Dissipation-Induced Transparency of Single Photons in a Chain of Coherent Perfect Absorbers

Anton N. Vetlugin[1], Mariia Sidorova[1,2], Ruixiang Guo[1], Cesare Soci[1], and Nikolay I. Zheludev[1,3,4]

[1]Centre for Disruptive Photonic Technologies, TPI, Nanyang Technological University, 637371, Singapore, Singapore

[2]Department of Physics, Humboldt-Universität zu Berlin, 12489, Berlin, Germany

[3]Optoelectronics Research Centre, University of Southampton, SO17 1BJ, Southampton, UK

[4]Hagler Institute for Advanced Study, Texas A&M University, College Station, 77843, TX, USA

Coherent perfect absorption (CPA), the time-reversed analogue of lasing, occurs when the system's scattering matrix has a zero eigenvalue, with the corresponding field eigenmode being fully dissipated. Interference of quantum light on a coherent absorber [1] has previously enabled which-way single-photon absorption [2], non-classical dissipation of two-photon states [3], and reverse Hong-Ou-Mandel interference [4], among other effects. Here, we move beyond a single absorber interference and study the propagation of photons in optical networks containing multiple coherent absorbers. Remarkably, we find that increasing the absorber density can strongly enhance net photon transmission. This dissipation-induced transparency originates from the mode-selective nature of CPA: each absorber effectively acts as a projective measurement on the photon state. A dense CPA chain thus implements a rapid sequence of measurements that suppresses dissipation and opens a transmission "window" via the quantum Zeno effect. We confirm this experimentally using heralded single photons propagating through a temporal CPA chain, where the photon survival probability increases markedly with absorber density, Fig. 1. Our results show that engineered dissipation can provide a novel resource for controlling quantum light in non-Hermitian photonic networks.

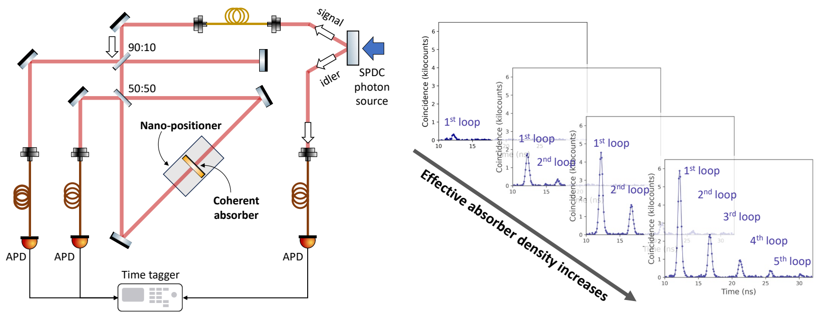

Fig. 1: *Repeated propagation of a heralded single photon through an interferometer loop containing a coherent absorber (left). Increasing the effective absorber density enhances the number of completed interferometer loops (right).*

Funding acknowledgement

We acknowledge support from the National Research Foundation Singapore (NRF-MSG-NCAIP) and the Agency for Science, Technology and Research (QEP3-NQSP (W25Q3D0004)).

References

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