

# Eugene Wigner Colloquium

*event of SFB 910*



## Emil Vosmar Denning

Department of Photonics Engineering, Technical University of Denmark

### “Collective quantum memory activated by a driven central spin”

Coherent excitation of an ensemble of quantum objects offers the opportunity to realise robust entanglement generation and information storage in a quantum memory. Thus far, interfacing with such a collective excitation deterministically has remained elusive owing to the difficulty of controlling a probe spin in the midst of a complex many-body system. In the strained atomic lattice of a semiconductor quantum dot, nuclear quadrupole effects generate an electron-nuclear interaction that can be engineered by driving the electron spin. By implementing an all-optical approach to access the individual quantised electronic-nuclear spin transitions, we have experimentally demonstrated coherent optical rotations of a single collective nuclear spin excitation.

In light of our experimental findings, we propose and analyse an extension of the experiments that allows to harness the collective nuclear excitation as a quantum memory. With detailed microscopic calculations of the many-body quantum dynamics in the system, we show that our scheme is readily implementable with current technologies to deterministically store the quantum state of an electron. In particular, we find that a storage fidelity of 90% can be reached with as little nuclear polarisation as 50%.

---

## Thursday, 14.11.19 · 16:15h · EW 202

Technische Universität Berlin · Institut für Theoretische Physik · Hardenbergstraße 36 · 10623 Berlin

[www.itp.tu-berlin.de/sfb910](http://www.itp.tu-berlin.de/sfb910)