Advanced Magnonics

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In the field of magnonics, wave-based logic devices are constructed and studied based on the utilization of spin waves and their quanta - magnons. The field is developing rapidly due to its potential to implement innovative ways of data processing as a CMOS complementary technology. Basic building blocks of magnonics have already been realized. Examples are spin-wave waveguide structures, frequency- and wavenumber-selective spin-wave filters based on magnonic crystals, parametric amplifiers and induction- and Spin Hall Effect-based spin-wave emitters and detectors.

In this talk, I will give an overview over the fundamentals and the current trends in magnonics. One topic is the realization of new functionalities and devices based on the already available "magnonic tool-box". In this context, I will discuss an important step towards spin-wave based logic elements – the realization of a magnon transistor in which the source-to-drain magnon current is controlled by the injection of magnons into the transistor's gate. I will report about the successful realization and possible application of this device.

Another important direction is to use fundamentally new macroscopic quantum phenomena such as Bose-Einstein condensates (BEC) at room temperature as a novel approach in the field of information processing technology. Very promising is the use of magnon supercurrents driven by a phase gradient in the magnon BEC. I will demonstrate evidences of the formation of a magnon supercurrent and its spatio-temporal behavior, which was revealed by means of time- and wavevector- resolved Brillouin light scattering (BLS) spectroscopy.