Quantum Coherent Transfer Function for Generic Pulse Storage and Retrival

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Challenges in storage of quantum information is one of the bottlenecks for realizing the quantum network [1]. In last few decades, electromagnetically induced transparency (EIT) based light storage and retrieval has been demonstrated as the potential technique for quantum information storage, except for the stringent limitations of the delay-bandwidth product [2]. Most of the optical storage studies have been limited to storing Sech, Gaussian or other well-known regular pulse shapes [3]. We demonstrated that an analytical framework based on a Fourier-domain coherent transfer function for arbitrary pulse shapes and derived a generalized expression for the retrieved light pulse from EIT storage in a three-level Λ system. We implemented Fourier algebra to separate the effect of storage from the arbitrary shape of the pulse being stored, deriving a generalized formula for arbitrary pulse shape [4].

In this poster, we will demonstrate that the Fourier transfer function could be considered as the quantum coherent transfer function that resonantly imparts its effect on the incoming "signal" (light) pulse and, thus, we can deconvolve the output pulse from the transfer function to gain information on the signal pulse. This result will be significantly enhancing the ability to retrieve the critical information content of the signal, particularly in the quantum domain.

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