MAR16-2015-000220

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

In Search of New Spintronic Devices Using the Modular Approach[1]

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There has been enormous progress in the last two decades, effectively combining spintronics and magnetics into a powerful force that is shaping the field of memory devices. At the same time, new materials and phenomena continue to be discovered at a very fast pace, providing an ever-increasing set of building blocks that could be exploited in designing functional devices of the future.

Through careful benchmarking against available theory and experiment we recently established a set of "elemental" circuit modules representing a diverse range of materials and phenomena [1], which are continually updated [2]. We will first show how these elemental modules can be integrated seamlessly to model both spintronic transport and nanomagnetic dynamics, starting from basic spin-valves and extending to complex experimental structures.

We will then show how this framework can be used to design transistor-like spintronic devices to provide novel functionality compared to a standard complementary metal oxide semiconductor (CMOS) device. This approach allows us to incorporate the detailed physics of diverse sophisticated phenomena accurately into detailed circuit-level simulations to provide reliable estimates for the switching energy and delay of carefully designed devices.

[1] K.Camsari et al., Scientific Reports, 5, 10571 (2015)
[2] https://nanohub.org/groups/spintronics

[1]This work was supported in part by C-SPIN, one of six centers of STARnet, a Semiconductor Research Corporation program, sponsored by MARCO and DARPA and in part by the National Science Foundation through the NCN-NEEDS program, contract 1227020-EEC.