CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé - UMR 3680

SÉMINAIRE
Mercredi 17 mai 2017 à 11h15

Orme des Merisiers SPEC, Salle Itzykson, Bât.774

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Neuromorphic computing with spintronic nanoscale oscillators

The brain displays many signatures of non-linear dynamical networks, such as synchronization or complex transient behaviour [1,2]. These observations have inspired a whole class of models that harness the complex non-linear dynamical networks to perform neuro-inspired computing [3]. In this framework, neurons are modelled as non-linear oscillators, and synapses as the coupling between oscillators. These abstract models are very good at processing waveforms for pattern recognition but there are very few hardware implementations based on networks of coupled oscillators. This type of computing requires a huge number of oscillators for achieving excellent performance and nanoscale oscillators are necessary for easy integration in a microchip. However small devices tend to be noisy and to lack the stability required to process data in a reliable way. Spin torque nano-oscillators are a promising solution to over this issue because their well-controlled magnetization dynamics can lead to high signal to noise ratios. In addition, the other main advantages of spintronic oscillators compared to others existing oscillators are their exceptional ability to interact, non-linear tunability, fast time response (ns range), long lifetime and lower power consumption [4]. In this seminar, I will show different ways of leveraging the non-linear dynamics of spin-torque nano-oscillators for neuromorphic computing, and present our first experimental results of speech recognition [5].

[1] D. R. Chialvo, Nat. Phys. **6**, 744 (2010).
[2] J. Fell and N. Axmacher, Nat. Rev. Neurosci. **12**, 105 (2011).
[3] E. M. Izhikevich, IEEE Trans. Neural Networks **15**, 1063 (2004).
[4] J. Grollier, D. Querlioz, and M. D. Stiles, Proc. IEEE **104**, 2024 (2016).
[5] J. Torrejon et al, arXiv:1701.07715 (2017).

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

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