WG3 – Nanoscale Quantum Coherence

TOPICS	Quantum coherence & dephasing as a sensing tool	Coherent quantum transport for energy harvesting	Fundamental aspects of quantum coherence at the nanoscale
MATERIALS & SYSTEMS	Colour centres in nanoscale diamond and silicon carbide Nanoplasmonics Nanofabrication & synthesis	Light harvesting complexes (natural, synthetic) Disordered photonic structures Nanoplasmonics Nanofabrication & synthesis	Molecules, QDs, Color Centers Spin Chains Nanoresonators, Beads
THEORY & MODELS	Ab-initio methods Interface effects Model Hamiltonians Protocols for sensing, imaging, etc…	Open quantum systems Computational chemistry, DFT Spin Hamiltonians	Master equation Ab-initio methods Exact diagonalization techniques Spin-chain Hamiltonians Quantum classical transition
EXPERIMENTS	Scanning probe techniques Superresolution imaging Microwave techniques Optical detection and precision measurements	Ultrafast and 2D spectroscopy Spectroscopy of single emitters Spectroscopy of nanoantennas Scanning probe techniques	Spectroscopy of single emitters Nano-optical tweezers

WG1 - Generation, detection and storage of quantum states of light

Topics	Superconducting detectors physics and performance	Sources	Processing/memories/ interfaces/applications
MATERIALS & SYSTEMS	- Superconducting nanowire single-photon detectors (meanders, nanodetectors) - NbN, NbTiN, WSi, MoSi, YBCO - Alternative substrates - Nano-fabrication - Waveguide detectors	- Semiconductor quantum dots - Organic molecules - SPDC/SFWM - Color centres in diamond - Rare earth ion doped crystals - Trapped atoms - Electrical pumping of quantum dots	- Tapered optical fibers with a nanofiber waist and >99% transmission - Tunable Whispering-Gallery-Mode (WGM) resonators with Q > 10e8 - Nonlinear waveguides (PPLN, PPKTP)
THEORY & MODELS	- Superconductivity in nanostructures - Finite difference time-domain simulation - Numerical simulations of the detection mechanism - Conventional and non-conventional superconductors	- Finite difference time-domain simulation - Optical Bloch equations - Jaynes-Cummings models - Density functional theory - Fermi's Golden Rule calculations - Density matrix approach for coupling with reservoir	- Semi-classical description of (arrays of) multi-level atoms with optical nearfields - Full quantum description of the interaction of multi-level atoms with WGM resonator modes
EXPERIMENTS	- Multi-photon excitations - Optical, electrical, temperature & magnetic field studies at < 1 K - High-temperature operation - Multilayers and novel geometries	- Confocal microscopy - Correlation function measurements - Quantum interference - Low-temperature experiments - Spectral and spatial modes control - Electrical pumping	- Coupling of sources to waveguide devices, open microcavities and nano-cavities - Cold cesium atoms trapped and interfaced via nanofiber-guided light - CQED with single Rubidium atoms coupled to WGM resonators - Frequency conversion - Interfacing rare-earth-ion doped quantum memories with single-photon sources - Quantum random number generation with nanoscale devices - Feasibility of free-space/ satellite QKD with nanoscale sources and detectors