An atomic memory suitable for semiconductor quantum dot single photons

ConferencePaper (Artikel, die in Tagungsbänden erschienen sind)

ID 4137544
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Year 2017
Title An atomic memory suitable for semiconductor quantum dot single photons
Book title (Conference Proceedings) Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC, 2017 Conference on)
Place of Conference Munich, Germany
Publisher IEEE
Pages 1
ISSN/ISBN 978-1-5090-6737-4 ; 978-1-5090-6736-7
Summary form only given. Quantum networks consist of many quantum memory nodes that are interconnected via photonic links, transporting single photons carrying quantum information. In the future, such quantum networks may enable: high-speed quantum cryptography for unconditionally secure communication; large-scale quantum computers; and quantum simulators that will allow for exponential speed-up in solving specific complex problems. A promising route towards functional quantum network nodes is the heterogeneous approach [1], where different and separately optimized physical systems are used for single photon generation and storage. For example semiconductor quantum dots may be used as efficient, fast and deterministic single photon sources, while atomic ensembles allow for efficient storage of these photons.We demonstrate a photonic memory in warm Rb vapour with on-demand storage and retrieval, based on electromagnetic induced transparency (EIT). The memory is suitable for storing single photons emitted by a GaAs droplet quantum dots [2] embedded into a state-of-the-art photonic structures [3]. With our experiments we close the gap between low speed quantum memories with acceptance bandwidth well below 100 MHz and ultra-high speed memories with acceptance bandwidth above 1 GHz. We find that in this intermediate regime vapour cell memories offer an excellent compromise between storage efficiency, storage time and experimental complexity.

edoc-URL http://edoc.unibas.ch/58162/
Full Text on edoc No;
Digital Object Identifier DOI 10.1109/CLEOE-EQEC.2017.8087439
ISI-Number WOS:000432564601200
Document type (ISI) Conference Paper