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On behalf of the

**University of Vienna/Faculty of Physics**

**Nanomagnetism and Magnonics, Physics of Functional Materials, and Electronic Properties of Materials**

we cordially invite you to the talk of

# PD Dr. habil. Oleksandr V. Dobrovolskiy

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## Superconducting magnon fluxonics, spin-wave nano-optics, and 3D nano-architectures as modern trends in spintronics

**Date**: Thursday, September 26th 2019, 14:00
**Location**: Josef Stefan lecture hall
Boltzmanngasse 5, 1090 Vienna, 3th floor

In the recent years, magnonics - the study of spin waves, i,e. precessional excitations of ordered spins in magnetic materials - has emerged as one of the most rapidly growing research domains in spintronics [1], rendering it as a potential rival of or complement to semiconductor technology for data communication and processing. Yet, loss reduction, shortening of the wavelength of spin waves, and the associated miniaturization of devices remain major challenges in magnonics [2], thus making approaches originating from other domains of physics especially valuable for the magnonics research.

In my talk, I will introduce three modern trends in magnon spintronics which are associated with superconductivity, nano-optics, and 3D nanomagnetism. Namely, superconducting magnon fluxonics has emerged, relying upon the interaction of spin waves with a lattice of Abrikosov vortices (fluxons) in superconductor/ferromagnet heterostructrues [3]. Therein, scattering of spin waves on the moving vortex lattice is accompanied by the Doppler effect and the Bloch-like band structure with forbidden-frequency gaps in the magnon spectrum can be tuned by both, the magnetic field and the transport current. In spin-wave nano-optics, approaches to generate and manipulate spin-wave beams in graded-refractive-index magnetic media are at the forefront of research, and my particular attention will be paid to spin-wave lenses based on the spin-wave phase-tuning using a single nanodefect [4].

Finally, 3D nano-architectures fabricated by focused ion and electron beam induced deposition [5] will be presented, offering unprecedented prospects for nanomagnetism and superconductivity because of topology and geometry-controlled effects. Thus, while 3D nanomagnetism is a very hot topic [6] with few techniques capable for the fabrication of respective structures, in the case of superconducting nanostructures, the combination of low-dimensionality with a curvilinear geometry allows for the observation of topology-driven effects, such as Berezinskii-Kosterlitz-Thouless transition [7] and unconventional phase slips, offering prospects for microwave applications [8] and photon detection.

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[3] O.V. Dobrovolskiy, ..., A.V. Chumak. Nat. Phys. 15, 477 (2019).
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[5] M. Huth, F. Porrati, O. V. Dobrovolskiy, Microelectron. Engin. 185-186, 9 (2018).
[6] A. Fernandez-Pacheco et. al. Nat. Commun. 8, 15756 (2017).
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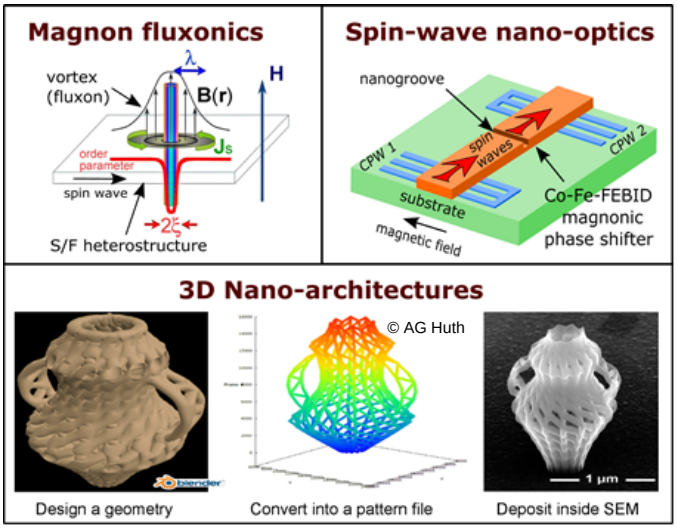


*Andrii Chumak, Dieter Süss, Wolfgang Lang*