Certification of Gaussian Boson Sampling Using Two-Point Correlation Functions

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This work comes under the 'Continuous Variables' research topic listed in the broad conference topics.

Expanding on the previous work by Walschaers *et al* [1], we will explore the statistical signatures obtained from Gaussian Boson sampling (GBS). We will show that it is possible to derive a general expression for the two-point correlation function for two arbitrary output modes when squeezed vacuum states are evolved under Haar-random unitaries, without having to project onto the photon-number basis. We will explain that it is possible to certify Gaussian Boson sampling using quantum squeezed vacuum states against classical thermal and coherent states by comparing the obtained statistical signatures of the two-point correlations from many different Haar-random unitaries. We will discuss the limits on error tolerance of the distribution moments by comparing the results from various sample sizes with the analytical results from random matrix theory. Finally we will investigate the effects of experimental limitations of GBS certification by exploring system loss and finite sample sizes.

[1] Walschaers M., Kuipers J., Urbina J. -D., Mayer K., Tichy M. C., Richter K., Buchleitner A., *Statistical benchmark for BosonSampling*, New J. Phys., **18**, 032001 (2016).