Cavity Spintronics

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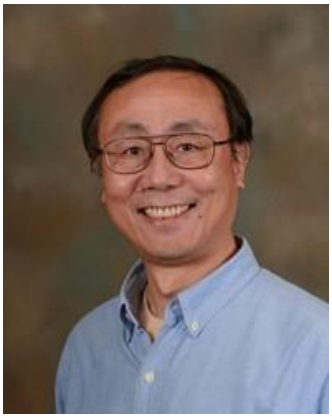
Cavity spintronics (also known as spin cavitronics) is a newly developing, interdisciplinary field that brings together microwave and optical communities with researchers in spintronics and magnetism. The field started around 2014 when it was found that ferromagnets in cavities hybridize with both microwaves and light by light-matter interaction [1]. Since then, the emergence of cavity spintronics has attracted broad interest from groups studying quantum electrodynamics, cavity polaritons, optomechanics, superconductivity, plasmonics, and phononics. At the center stage of the topic is the physics of magnon-photon coupling: Via the quantum physics of spin-photon entanglement on the one hand and classical electrodynamic coupling on the other, magnon-photon coupling connects some of the most exciting concepts in modern physics, such as quantum information and quantum optics, with one of the oldest sciences on earth, magnetism.

This talk aims to provide an introduction to this new frontier of condensed matter physics to researhers working in magnetism, spintronics, quantum information, and microwave technologies. The talk starts with a historical review, tracing this new field back to some of the most courageous work in the history of magnetism, spintronics, cavity quantum electrodynamics, and polaritons. Recent experiments focusing on the development of new cavity-mediated techniques, such as coupling of magnetic moments, distant manipulation of spin current, qubit-magnon coupling, and conversion between optical and microwave photons, will be highlighted.

[1] Can-Ming Hu, "Dawn of cavity spintronics," https://arxiv.org/abs/1508.01966

Biography



Can-Ming Hu graduated in 1988 from Fudan University in China. He received his doctorate degree in 1995 from Wuerzburg University in Germany. From 1998 to 1999, he spent a year at NTT Basic Research Laboratories in Japan working on semiconductor spintronics. In 2005, after receiving the habilitation degree from the University of Hamburg, Germany, he and his group moved to University of Manitoba, Canada, where he became a full professor in 2012. In 2015 his group was the first to develop a method for electrical detection of cavity magnon polaritons, thereby making a strong contribution to the emergence of the new field cavity spintronics.

Prof. Hu has published over 130 technical articles in peer-reviewed journals, including book chapters and invited review articles. He has given about 100 invited presentations on semiconductor physics, spintronics, magnetism, and microwave technologies. He co-organized several international workshops: Spin Mechanics IV (Canada, 2017), Magnetic North III (Canada, 2012), Magnetic North I (Canada, 2010), and International Symposium on Quantum Hall Systems and Quantum Materials (Germany, 2004). He served as a deputy director of the State Key Laboratory of Infrared Physics in China, a regional councillor for the Canadian Association of Physicists, and is currently a member of the Commission on Magnetism (C9) of the International Union of Pure and Applied Physics.