# MAINZ LECTURE SERIES

## Mittwoch, den 12.12.2018 um 9:00 Uhr in Raum 46-323

## Brain-inspired approaches in ultrafast magnetism


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The explosive growth of digital data and its related energy consumption is pushing the need to develop fundamentally new physical principles for faster and more energy-efficient control of materials. Magnetic materials are already at the center of computing today, due to their ability to store information within the direction of magnetic moments in a non-volatile and rewritable way. In recent years, tremendous progress has been made in controlling magnetism with femtosecond optical pulses, including demonstrations of record-breaking fast write-read events [1], operation in technologically relevant materials such as CoPt [2] and enabling magnetic recording that is not only much faster but also exhibits a projected heat load of only 22 aJ per magnetic bit [3]. Here we present our recent progress focused on (i) experimental demonstration of supervised learning of an opto-magnetic neural network that exploits the optical control of magnetization of Co/Pt films as artificial synapses [4] and (ii) using machine learning to simulate ultrafast quantum spin dynamics in antiferromagnets triggered by ultrafast control of the exchange interaction [5, 6].



1. Vahaplar, K., et al., Ultrafast Path for Optical Magnetization Reversal via a Strongly Nonequilibrium State. Physical Review Letters, 2009. 103(11): p. 117201.
2. Lambert, C.H., et al., All-optical control of ferromagnetic thin films and nanostructures. Science, 2014. 345(6202): p. 1337.
3. Stupakiewicz, A., et al., Ultrafast nonthermal photo-magnetic recording in a transparent medium. Nature, 2017. 542: p. 71.
4. A. Chakravarty, et al., Supervised learning of an opto-magnetic neural network with femtosecond laser pulses. In preparation, 2018.
5. Fabiani, G. and J.H. Mentink, Investigating ultrafast quantum spin dynamics with machine learning. in Machine Learning for Quantum Many-body Physics. 2018. Dresden.
6. Mentink, J.H., Manipulating magnetism by ultrafast control of the exchange interaction. J. Phys.: Condens. Matter, 2017. 29 p. 453001


Gäste sind herzlich willkommen. Der Gast wird betreut von D. Nenno (nenno@physik.uni-kl.de)