Stage de master de physique / Physics Master Internship

Proposition de stage/ Internship proposal (1 page max)

Date de la proposition : 28/09/22

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Code d'identification : INSP Organisme :SU CNRS
Site Internet / *web site*: https://www.insp.upmc.fr/
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Lieu du stage / *internship place*: tour 22-32 room 311

Titre du stage / *internship title*: **Picosecond ultrasounds as elasticity probes in neuron-like cells models**

Résumé / *summary*

The ability of cells to interact with their extracellular microenvironment, i.e. extracellular matrix or other cells, plays a critical role in several fundamental biological processes, such as cell proliferation, differentiation, migration, and tissue morphogenesis. Perturbation of tissue rigidity is associated with different types of pathology. However, it is sometime difficult to determine if this variation of stiffness is the cause or the consequence of the pathology. This is why the characterization of the mechanical properties of cells is essential to understand their behavior.

Several recent reviews describe tools used to study cell mechanics and to apply forces on them. The vast majority of conventional methods of measuring the local mechanical properties of cells are based on the use of solid probes, such as AFM, so that the measured mechanical properties can strongly depend on the contact/adhesion between the probe and the cell.

In contrast, acoustic waves generated by lasers provide a very adequate tool for probing the mechanical properties of biological cells or tissues in a non-contact, non-invasive configuration.

After having demonstrated [1-3] that it was possible to trace the elasticity at the micrometer scale in mummified cells (see fig1), a vast work consists now in envisaging studies in an aqueous medium and on living cells, in order to be able to eventually correlate the elastic properties to certain biological features.

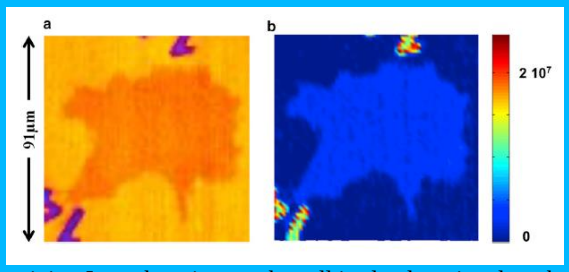

FIGURE 1 (a) Mapping of the transient reflectivity. In such an image, the cell is clearly pointed out by a smaller amplitude of the echo because of acoustic energy transmission into the cell body. (b) Mapping of the acoustic impedance deduced from the echo amplitude at the interface between the Ti transducer and cell is shown. Units in MPa . s .m.

References:

[1] **Data-Clustering Analysis of Scanning Ultrafast Acoustic Experiments: Revealing Acoustic and Structural Properties of a Motoneuron**
PHYSICAL REVIEW APPLIED **18,** 034051 (2022)

[2] **Correlative Imaging of Motoneuronal Cell Elasticity by Pump and Probe Spectroscopy** BIOPHYSICAL JOURNAL **120**, (3), 402-408 (2021)

[3] **Picosecond ultrasounds as elasticity probes in neuron-like cells models**
APPLIED PHYSICS LETTERS, 115, (21), 213701, (2019)

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : YES**

Si oui, financement de thèse envisagé/ *financial support for the PhD***:**