



The Vienna Doctoral Programme on Complex Quantum Systems  
invites you to a

# Alumnus Talk

by

**Michael R. Vanner**

*Imperial College London*

## ***Measurement based quantum optomechanics: Towards macroscopic superposition state preparation***

Cavity quantum optomechanics uses the radiation-pressure interaction and the tools of quantum optics to extend the control of individual quantum systems to macroscopic mechanical oscillators. The field is currently receiving a surge of interest for its potential to contribute to both fundamental and applied science with current research directions including table-top tests of quantum gravity and the development of high-precision weak-force sensors. In this talk, I will discuss three related research projects that push towards the generation of mechanical superposition states—a key outstanding goal in the field. By utilizing single photon counting and optical interferometry, the first observation of a mechanical interference fringe pattern was performed [1], where the fringes were written into a position distribution of a mechanical thermal state. Building on this scheme, we have devised a protocol that uses a sequence of interactions and single photon counting measurements to "grow" mechanical superposition states of increasing size [2]. Lastly, and time permitting, the theory behind an analogue approach to optomechanics that couples a carbon nanotube to a superconducting qubit will be described that has the potential to distinguish non-classical properties of such a fringe pattern.

The speaker as a CoQuS alumni will also discuss his career trajectory and his recent experiences building his own research group (<https://groups.physics.ox.ac.uk/QMLab/>).

**Monday, 25 March 2019,  
17:00 get-together with coffee and snacks!**

Main Lecture Hall, Atominstitut, TU Wien, Stadionallee 2, 1020 Vienna

Hosted by: Markus Arndt

[1] M. Ringbauer et al, New Journal of Physics 20, 053042 (2018).

[2] J. Clarke, and M. R. Vanner, Quantum Science and Technology 4, 014003 (2019).

