TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

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OPTIMAS light-spin-matter

# Einladung zum Laser- und Quantenoptikseminar

## Freitag, 01.02.2019, um 10:00 Uhr

## Raum 46-387/388


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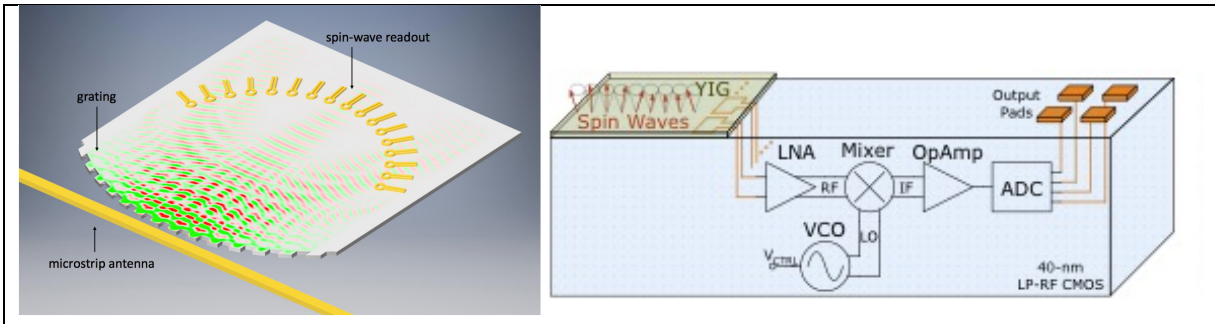
# Applications for spin-based computing devices


It is generally acknowledged today that Moore's law, in its original form, has ended, and the field of microelectronics is open for fundamentally new ideas and new ways of doing computing. There is a lot of hope in spin-based devices: about half of emerging nanoelectronics concepts use magnetic materials in one way or another. A killer application, however, where a spin-based device would significantly outperform semiconductor-based circuits, has not been demonstrated yet.

In this talk I will give a quick survey of our research into magnetoelectronic computing devices. I will start with an overview of more matured projects such as Nanomagnet Logic and spin-torque oscillator based devices but I will focus most of the talk of potential applications of spin waves. What makes spin waves outstanding candidates is that they may simultaneously allow fast and low power processing - something that is very difficult to achieve in CMOS-based electronics. One application of spin waves could be ultra-low power and compact information processing in the microwave domain. Low-power special-purpose processors could become part of image processing pipelines as well.

I will visit old ideas about optical computing as some of these ideas may be eventually implemented in the spin wave domain. The complex nonlinear dynamics of spin waves may allow neuromorphic computing concepts to be realized, which could also be a potential killer applications for spin waves.


Conceptual sketch of a spin-wave-based spectrum analyzer [1] and circuit schematics of an on-chip amplifier for spin wave detection [3].


[1] Papp, A, Porod W., Csurgay A. I., Csaba, G. "Nanoscale spectrum analyzer based on spin-wave interference." Scientific Reports 7, no. 1 (2017): 9245.

[2] Csaba, György, Adam Papp, and Wolfgang Porod. "Perspectives of using spin waves for computing and signal processing." Physics Letters A 381, no. 17 (2017): 1471-1476.

[3] Egel, E., Meier, C., Csaba, G. and Breitkreutz-von Gamm, S., 2017. Design of a CMOS integrated on-chip oscilloscope for spin wave characterization. *AIP Advances*, *7*(5), p.056016.


Der Gast wird betreut von JProf. Dr. A. Chumak

GÄSTE SIND HERZLICH WILLKOMMEN!