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(G*) Coherent optical memories for visible light communication schemes

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Future quantum networks have significant implications in the secure transfer of sensitive information. A key component to enabling longer transmission distances in these networks is an efficient and reliable quantum memory (QM) device. QM devices can enable the storage of quantum optical light and will be a vital component of quantum repeater nodes and precise quantum sensors. We will present the Signal-to-Noise Ratio (SNR) and a Bit-Error Rate (BER) performance metrics for a unique, dual-rail QM system housed in a deployable module.

Our setup utilizes a rubidium vapor cell operating at near room temperature under the conditions of electromagnetically induced transparency [1]. This effect allows optical light states to be coherently mapped into and out of a warm atomic ensemble. A dual-rail configuration is employed which permits the storage of arbitrary polarization qubits. We will report the capabilities of our memory as a device in visible light communication and its SNR and BER performance under various operating conditions such as memory lifetime and optical storage efficiency [2].
Furthermore, we will present the capability of this system for an on-off keying communication scheme by analyzing differential signaling between the rails. This is, to our knowledge, the first demonstration of an optical dual-rail memory utilized for this type of communication scheme.

Demonstrations utilizing these novel QM systems in established communication protocols will be key for quantum networks and the future quantum internet.
[1] Namazi, Mehdi et al., Phys. Rev. Appl. 034023 (2017) [2] J. De Bruycker, et al., 12th International Symposium on Communication Systems, Networks and Digital Signal Processing pp. 1-5 (2020).

Keyword-1

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Keyword-2

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Keyword-3

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