

# Seminar: Andrew Kent

Center for Quantum Phenomena, Department of Physics, New York University

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## Magneto-Optical Detection of Spin-Orbit Torques



Andrew Kent is a Professor of Physics and the Founding Director of the Center for Quantum Phenomena at New York University. He earned his B.Sc. with Distinction in Applied and Engineering Physics from Cornell University and his Ph.D. in Applied Physics from Stanford University. His research focuses on the physics of magnetic nanostructures, nanomagnetic devices, and magnetic information processing. He is a Fellow of the American Physical Society (APS) and the Institute of Electrical and Electronics Engineers (IEEE). Dr. Kent has received numerous awards and honors, including an Honorary Doctorate from the University of Lorraine, France (2013), the French Jean d'Alembert Research Fellowship (2017), and appointments as Professor at the University of Lorraine in 2018 and 2023.

### Abstract

Spin-orbit torques (SOTs) are of great importance for the efficient manipulation of magnetization in spintronic devices. They enable fast, energy-efficient magnetization control and provide several advantages over spin-transfer torques, including simplified device geometries with optical access to the magnetic free layer, scalability, and compatibility with semiconductor technologies. Quantifying SOT efficiencies and distinguishing between different torque symmetries are central issues in this rapidly developing field. Although a variety of experimental techniques have been used, including spin-torque ferromagnetic resonance, spin pumping, and harmonic Hall measurements, establishing a microscopic understanding of the origins of the torques and separating symmetry contributions remains challenging.

In this talk, I will discuss a new magneto-optic Kerr Sagnac interferometer developed at NYU that enables optical detection of spin-orbit torques with nanoradian sensitivity. The instrument enables highly sensitive, diffraction-limited, symmetry-resolved studies of SOTs in magnetic heterostructures and two-dimensional materials. I will present our initial results quantifying SOTs in ferrimagnetic heterostructures, as well as benchmark measurements on conventional Permalloy/Pt and CoFeB/Pt bilayers.

\* Work on ferrimagnetic heterostructures was done in collaboration with Akilan K, Sébastien Petit-Watelot, Melissa Yactayo, Laurent Badie, Stéphane Mangin, Michel Hehn, and Juan-Carlos Rojas-Sánchez.

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