

Mid-Infrared Quantum Technology for Sensing (MIRAQLS)

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To increase our ability to sense the changes in the environment around us, we must understand how to control the quantum properties of light and matter at the fundamental limits of their interaction. As such, quantum sensing is poised to bring paradigm-shifting transformations to how precision measurements are performed. Given the central role that MIR spectroscopy plays on many of the pressing issues facing modern society, there is an urgent need for systematic investments into the innovation and development of MIR quantum technologies for sensing applications. MIRAQLS brings together an interdisciplinary team of Canadian and European researchers, together with industry partners, who share a long-term vision for the development of MIR quantum photonic technologies for sensing applications. Our team combines expertise in quantum photonics, materials science, optoelectronic component development, MIR laser science and spectroscopy, biophotonics, photonic inverse design, quantum optics theory, and quantum information science, and quantum technologies. MIRAQLS aims to tackle some of the biggest challenges that have hampered the development of MIR quantum technologies, while at the same time delivering concept demonstrators, such as quantumenhanced Fourier-transform infrared spectrometer (q-FTIR), quantum-enhanced optical coherence tomography (q-OCT) and SU(1,1) interferometry. By manipulation of quantum statistics of the input states, e.g. squeezing and entanglement operations, we aim to achieve better sensitivity bounds in comparison to the classical technology, limited to the operation at the standard quantum limit (SQL). Improvements in MIR sensing will directly translate to increased societal wellbeing, safety, and prosperity; it becomes indispensable in the context of the global fight against the looming climate crisis.