Masters – Spintronic Memristor

CMOS technology through transistor scaling has been the main driver for the huge productivity growth registered over the past 50 years. However, transistor scaling is approaching its physical limits and new devices, circuits and architectures are being investigated to continue the performance scaling. To replace the silicon transistor, many devices have been proposed and are currently at varying levels of maturity – from idea to experimental demonstration. Devices with spin as a state variable encompass a broad range of computing concepts and physical incarnations for memory and logic applications.

For instance, magnetic domains are commonly used in hard-disk drives and Magnetic Random Access Memory (MRAM) to store information. When these domains are inside a magnetic strip, they can be moved by several means, such as Spin Transfer Torque (STT) or Spin-Orbit Torques (SOT). Several applications using domain wall (DW) motion have been considered, in particular for logic and memory. But DW can also be used for neuromorphic computing, which combines both logic and memory. In this case, the DW motion induces a change in resistance, thus leading to a new device, called “memristor”. This is the key component to build large-scale neuromorphic circuits that will enable efficient and low-power implementation of machine learning algorithms. The goal of this thesis is to build DW-based memristor devices and to propose innovative solutions for the controllability of the domain wall. The candidate will design and fabricate Hall bar devices at imec’s LAB clean room and characterize their magnetic and electric properties.

The team working on spin devices currently includes a mix of experimentalists, scientists focused on micromagnetic modeling and engineers working on circuit models using these concepts.

Profile

You have a Bachelor in Physics or Engineering with a strong background in solid-state Physics.
You have some knowledge on spintronics
You are a self-starter and a hands-on person with a clear motivation to work in a cleanroom environment.
You can easily integrate in an international team.
You have good English communication skills.

This master topic is partially funded by imec, depending on the candidate excellence.

For more information, please contact:
Dr. Adrien Vaysset (vaysset@imec.be)
Dr. Mauricio Manfrini (manfrini@imec.be)