OIST SEMINAR

Hosted By Quantum Dynamics Unit

Speaker: Dr. **Eisuke Abe**

School of Fundamental Science and Technology, Keio University,
3-14-1 Hiyoshi, Kohoku-ku, Yokohama 223-8522, Japan

Date: Monday, Feb 29th
Time: 10：00-11:00
Venue: Meeting Room D015, Level D, Lab1

“Spins in various semiconductor systems: Coherence, entanglement, and applications”

Abstract:

Spins in semiconductors have been considered as quantum bits or quantum memories for quantum information technology. Their quantum mechanical properties such as coherence and entanglement are currently subjects of intense research. In this talk, I will pick up three representative semiconductor systems: (1) phosphorus donors in bulk silicon (for quantum information processing), (2) optically-bright self-assembled quantum dots (for quantum communication), and (3) nitrogen-vacancy centers in diamond (for quantum sensing), and discuss the experimental works I have been involved over the last five years or so. In (1), the coherence times of the donor electron and nuclear spins will be discussed [1-2]. In (2), the entanglement between a quantum dot spin and a photon emitted from the dot will be discussed [3-5]. In (3), our materials science efforts to create nitrogen-vacancy centers near the surface of diamond, crucial to enhance the magnetometry sensitivity, will be discussed.

[1] E. Abe *et al.*, "Electron spin coherence of phosphorus donors in silicon Effect of environmental nuclei", Phys. Rev. B **82**, 121201 (2010).

[2] E. S. Petersen *et al.*, "Nuclear spin decoherence of neutral ^{31}P donors in silicon: Effect of environmental ^{29}Si nuclei", arXiv:1508.05362.

[3] K. De Greve *et al.*, "Quantum-dot spin—photon entanglement via frequency downconversion to telecom wavelength", Nature **491**, 421 (2012).

[4] K. De Greve *et al.*, "Complete tomography of a high-fidelity solid-state entangled spin—photon qubit pair", Nature Commun. **4**, 2228 (2013).

[5] L. Yu *et al.*, "Two-photon interference at telecom wavelengths for time-bin-encoded single photons from quantum-dot spin qubits", Nature Commun. **6**, 8955 (2015).