LabTAU - Unité de recherche U1032
Applications des ultrasons à la thérapie
Jean-Yves Chapelon, directeur

2 Years Post-Doctoral Position Available.

Passive and active shear wave elastography.

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The concept developed in this project is to use noise correlation technique in elastography, a shear wave tomography of soft tissues. It finds its origin in both physics and seismology. In seismology[1], coda wave interferometry also known as noise correlation has been a major breakthrough in the last decade. This approach is known in physics as time reversal[2]. The aim of this project is to apply this fruitfull concept in medical imaging. More precisely, our short term next two years objective, in total rupture with any other program research on the subject, is to prove the potential of noise correlation in elastography. Extracting mechanical properties is usually performed with a single shear wave source and a time of flight technique to estimate the shear wave speed. From noise correlation methods, a complex wave pattern produced by several sources can also be used to improve SNR and spatial resolution. Beside, natural physiological noise exists in the human body as well. Pulsatility of the blood system, cardiac beatings or muscle activities are all playing the role of shear wave sources. Thus elastography becomes a passive method[3], free of any controlled shear wave sources.

Our long term vision is to extend passive elastography developed in ultrasound imaging[4] and generally speaking noise correlation techniques, to other medical imaging technology such as magnetic resonance imaging (MRI) or optical coherence tomography (OCT). With this early project as a starting point, noise correlation might well become a breakthrough in medical imaging for cancer detection.
The candidate should be skilled in medical ultrasound, wave physics and should have some experience with signal analysis. The 2-year post-doctoral position will ideally begin on October 1st, 2015.

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[1] M. Campillo and A. Paul. Long-range correlations in the diffuse seismic coda. Science, 299:547–549, 2003.
[2] M. Fink, Phys. Today **50** No. 3, 34–40 (1997).
[3] T Gallot, S Catheline, P Roux, J Brum, N Benech, and C Negreira. Passive elastography: Shear-wave tomography from physiological-noise correlation in soft tissues. IEEE Trans. Ultrason. Ferroelec. Freq. Contr., 58(6):1122, 2011.
[4] S. Catheline, R. Souchon, M. Ruppin, J. Brum, A. H. Dinh, J-Y Chapelon, Tomography from diffuse waves: passive shear wave imaging using low frame rate scanners, Appl. Phys. Lett. 103, 014101 (2013).

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