

Quantum Measurement and Full Counting Statistics of Phonon Shot Noise

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While an optomechanical system which is weakly coupled to the energy of a mechanical resonator cannot resolve individual mechanical Fock states, it can be used to detect the nonclassical energy fluctuations of the driven resonator, i.e. “phonon shot noise”. This is thus a promising, experimentally-feasible approach for detecting nonclassical behaviour in a mechanical resonator. In this talk, I will discuss quantum measurement issues related to the continuous monitoring of phonon shot noise [1]. I will also discuss the behaviour of higher moments and the full probability distribution of these energy fluctuations. Surprisingly, higher moments provide a far more sensitive probe of quantum effects than the second moment. The full probability distribution can also exhibit negativity, somewhat akin to the full counting statistics of transferred charge in superconducting systems.

[1] A. A. Clerk, F. Marquardt and J. G. E. Harris, Phys. Rev. Lett. **104**, 213603 (2010).