Q 43: Quantum Information: Concepts and Methods VI

Time: Wednesday 14:30–16:00 Location: K/HS1

Q 43.1 Wed 14:30 K/HS1

Multi-boson correlation interferometry and boson sampling in time — •Vincenzo Tamma and Simon Laibacher — Institut für Quantenphysik, Universität Ulm

Multi-boson interference based on correlated measurements is at the heart of many fundamental phenomena in quantum optics and of numerous applications in quantum information. Recently, the feasibility of multi-boson experiments based on higher order correlation measurements well beyond the first two-boson experiments of Shih-Alley and Hong-Ou-Mandel has been demonstrated.

These remarkable experiments have motivated us to develop a full description of arbitrary multi-boson interferometric schemes based on correlated measurements of single bosons with arbitrary spectra.

We highlight how the probability density corresponding to N-boson correlated events depends on the N detected ports and the respective detection times in terms of time-dependent matrix permanents. Physically, this is a manifestation of the multi-boson interference leading to generalized Hong-Ou-Mandel "dips" of arbitrary order N.

Our analysis also applies to the *boson sampling problem* (BSP), formulated as the task to sample from the probability distribution of finding N single input bosons at the output of a passive linear interferometer. We generalize the BSP to the *boson sampling in time* from the overall relevant output probability distribution depending on both the detected output ports and on the corresponding detection times.

[1] V. Tamma and S. Laibacher, (2014), arXiv:1410.8121. [2] V. Tamma and S. Laibacher, (2014), arXiv:1409.7426.

Q 43.2 Wed 14:45 K/HS1

Quantum Imaging of an irregular array of Thermal Light Sources — •Anton Classen[1], Raimund Schneider[1,2], Thomas Mehringer[1,2], and Joachim von Zanthier[1,2] — [1]Institut für Optik, Information und Photonik, Universität Erlangen-Nürnberg, 91058 Erlangen — [2]Erlangen Graduate School in Advanced Optical Technologies (SAOT), Universität Erlangen-Nürnberg, 91052 Erlangen

Multiphoton interference of thermal light sources is a current topic of research [1,2]. Quantum imaging techniques based on multiphoton interference are able to beat the classical Abbe limit via post-selection [2]. So far this has been demonstrated for a setup with N equidistantly aligned thermal light sources and N detectors measuring the Nth-order correlation function. Here we present a more versatile detection scheme making use of arbitrary mth-order correlation functions to obtain structural information about irregular source geometries. We show that an unambiguous reconstruction of the entire source arrangement can be obtained in a sub-classical regime and present experimental results.

[1] J. H. Shapiro, R. W. Boyd, The physics of ghost imaging, Quantum. Inf. Process. 4, 949 (2012)

[2] S. Oppel, T. Büttner, P. Kok, J. von Zanthier, Superresolving Multiphoton Interferences with Independent Light Sources, Phys. Rev. L. 109, 233603 (2012)

Q 43.3 Wed 15:00 K/HS1

Characterisation of multiparticle correlations with exponential families — •Felix Huber — Theoretical Quantum Optics, University Siegen

Irreducible k-particle correlations are based on the information that is contained in the reduced k-particle density matrices, which is not already contained in the (k-1)-particle reduced states. By a dual structure, irreducible correlations also characterise a state by its relative entropy distance to thermal states of k-particle Hamiltonians. The interaction structure of the Hamiltonian can then be used to describe the complexity of multiparticle systems and the correlations present, as well as to identify thermal states of k-particle Hamiltonians. Here, we will present witnesses to exclude that a state is a thermal or ground state of a 2-particle Hamiltonian in the case 5 of qubits.

Q 43.4 Wed 15:15 K/HS1

Visualizing operators of coupled spin systems — Ariane Garon, •Robert Zeier, and Steffen J. Glaser — Department Chemie, Technische Universität München, Lichtenbergstrasse 4, 85747 Garching, Germany

The state of quantum systems, their energetics, and their time evolution is modeled by abstract operators. How can one visualize such operators for coupled spin systems? A general approach is presented which consists of several shapes representing linear combinations of spherical harmonics. It is applicable to an arbitrary number of spins and can be interpreted as a generalization of Wigner functions. The corresponding visualization transforms naturally under non-selective spin rotations as well as spin permutations. Examples and applications are illustrated for the case of three spins 1/2.

http://arxiv.org/abs/1409.5417

Q 43.5 Wed 15:30 K/HS1

Concentrating Information — •Alexander Streltsov[1], Soojoon Lee[2], and Gerardo Adesso[3] — [1]ICFO, Castelldefels (Barcelona), Spain — [2]Kyung Hee University, Seoul, Korea — [3]University of Nottingham, Nottingham, United Kingdom

We introduce the concentrated information of tripartite quantum states. For three parties Alice, Bob and Charlie, it is defined as the maximal mutual information achievable between Alice and Charlie via local operations and classical communication performed by Charlie and Bob. The gap between classical and quantum concentrated information is shown to be an operational figure of merit for a state merging protocol involving shared mixed states and no distributed entanglement. We derive upper and lower bounds on the concentrated information, and obtain a closed expression for arbitrary pure tripartite states in the asymptotic setting. In this situation, one-way classical communication is shown to be sufficient for optimal information concentration.

Q 43.6 Wed 15:45 K/HS1

Monogamy equalities for qubit entanglement from Lorentz invariance — •Christopher Eltschka[1] and Jens Siewert[2,3] — [1]Universität Regensburg, Regensburg, Germany — [2]Universidad del País Vasco - Euskal Herriko Unibertsitatea, Bilbao, Spain — [3]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain

A striking result from nonrelativistic quantum mechanics is the monogamy of entanglement, which states that a particle can be maximally entangled only with one other party, not with several ones. While there is the exact quantitative relation for three qubits and also several inequalities describing monogamy properties it is not clear to what extent exact monogamy relations are a general feature of quantum mechanics. We prove that in all many-qubit systems there exist strict monogamy laws for quantum correlations. They come about through the curious relation between the nonrelativistic quantum mechanics of qubits and Minkowski space. We elucidate the origin of entanglement monogamy from this symmetry perspective and provide recipes to construct new families of such equalities.