Optimal Generation and Detection of Nonclassical Correlations in Levitated Optomechanics

A A Rakhubovsky[1] and R Filip[1]

[1] *Department of Optics, Palacký University, Olomouc, Czech Republic*
Contact Email: andrey.rakhubovsky@gmail.com

Quantum optomechanics [1] studies radiation-pressure interaction between light and mechanical motion. A plethora of expeirmental advances of this field in recent years was in the domain of pulsed optomechanics [2, 3]. Particle-like optomechanical [4] and mechanical-mechanical [5] correlations have been created and verified via intensity interferometry.

Continuous-variable pulsed optomechanical entanglement, since its theoretical proposal [3], has been verified experimentally [6] and proven to persist at relatively high temperatures [7]. In this talk, based on [8, 9], we consider optimal ways to generate and detect such entanglement. We argue that the tools of bayesian optimization allow a significant enhancement of the magnitude of optomechanical correlations and that an intelligent detection scheme allows verifying such correlations without full optomechanical state tomography.

References

[1] Ma Aspelmeyer, T J Kippenberg and F Marquardt, Rev. Mod. Phys. **86**, 1391 (2014)

[2] M R Vanner, I Pikovski, G D Cole, M S Kim, Č Brukner, K Hammerer, G J Milburn and M Aspelmeyer, Proc. Natl. Acad. Sci. **108**, 16182 (2011)

[3] S G Hofer, W Wieczorek, M Aspelmeyer and K Hammerer, Phys. Rev. A **84**, 052327 (2011)

[4] R Riedinger, S Hong, R A Norte, J A Slater, J Shang, A G Krause, V Anant, M Aspelmeyer and S Gröblacher, Nature **530**, 313 (2016)

[5] R Riedinger, A Wallucks, I Marinković, C Löschnauer, M Aspelmeyer, S Hong and S Gröblacher, Nature **556**, 473 (2018)

[6] T A Palomaki, J D Teufel, R W Simmonds and K W Lehnert, Science **342**, 710 (2013)

[7] A A Rakhubovsky and R Filip, Phys. Rev. A **91**, 062317 (2015)

[8] A A Rakhubovsky, D W Moore, U Delić, N Kiesel, M Aspelmeyer and R Filip, Phys. Rev. Appl. **14**, 054052 (2020)

[9] A Pitchford, A A Rakhubovsky, R Mukherjee, D W Moore, F Sauvage, D Burgarth, R Filip and F Mintert, arXiv:2006.15050 (2020)