# PROPOSITION DE STAGE

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| **TITRE** | **Single molecules coupled to a nano-mechanical oscillator** |
| **LABORATOIRE** | **Laboratoire Ondes et Matière d'Aquitaine (LOMA)** |
| **RESPONSABLE(S)** | **F. Pistolesi et R. Avriller** |



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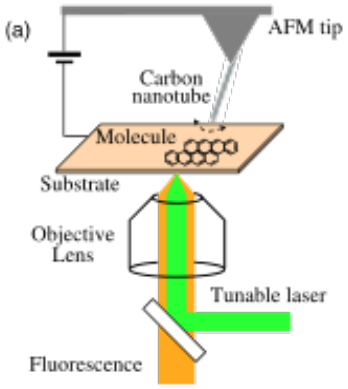
## Abstract


Detection and actuation of nanomechanical oscillators is an important challenge for science and technology. The possibility of manipulating mechanical oscillators in the quantum regime is a very active field of research with important results obtained recently like the observation of a mechanical oscillator in its ground state, the side-band ground-state cooling, the detection with the sensitivity given by the quantum limit.


Molecules dispersed in a solid state matrix are studied since a long time by optical methods, that allow to address the two-level electronic system present in a single molecule. We have recently proposed [V. Puller, B. Lounis, F. Pistolesi, Phys. Rev. Lett. 110, 125501 (2013)] to couple a mechanical oscillator to a single molecule and detect the motion of the oscillator by the spectroscopic signal (see the figure). We have also shown that with this method it is possible to cool the oscillator close to the ground state. One of the advantages of this system over other systems is the strength of the interaction between the electronic two level system of the molecule and the oscillator.

In this internship several points might be considered depending on the interest of the student. On topic is the strong coupling regime, and the dynamics of the coupled laser-molecule-oscillator system. A second problem that could be addressed is the coupling of the oscillator to two or more molecules. The research program is theoretical, with numerical or analytical approach, depending on the interest of the student.

Web site of our group: https://www.loma.cnrs.fr/thematique-quatems/