Shedding Light on Nuclear Spins: Through the looking-glass

Mete Atatüre

Cavendish Laboratory, University of Cambridge, JJ Thomson Ave., Cambridge CB30HE, UK

ma424@cam.ac.uk

Optically active spins in solids are strong candidates for scalable devices towards quantum networks. Semiconductor quantum dots set the state-of-the-art on optical properties as near-ideal single photon sources for the criteria of tuneability, brightness, and indistinguishability. The spin side of semiconductor quantum dots is complicated via the presence of nuclear spins of the hosting material. Their inherently mesoscopic nature leads to a unique realisation of a tripartite interface between light as information carrier, an electron spin as a proxy qubit, and an isolated nuclear spin ensemble. The ability to control these constituents and their mutual interactions create opportunities to realize an optically controllable ensemble of ~50,000 spins. In this talk, I will present a journey from treating the quantum dot nuclei as an uncontrolled noise source limiting spin coherence to the observation of their collective magnon modes and eventually to their capacity as quantum registers, all witnessed via a single electron spin driven by light.