Contribution ID: **89** Type: **Poster**

One-axis twisting as a method of generating many-body Bell correlations

Wednesday, 13 September 2023 22:20 (20 minutes)

We demonstrate that the one-axis twisting (OAT), a versatile method of creating nonclassical states of bosonic qubits, is a powerful source of many-body Bell correlations. We develop a fully analytical and universal treatment of the process, which allows us to identify the critical time at which the Bell correlations emerge and predict the depth of Bell correlations at all subsequent times. Our findings are illustrated with a highly nontrivial example of the OAT dynamics generated using the Bose-Hubbard model [1].

Next, we show how to generate the many-body Bell correlations in spin chains, with controllable short-range two-body interactions. Subsequently, we classify the depth of produced Bell correlations. We identify a critical range necessary to generate many-body Bell correlations in the system and provide the physical mechanism behind this critical behavior. Importantly, we show, that these Bell correlations are fully determined by just a single element of the density matrix, and can be measured by the existing state-tomography methods [2].

[1] M. Płodzień, M. Lewenstein, E. Witkowska, J. Chwedeńczuk, "One-axis twisting as a method of generating many-body Bell correlations", Phys. Rev. Lett. 129, 250402 (2022)

[2] M. Płodzień, T. Wasak, E. Witkowska, M. Lewenstein, J. Chwedeńczuk, "Generation of scalable many-body Bell correlations in spin chains with short-range two-body interactions", arXiv:2306.06173

Primary author: PŁODZIEŃ, Marcin (ICFO –The Institute of Photonic Sciences)

Co-authors: Dr WASAK, Tomasz (Nicolaus Copernicus University in Toruń); Dr WITKOWSKA, Emilia (Insitute of Physics, Polish Academy of Sciences); Prof. LEWENSTEIN, Maciej (ICFO –The Institute of Photonic Sciences); Dr CHWEDEŃCZUK, Jan (University of Warsaw)

Presenter: PŁODZIEŃ, Marcin (ICFO –The Institute of Photonic Sciences)

Session Classification: Poster Session III

Track Classification: Other