QuanTalks

IISc Quantum Technologies Initiative (IQTI) Seminar Series

Title: Hybrid quantum spintronics

Speaker: Dr. Pramey Upadhyaya,
Assistant Professor, School of Electrical and Computer Engineering, Purdue University, USA.
Email: prameyup@purdue.edu

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2 30 PM (IST)

Meeting Link
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Venue
Physics Auditorium,
Indian Institute of Science, Bangalore

Abstract: With the promise of lower-dissipation and longer quantum coherence time offered by the spin, several fundamental and technological advances have been made in the field of classical and quantum spintronics. However, thus far, the advances in the classical and the quantum domains have largely occurred independent of each other. In this talk, taking the example of integrating dynamic excitations of magnets (magnons) with quantum spins hosted in solid state platforms (e.g. NV center), we will present an emerging direction—hybrid quantum spintronics— which merges these advances to explore new phenomena and devices at the interface of classical and quantum spintronics. On the one hand, we show how quantum spins can give rise to previously unavailable nanoscale probes for exploring a wide range of magnetic and electric phenomena [1,2]. On the other hand, we demonstrate how magnons can act as novel on-chip nanoscale drives for enabling scalable and nonreciprocal quantum circuits [3.4].

Biography: Pramey Upadhyaya is an Assistant Professor of Electrical and Computer Engineering at the Purdue University. Before joining Purdue, Pramey was a postdoctoral scholar in the Physics and Astronomy Department, University of California Los Angeles. He earned his bachelor's degree in Electrical Engineering from the Indian Institute of Technology Kharagpur, India, in 2009, and the master's and Ph.D. degree in Electrical Engineering department from the University of California Los Angeles, USA, in 2011 and 2015, respectively. His research has explored the theory of classical and quantum spintronic phenomenon and their device applications, enabled by electrical and thermal control of magnetism. Along with his teammates, this work has resulted in one of the earliest demonstrations of current-induced room-temperature skyrmion manipulations, spin torque switching by topological surface states and quantum sensing of spintronic phenomena. He is a recipient of NSF CAREER (2020), Purdue Outstanding Engineering Teacher and Ruth and Joel Spira Outstanding Teacher Awards (2021).

[1] Du, et. al. Science 357, 195 (2017)
[2] Solanki, et. al. Phys. Rev. Res. Lett. 4, L012025 (2022)
[3] Rustagi et. al. Phys. Rev. B. Rapid Comm. 102, 220403 (2020)
[4] Rustagi et. al. arXiv 2203.03652 (2022); under review Phys. Rev. Appl.