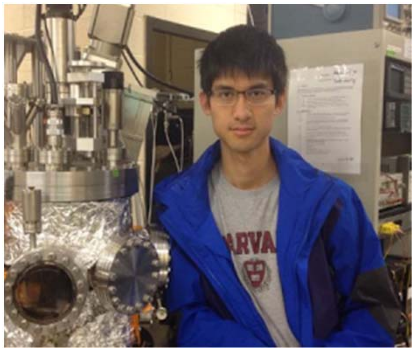
PURDUE UNIVERSITY

Birck Nanotechnology Center



Dr. Yi Li is now conducting his second postdoctoral research at Argonne National Laboratory, in a joint appointment with Oakland University. He has obtained his B.S. degree in Physics from Peking University (2009) and his Ph.D. degree in Materials Science & Engineering from Columbia University (2015). Prior to Argonne he has been a postdoc at CEA Saclay in France for two years (2015-2017). Yi Li's research focuses on spintronics, magnetization dynamics and magnetic nano-devices. For more information about his work please visit: https://sites.google.com/view/prc1988

"Spintronics Preeminent Team Faculty Candidate"

Monday, May 21st at 9:00am – WANG 1004
Faculty Candidate: Dr. Yi Li

Microwave spintronics in nanomagnets: from nonlinear resonators to auto-oscillators

In spintronics, ferromagnets are the solid-state building blocks with flexible functionality due to their wide interactions with charges, spin currents and electromagnetic waves. In addition, their intrinsic gigahertz-range dynamics allow low-latency operations and show potentials for microwave applications. Furthermore, when the dimensions are restricted to nano-size, due to mode quantization the excitation energy can be highly concentrated into a single mode. This allows us to enter highly nonlinear dynamic regions and reveal new functionality for microwave devices.

In the first part we study the microwave-driven dynamics of a single YIG nanodisc in the deeply nonlinear regime, up to 90 degree precession angle with quasi-total dynamic suppression of magnetization, measured by magnetic resonance force microscopy. In the nonlinear regime, we observe brand new spin wave modes corresponding to the nutation of magnetizations, which leads to dynamic instability with a second excitation or above a critical precession amplitude [1]. In the second part we move to spin-torque oscillators, a nanomagnetic device with spontaneous microwave output by feeding a dc current only. We show that two such oscillators can be dynamically coupled and synchronized by the dipolar interaction of their magnetic components [2]. Moreover, by using an external microwave field as a probe, we demonstrate enhanced dynamic coupling, which can be used to quantify the strength and the phase of the coupling [3], as well as dynamic interruption of coupling leading to the desynchronization of the two oscillators [4]. We show that both phenomena are linked to the nonlinear nature of magnetization dynamics.

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