

Optomechanical Entanglement: From Curiosity to Operation

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Abstract: The recent observation of entanglement between a mechanical oscillator and the electromagnetic field in a mw system [1] ultimately witnesses the dawn of the quantum age in optomechanics. In this talk I will show that the pulsed protocol [2] which was implemented in [1] can be extended to the time continuous regime. Optomechanical entanglement can serve as a resource for remote preparation of arbitrary quantum states, or *quantum steering*, through time continuous teleportation [3]. The experimental requirement is a strong optomechanical cooperativity (for linearized coupling), the same as for ground state cooling and observation of back action noise. On a more general perspective, optomechanical entanglement provides a universal resource for quantum networks interfacing mechanical systems with other quantum systems, such as atoms or superconducting qubits, exhibiting strong coupling to the electromagnetic field.

[1] K. Lehnert, Talk at QNM – 2013, Monte Verita

[2] S. G. Hofer, W. Wiczorek, M. Aspelmeyer, K. Hammerer, Phys. Rev. A 84, 052327 (2011)

[3] S. G. Hofer, D. V. Vasilyev, M. Aspelmeyer, K. Hammerer, arXiv:1303.4976