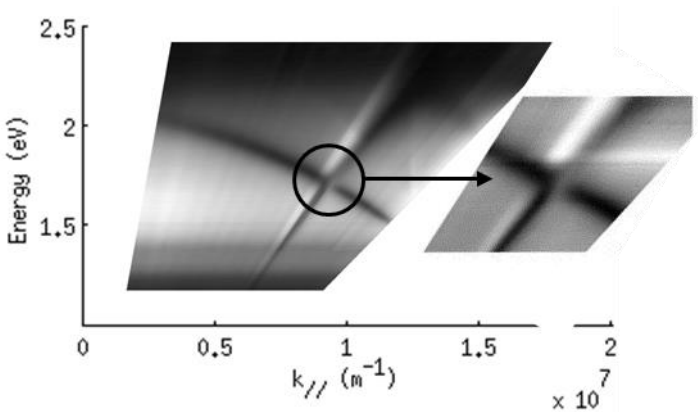


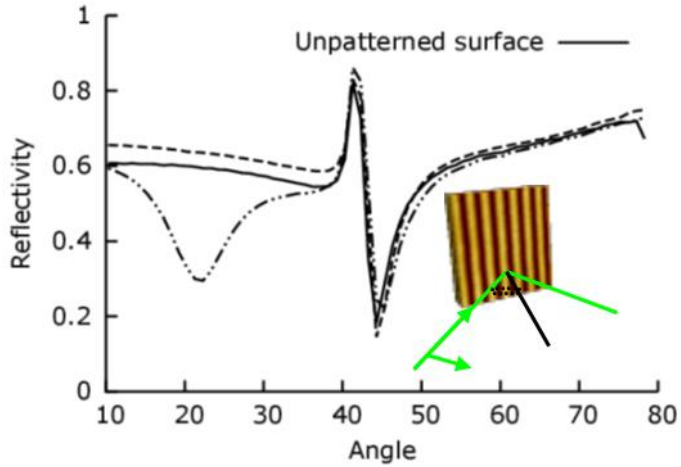


Plasmons dans les empilements métal / diélectrique nano-structurés

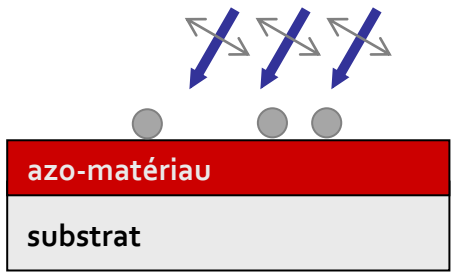


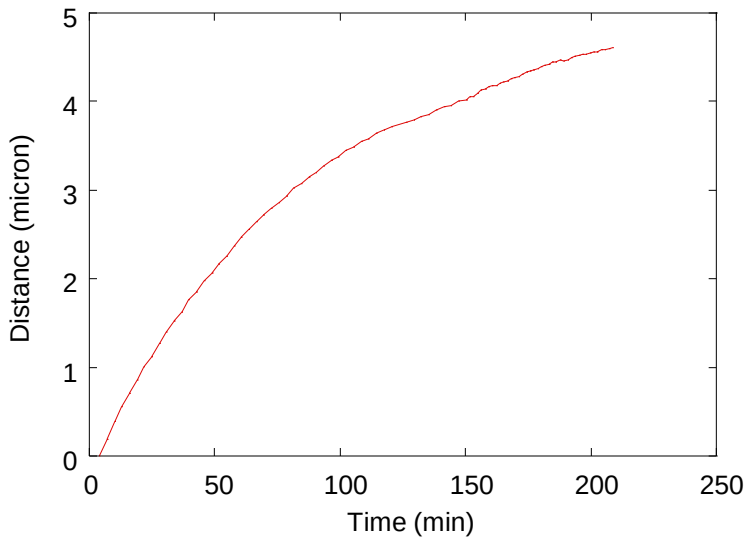


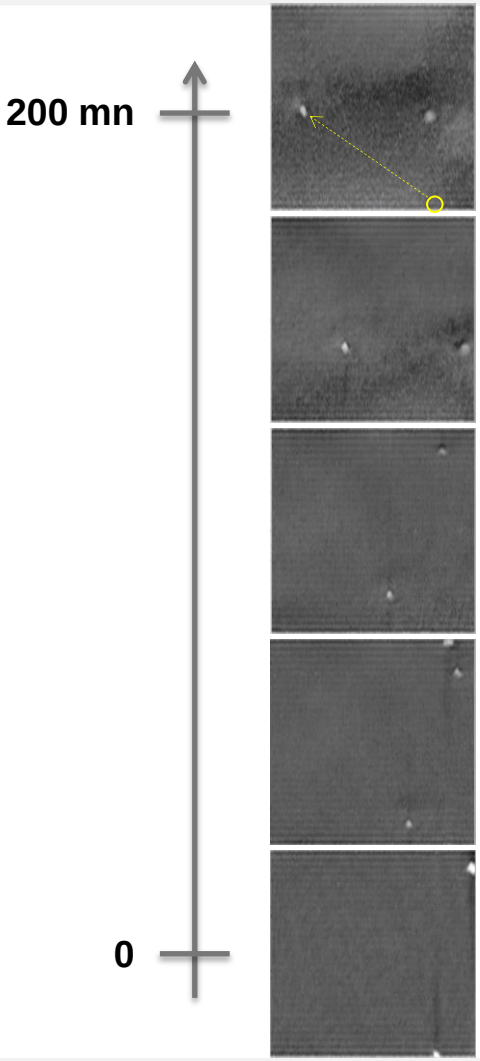




Contrôle optique de la position des nano-émetteurs



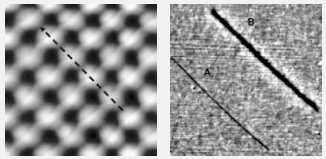


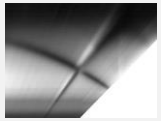


Conclusion

- Nano-structuration d'empilements métal / diélectrique

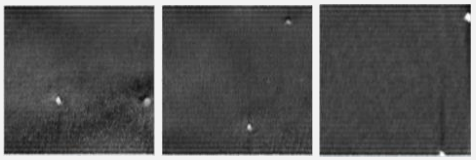
  en champ lointain – à grande échelle
  en champ proche – à l'échelle locale





- Contrôle des propriétés plasmoniques du motif

- Contrôle du déplacement de nano-particules sur une surface



La suite

- Détection de la luminescence de nano-émetteurs en champ proche

- Structuration d'une cavité plasmonique autour d'un nano-émetteurs