

NANOFTIR

SPECTROSCOPIE A TRANSFORMEE DE FOURIER RESOLUE SPATIALEMENT A L'ECHELLE DE 100 NANOMETRES

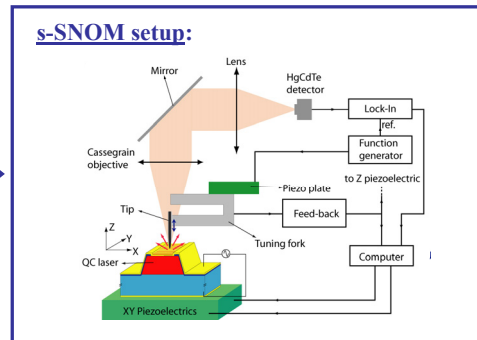
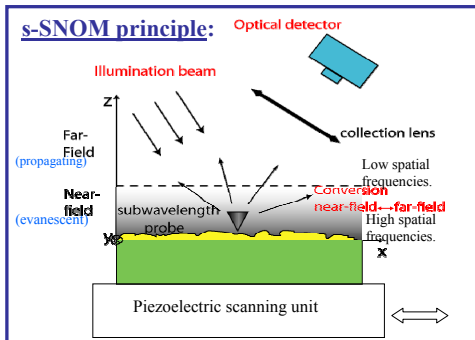
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Introduction :

- Scattering-type scanning near-field optical microscopy (s-SNOM) provides the ability to detect evanescent electromagnetic fields with a resolution $\ll \lambda$.
- This is an unique technique to map electromagnetic fields on opto-electronic devices such as quantum cascade lasers (QCLs) [1].
- Thanks to our home-made s-SNOM which operates in the mid-infrared we are able to map surface plasmons generated by a quantum cascade laser with a metal grating [2].

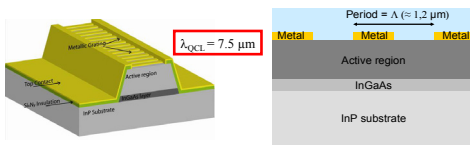


The goal :

- To generate electrically hybrid surface plasmons with a gold grating at the surface of a QCL.
- To launch the electrically generated plasmons in a large gold pad (60 μm) which constitutes a passive waveguide.
- To combine the near-field set-up with a FTIR spectrometer (in progress)

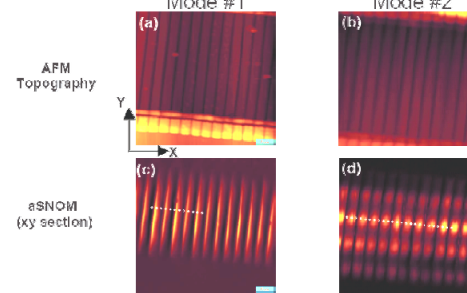
Investigation of QCLs with a metal grating [2] :

The device :

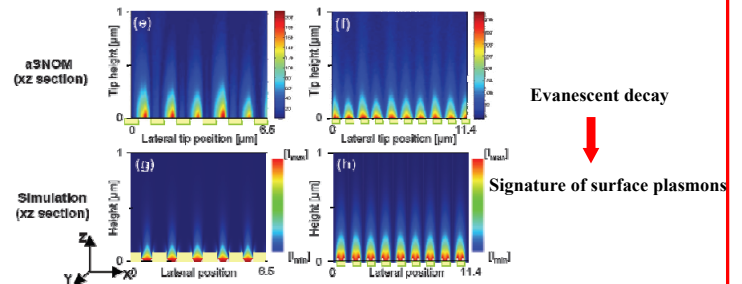


The top of a QCL has been structured with a gold grating
→ Distributed Feedback (DFB) QCL

Near-field measurements :



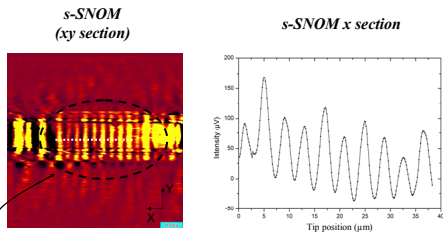
Near-field experiences on the device during operation demonstrate the presence of an intense evanescent electric field localized onto the metalized (mode#2) or onto the air gap (mode #1) accessible region of the laser surface.



The grating breaks the translational invariance
→ single mode emission
→ a hybrid surface-plasmon guided mode appear (mode 2)

Prospect : To launch this hybrid surface plasmons onto a passive waveguide

Preliminary result :



→ direct imaging of surface plasmons launched on the gold pad

$$\lambda_{\text{plasmons}} = 7.5 \mu\text{m} = \lambda_{\text{QCL}}$$

Possibility to generate surface plasmons in a large spectral range

Conclusions :

- s-SNOM observation of electrically generated hybrid surface plasmons on a DFB QCL with a gold grating.
- Direct s-SNOM observation of a standing wave pattern due to surface plasmons launched on a gold pad.