On-line SPICE-SPIN+X Seminars

Wednesday, 7th July 2021, 15:00 (German Time)

The seminar will be via Zoom (Meeting ID: 846 6680 3203) and live streamed in the SPICE YouTube Channel.

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Neuromorphic magnon-spintronic networks

Today's computational technology based on CMOS has experienced enormous scaling of data processing capability as well as of price and energy consumption per logic element. However, new ways to process and analyze data like brain-inspired computing need novel hardware which implements the structure of the new logical concepts as directly as possible into a physical realization. In this context, spintronic systems are promising because of their intrinsic nonlinearity, low power consumption, scalability, ability to store information and to use multiplexing functionality.

I will discuss how the field of magnon-spintronics can contribute to this development using a novel hybrid system which combines nanoscaled ultralow damping magnonic systems [1,2] with spintronic auto-oscillators [3]. The proposed system uses guided coherent spin waves and their interference effects in magnetic insulators to interconnect metallic spintronic neurons. In this way, it takes advantage of the intrinsic nonlinearity of the spin system and the multiplexing functionality provided by the wave character. I will compare this type of network to the recently demonstrated optical neurosynaptic networks [4]. In addition, I will present the "inverse design" concept [5] which enables novel ways to efficiently design the building blocks needed for the proposed magnon-spintronic networks.

[1] Wang et al., Phys. Rev. Lett. 122, 247202 (2019) doi: 10.1103/PhysRevLett.122.247202

[2] Q. Wang, et al. Nature Electronics 3, 765–774, (2020) doi: 10.1038/s41928-020-00485-6

[3] M. Romera et al., Nature 563, 230 (2018) doi: 10.1038/s41586-018-0632-y

[4] Feldmann et al., Nature 569, 208 (2019) doi: 10.1038/s41586-019-1157-8

[5] Q. Wang, A. V. Chumak, and P. Pirro, Nat. Com. 12, 2636 (2021) doi: 10.1038/s41467-021-22897-4