QUBIC
The Australian Research Council Centre of Excellence in Quantum Biotechnology

Tiny Drums, Big Sensitivity: Building Atomically Thin Sensors

Institution	The University of Queensland, St. Lucia Campus
Project details	**Project Description** Two-dimensional (2D) materials such as graphene and MoS_2 can be only a few atoms thick, yet they are mechanically robust and extremely sensitive to their surroundings. When suspended over microscopic structures, they behave like tiny vibrating drums whose mechanical response can be influenced by very small environmental changes, making them promising platforms for ultrasensitive sensing. This project will focus on building a **2D material transfer platform** for precisely positioning individual flakes onto micro- and nanoscale sensing structures. The student will assemble and optimise the 2D transfer setup, identify suitable graphene flakes, and develop techniques for transferring them onto predefined structures. The 2D materials will be characterised using **Raman spectroscopy** to identify their material properties and layer thickness. The student will then investigate how the mechanical response of the designed 2D sensors can be used to detect extremely small changes in their environment, providing a pathway towards ultrasensitive nanoscale and biomolecular sensing. The project combines **hands-on instrument building, 2D material manipulation, spectroscopy, and nanosensing**, while establishing an enabling platform for future quantum biotechnology applications. **Expected Aims and Outcomes** • Build and align a functional 2D material transfer platform. • Exfoliate, identify, and precisely transfer suitable 2D material flakes. • Learn the fundamentals of Raman spectroscopy and use it to characterise transferred 2D materials and determine their layer thickness. • Explore 2D mechanical resonators for ultrasensitive sensing.
Who can apply	Suitable for undergraduate students in physics, engineering, materials science, nanotechnology, or related disciplines. No prior experience with 2D materials or optics is required. Curiosity and an interest in hands-on experimental work is preferred.
Contatct / Project supervisors	Dr. Nishta Arora Queensland Quantum Optics Lab School of Mathematics and Physics, The University of Queensland Email: nishta.arora@uq.edu.au