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CV/ biography

Julie Grollier is researcher director in the CNRS/Thales lab in France, where she is leading the "Nanodevices for Bio-Inspired Computing" team.

Julie completed her Ph.D in the field of spintronics at Pierre and Marie Curie University, under the supervision of Albert Fert. After two years of post-doc, first in Groningen University (Netherlands, group of B.J. van Wees), then in Institut d'Electronique Fondamentale (France, group of C. Chappert), she joined CNRS in 2005. Her current research interests include spintronics and novel nanodevices for neuromorphic computing.

Julie has over 100 publications, and is a frequent invited speaker in international conferences. She is a Fellow of the American Physical Society. In 2010 she was awarded the Jacques Herbrand prize of the French Academy of Science. In 2013, she created the interdisciplinary research network GDR BioComp, which goal is to produce hardware bio-inspired systems, and chaired it for five years. In, 2018 she received the Silver Medal of CNRS in Physics for her pioneering work on spintronics and brain-inspired computing. She is the recipient of two prestigious European Research Council grants: "NanoBrain" project (Memristive Artificial Synapses and their integration in Neural Networks, 2010-2015) and "BioSPINSpired" project (Bio-inspired Spin-Torque Computing Architectures, 2016-2021).

SPINTRONIC NEURAL NETWORKS

Spintronic oscillators are nanoscale devices realized with magnetic tunnel junctions that have the potential to be integrated by hundreds of millions in electronic chips. Their tunable, non-linear dynamical properties can be leveraged to imitate biological neurons. The transient dynamics of coupled spintronic nano-oscillators has been used to perform pattern recognition, such as speech classification (1-4). These demonstrations should now be scaled to deep networks to establish their potential.

A key asset of spintronic nano-oscillators towards this goal is their ability to emit radio-frequency (RF) signals. These oscillators indeed produce microwave voltages with varying amplitude and frequency in response to direct current inputs. They could therefore potentially communicate through radio-frequencies signals, allowing fully parallel operation with minimized wiring, at a speed seven orders of magnitude faster than the brain. But for this, it is necessary to devise radio-frequency synapses that can interconnect the oscillators.

In this talk, I will rapidly review recent results on neuromorphic computing with spintronic nano-oscillators. I will then describe how they can be interconnected layer-wise through RF spintronic nano-synapses, and present our recent simulation results of classification with these novel RF synapses.

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