# Theoretical quantum optomechanics: cavity cooling of levitated nanoparticles for quantum sensing applications

Applications are invited for a 4-year PhD exploring the dynamics of quantum systems relevant to the development of quantum sensing technologies. The project would suit quantum theorists interested in close interactions with our experimental collaborators and other experimental developments in the field.

After a decade of development, in 2020 experiments have succeeded in cooling small silica particles, levitated in optical light, from room temperature down to near their motional quantum ground states. As particles levitated in light offer exceptional decoupling from environmental sources of heat and quantum decoherence, they offer the prospect of exceptionally sensitive tests of quantum behaviour in near-macroscopic system, sensing of forces that enable tests of foundational physics as well as practical quantum sensing applications of technological importance. At UCL the optomechanics group is currently implementing the recent technical breakthrough that enables the stable strong cooling of the levitated particle.

The theoretical PhD project will support the experimental work with quantum analysis and modelling, but will also go beyond explore quantum sensing possibilities relevant to the inherently 3D nature of the detection process.

The supervisors and prospective PhD students would be members of an active and diverse research group encompassing experimentalists (Barker, Pontin) and theorists (Monteiro,Bose,Toros) working in areas of quantum optics, quantum optomechanics, quantum sensing ranging from practical applications to foundational work. UCL hosts a Centre for Doctoral Training in delivering quantum technologies which provides a large cohort of PhD students in related areas allowing ample opportunities for interaction and networking. About 40 academics at UCL work in quantum technology related areas, hosted by the UCL Institute for Quantum Science and Technology.

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