

Plenary Talk

PLV IV Tue 8:30 HSZ/AUDI

Spins in Quantum Dots: The Quiet Revolution — ●DORIAN GANGLOFF — Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom

Solid-state spins in semiconductors provide a natural interface between stationary qubits and single photons, forming key building blocks for future quantum communication networks. Historically, semiconductor quantum dots (QDs) were considered too noisy for spin physics: strong hyperfine interactions within a mesoscopic system, materials inhomogeneity, and limited control tools once cast doubt on their suitability as coherent spin qubits. In recent years this perception has shifted dramatically. Advances in growth, device engineering, coherent control,

and nuclear-spin cooling have ushered in a quiet revolution in III-V QDs. They now exhibit excellent optical coherence, near-unity photon collection when integrated with photonic structures, and spin degrees of freedom with long coherence times.

In this talk I will present three developments that illustrate this transformation: (1) High-fidelity electron-spin control, (2) Quantum memories from nuclear spins, and (3) Deterministic design of QD properties prior to growth.

Together, these advances reveal how the long-standing “noise problem” in III-V quantum dots is being turned into a resource, and underline their emergence as a platform for quantum communication and quantum information processing.