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## ABSTRACT

## Antiferromagnetic spintronics

Louis Néel pointed out in his Nobel lecture that while interesting from theoretical viewpoint, antiferromagnets did not seem to have any applications. Indeed, the alternating directions of magnetic moments on individual atoms and the resulting zero net magnetization make antiferromagnets hard to control by tools common in ferromagnets. This has hindered both the research and utility of these abundant magnetic materials. Recent studies have shown, however, that electrical current can be used to efficiently reorient the Néel vector. Combined electrical writing and electrical readout have been experimentally demonstrated in thin-film antiferromagnets CuMnAs, Mn2Au, NiO and others. A proof-of-concept USB device has been realized showcasing binary and multi-level characteristics of memory cells fabricated in CuMnAs. The absence of dipolar fields is favorable for high density integration and makes the memory robust against external magnetic field perturbations. The multi-level switching allows to integrate memory with logic or neuromorphic functionalities within the bit cell. Another unique merit of antiferromagnets is the ultra-fast, THz spin dynamics which has allowed to demonstrate switching by electrical pulses whose length has been scaled down to a picosecond. Despite this recent progress summarized in the lecture, antiferromagnetic spintronics is still at its infancy with the field's full potential yet to be explored. We will conclude the lecture by outlining the rich symmetry and topology landscape that is now emerging by including antiferromagnets in spintronics to stimulate a renewed basic and applied research interest in these historically overlooked Néel's magnets.

Reference

Focus on Antiferromagnetic Spintronics, Nature Physics 14 (2018).

## BIO

Born in Prague, Czech Republic, Tomas Jungwirth received his PhD degree in condensed matter physics from the Charles University in Prague in 1997. The PhD thesis work on quantum Hall effect phenomena in semiconductors was performed partly in the Institute of Physics ASCR in Prague and partly at the Indiana University, USA. Subsequently he worked as a NATO Postdoctoral Fellow at the Indiana University and a Research Fellow and Adjunct Professor at the University of Texas, USA. In 2004 Tomas Jungwirth was appointed a Professor-

Chair at the University of Nottingham, UK and in 2007 a Head of the Department of Spintronics and Nanoelectronics of the Institute of Physics ASCR in Prague.

The fields of expertise of Tomas Jungwirth are condensed matter physics, materials science, electronic properties of nanostructures, quantum Hall effects, magnetic, magneto-transport and magneto-optical properties of ferromagnetic semiconductors, quantum-relativistic spin-orbit coupling phenomena including anisotropic magnetoresistace, anomalous and spin Hall effects, and non-magnetic, ferromagnetic, and antiferromagnetic spintronic devices.

Tomas Jungwirth has co-authored about 200 publications including 50 papers in Reviews of Modern Physics, Physical Review Letters, Nature Publishing Group, or Science. In 2011 he was awarded an ERC Advanced Grant in the field of spintronics. He was a member of the ERC Advanced Grant Evaluation Panel from 2009 to 2014. Besides the ERC Scientific Council, he is a member of the Research and Development Council of the Government of the Czech Republic, member of the Learned Society of the Czech Republic, and member of the Academy of Europe.

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