Proposition de thèse (1 page max)

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Titre / *title*: A **paradigm shift in acoustic imaging**

The generation of acoustic waves by pump and probe spectroscopy with frequencies up to a couple hundred GHz allows to obtain very good in-depth resolution. However, the spatial resolution is limited to a few hundred nanometers because the size of the laser spot being restricted by the diffraction of light. Recently we have proposed a novel approach by coupling AFM and picosecond ultrasonics, figure 1. Here, the generation of the acoustic waves and their detection are carried out at the free surface of the cantilever. The tip acts as a confinement system that is used to probe and excite the sample. Acoustic propagation in a conical silicon tip is firstly investigated both experimentally and numerically. The sensitivity of the acoustic field detected at the cantilever to a sample is proven and the first results of impedance surface imaging of a structured sample are demonstrated in contact mode. Acoustic transmission through the AFM probe to the sample in contact is also highlighted which paves the way for 3D acoustic imaging at the nanoscale.
The proposed work consists in exploiting this new coupling in order to obtain the first acoustic maps at the scale of ten nanometers of surface structures but also of buried structures.

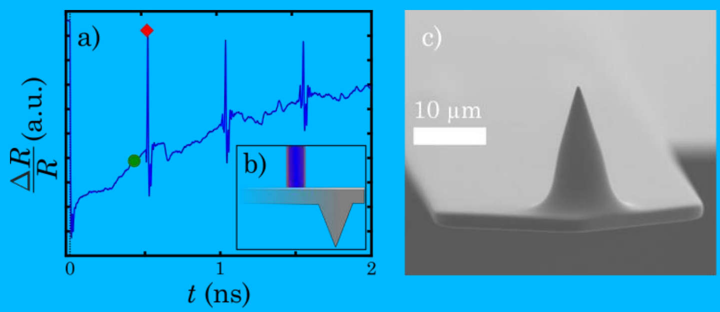

FIG. 1. a) Variation of reflectivity measured on the Al layer. b) Design of the measurement geometry. c) SEM image of an AFM probe.

Reference:

Substrate influence on the vibrational response of gold nanoresonators: Towards tunable acoustic nanosources PHYSICAL REVIEW B, **105**, (3) 035422, (2022)

Vibrational response of Au-Ag alloy and porous Au single nanowires probed by ultrafast pump-probe spectroscopy APPLIED PHYSICS LETTERS, **115**, (8), 083103, (2019)

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