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Generating function approach to open quantum walks

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Open quantum walks (OQWs) have been introduced as a type of quantum walks which are entirely driven by the dissipative interaction with external environments and are defined in terms of discrete completely positive trace-preserving maps on graphs [1]. Recently, a quantum optical scheme for the experimental realization of OQWs was proposed [2]. In the proposed scheme, a two-level atom plays the role of the “walker” and the Fock states of the cavity mode correspond to the lattice sites of the OQW. Using the small unitary rotations approach and rotating wave approximation the effective dynamics of the system is shown to be an OQW. The presence of spontaneous emission in the system was an essential ingredient for obtaining an OQW. In this contribution, we solve this OQW analytically using generating functions. We used the obtained solution to construct the moments of this quantum walk explicitly. The dynamics of the observables (mean, variance) are presented for various parameters.

Keywords: Open quantum walks; quantum optics; quantum dynamics engineering.

References:

- [1] S. Attal, F. Petruccione, C. Sabot and I. Sinayskiy, J. Stat. Phys. 147 (2012), 832.
- [2] I. Sinayskiy and F. Petruccione, Int. J. Quantum Inform. 12 (2014), 1461010.

Apply to be considered for a student ; award (Yes / No)?

Yes

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PhD

Primary author: Mr ZUNGU, Ayanda (Department of Physics, North-West University, Mafikeng Campus)

Co-authors: Prof. SINAYSKIY, Ilya (School of Physics and NITheP, University of KwaZulu-Natal); Prof. PETRUCCIONE, Francesco

Presenter: Mr ZUNGU, Ayanda (Department of Physics, North-West University, Mafikeng Campus)

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