Minicolloque n° PMQ29 **Oral** ☐ ~~**Poster**~~

Nano-electromechanical sensing with focused electron beams for measuring local dynamical properties of a nano-cantilever

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The interest for nanomechanical devices has risen over the last few years, both in fundamental and applied physics research. Recently, a new detection scheme was proposed, based on a focused electron beam illuminating a nanomechanical resonator, and exploiting the high contrast of the secondary electrons (SE) to measure the high-frequency fluctuations of the resonator. Using this technique, it was notably demonstrated that this process can be so sensitive as to allow a shot-noise – limited detection [1].

However, due to their extremely reduced size and masses, nanomechanical resonators are prominently sensitive to measurement backaction, and in particular its dissipative components, which generally result in heating the nanomechanical device of interest. In particular, the electromechanical coupling to an electron beam represents a unique playground for investigating the local dissipative effect coming along with the measurement process, which is a fundamental yet to be addressed.

In this work, we explore how one could determine the dynamical and fluctuational properties of an InAs nanowire by locally probing the fluctuations of such a system through illumination by a focused electron beam. We detail a number of phenomena which take place during this process and stand in the way of a proper local temperature mapping of a nanomechanical resonator [2].

[1] S. Pairis et al., Phys. Rev. Lett. **122**, 083603 (2019)
[2] C. Chardin et al., In prep.

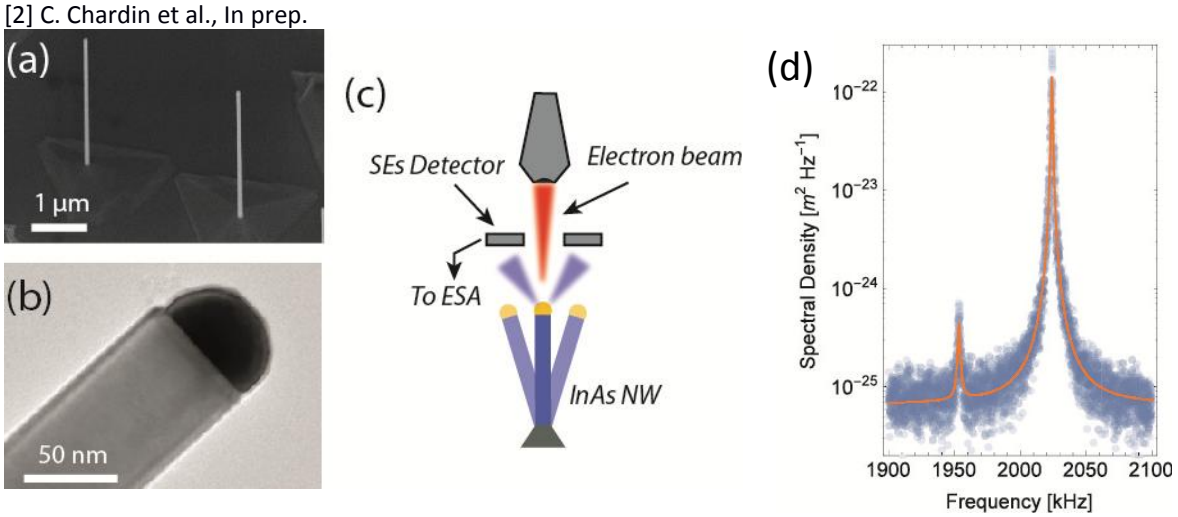

Figure 1 : (a) SEM micrograph showing two of the typical InAs nanowires used in the reported work. (b) TEM micrograph showing a magnified view of such InAs nanowire. (c) Schematic principle of the detection scheme. The fluctuations of the emitted secondary electrons are monitored as to reveal the nanomechanical motion fluctuations. (d) Typical motion spectrum obtained from the spectral analysis of the secondary electrons fluctuations