CEA - Saclay 91191 Gif-sur-yvette Cedex

**Service de Physique de l'Etat Condensé**

**SÉMINAIRE**

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**Mercredi 20 mars 11h15**

**Orme des Merisiers SPEC Salle Itzykson, Bât.774**

# Exploring micro and nano-mechanics through thermal fluctuations


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For decades, miniaturization has led to ever more integrated and energy efficient devices, challenging micro-electronics and mechanics industries. A major issue to overcome nowadays is the lack of characterization and manipulation tools at the nanometer scale. On the academic side, many fundamental questions of quantum mechanics and statistical physics are still open at such small scales, like the description of mesoscopic interactions or the role of fluctuations.

The design in our laboratory of an AFM (Atomic Force Microscope) with high resolution in force led to an original instrument to tackle these fundamental questions and their applications, with a world leading precision. Indeed, using a quadrature phase differential interferometer, we can measure the deflexion of the force sensor (micro-cantilever) with a fm/rtHz resolution in a several m input range, a 10 to 100 fold improvement of both sensitivity and range with respect to commercial systems.

We use this tool to investigate the mechanical behavior of micro and nano-systems such as AFM cantilevers or carbon nanotubes in contact with a substrate. During the presentation, I will demonstrate how thermal noise in these systems, far from being a limitation to the precision of the measurement, allows us to extract physical data on the elastic properties (Young's modulus or shear modulus) or on the interactions at nanoscale.


A coffee break will be served at 11h00. The seminar will be given in English.

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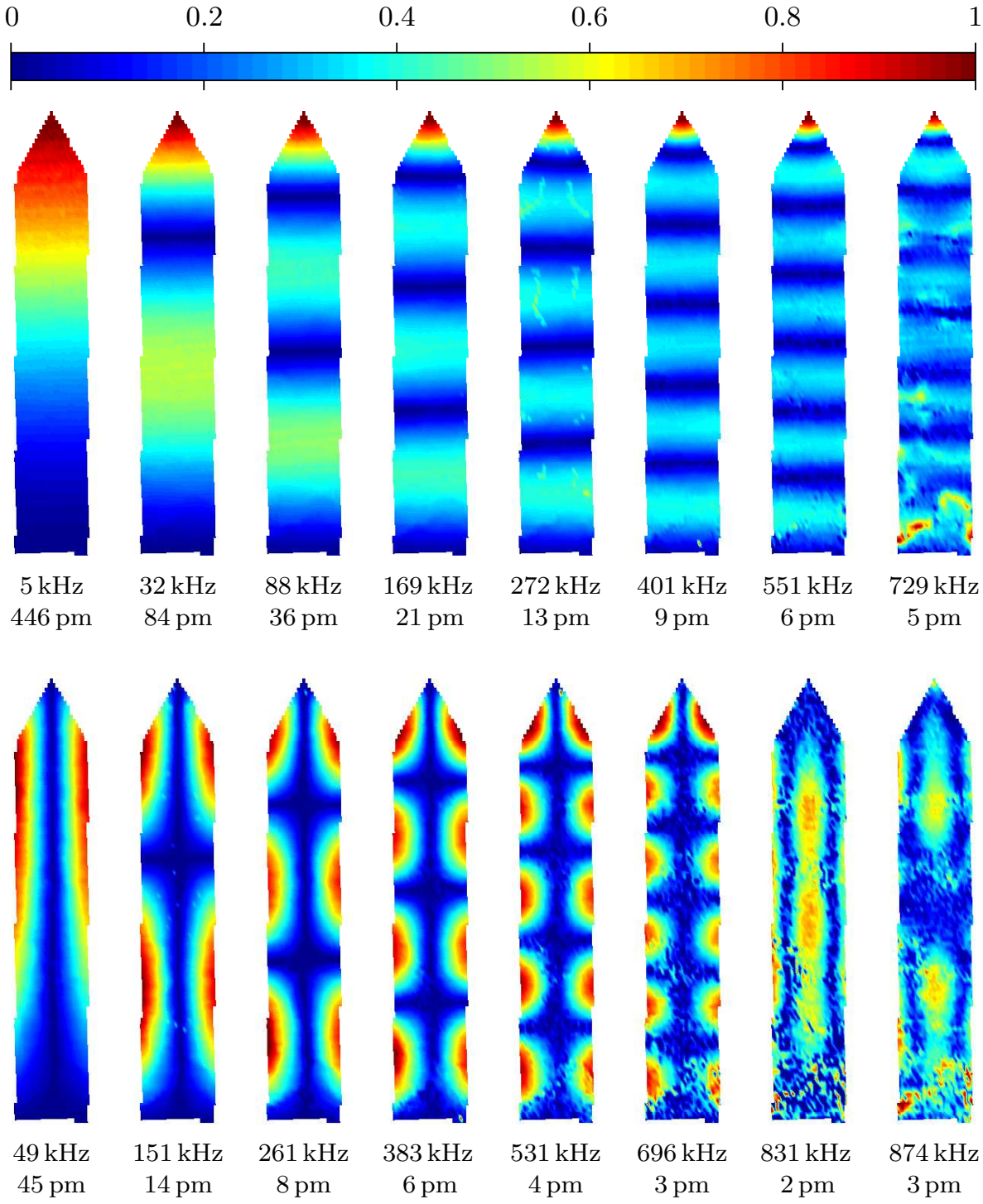


Figure 1: Cartographie du bruit thermique d'un micro-levier AFM libre (largeur 100m, longueur 500m) : les fluctuations naturelles du systme excitent ses modes propres et mettent en vidence leur forme spatiale. L'amplitude de vibration RMS est code  l'aide de l'chelle de couleur indique, la valeur pleine chelle tant indique sous chaque mode : notre rsolution est infrieure au picomtre.