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# NAMIQOS: 3 year EPSRC PhD

## Nanoparticle Manipulation and Integration for Quantum Optomechanical Systems

October 2024 – September 2027

### BACKGROUND

Optical forces arise when light, which has no mass yet carries momentum, is deflected through interaction with a material object. Lasers of power  $\sim 100\text{mW}$  focused to a spot  $\sim 10\mu\text{m}$  exert significant forces on objects  $\sim 100\text{nm}$  across. These nanoparticles can be levitated, in vacuum, and manipulated by modulating the optical field. Interferometric measurement and active feedback techniques allow these systems to approach the quantum limits of sensitivity.

This research is part of the field of levitated optomechanics. Since the seminal demonstration of feedback cooling to sub-Kelvin temperatures, the field has seen rapid and intense research, with recent achievements including cooling to the quantum-mechanical ground-state with optical cavities and in a cryogenic environment.

### HOST & LOCATION

The Department of Physics, Faculty of Science & Engineering. Swansea University is a research-led independent University with a diverse community of 20k students across Singleton and Bay Campuses, on the edge of Gower Peninsular in South Wales.

The departmental research portfolio includes world-leading theoretical particle physics, advanced semiconductors, the CERN-based ALPHA antimatter collaboration, and ultrafast science.

### THE PROJECT

This project will explore development of practical devices based on levitated optomechanics including engineered isolation of specific mechanical modes and microfabrication techniques to source, prepare, and levitate nanoparticles in a compact, robust device. Microfabrication will be explored in collaboration with Swansea University's Centre for Integrative Semiconductor Materials. CISM is a new £30M research and innovation facility on Swansea University Bay Campus which brings together semiconductor and advanced materials platforms and offers manufacturing grade ISO-qualified clean rooms for process development, backend materials integration and packaging capabilities, and access to advanced characterisation and analysis.

### DETAILS & APPLY

Project to start October 2024 and end September 2027.

Applicants must have a relevant undergraduate degree.

For further information, see <https://levitation.wales/namiqos>

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