Solid State Technology and Devices Seminar

Magnonic Spintronics: Toward Spin Wave Based Information Processing

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Abstract: Spin wave is considered as one of the promising candidates for realizing unconventional computing and interconnection. Compared with other forms of waves, spin wave has many unique features, including short wavelength, intrinsic nonlinearity, non-reciprocity, etc. In this talk I will discuss some of our recent efforts in studying transport properties of spin wave (or equivalently, magnons) in various magnetic structures. In the first example, I will show that there exist mutual interactions between magnons and magnetic domain walls in a ferromagnet, where domain walls change the phase and magnitude of spin waves, and a strong spin wave in turn moves the position of domain walls. This mutual interaction can be used to realize a programmable spin wave phase shifter. In the second example, I will talk about long-range spin transport in an easy-plane antiferromagnet, where the spin angular momentum propagates via the superposition of two linearly polarized magnon modes. We show that the magnon transport in this antiferromagnet can be used to build a non-volatile spin current switch. These mechanisms and device structures could be used as building blocks for future magnon based information processing in the classical and quantum domain.

Bio: Dr. Luqiao Liu is an Associate Professor of Electrical Engineering at Massachusetts Institute of Technology. He received his B.S. in physics from Peking University in 2006, and Ph.D. in Applied Physics from Cornell University in 2012. He worked as a Research Staff Member at IBM Watson Research Center before joining MIT in 2015. Luqiao's current research focuses on spintronic material and devices for memory, logic and communication applications. Luqiao Liu has received the award of McMillan Award, NSF Career Award, Air Force Young Investigator Award, Sloan Fellowship, and International Union of Pure and Applied Physics Young Scientist Award.