Research report 2015

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Publication

[1] Hamiltonian Purification

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[2] Photon distribution at the output of a beam splitter for imbalanced input states

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Research summary in 2015

1. Projective operations in quantum mechanics take a peculiar and important position in relation, e.g., to a quantum measurement process, and in recent years their effect on the dynamics has attracted much attention. In contrast to a naive expectation, it has been shown that the projected space can be made exponentially more complex than the original one and that a pair of Hamiltonians that do not commute with each other can be realized as projected images of two mutually commutable Hamiltonians in a higher dimensional space (Hamiltonian purification).

2. It is known that bosons, like photons, show a peculiar characteristics called bunching, that is, two bosons have a tendency to appear in one of the two output ports after they go through a beam splitter. This is due to the Bose statistics they follow. Though it is already known that when many photons have been injected simultaneously to two input ports of a beam splitter, the number distribution of photons at two output ports follows a simple mathematical form, the analytical estimation has been limited to a balanced (50:50) case. We succeeded in generalizing this and in analytically estimating the number distribution at the output ports even for the cases where the input photon numbers are imbalanced and fluctuated at most Poissonian. Our analytical formula shows an excellent agreement with numerical simulations and a $1/\sqrt{1-x^2}$ law has been extracted for the output distribution.