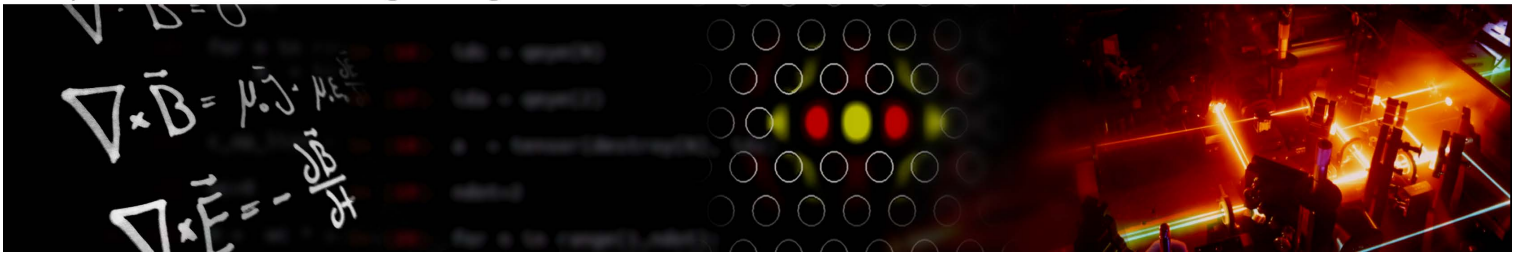
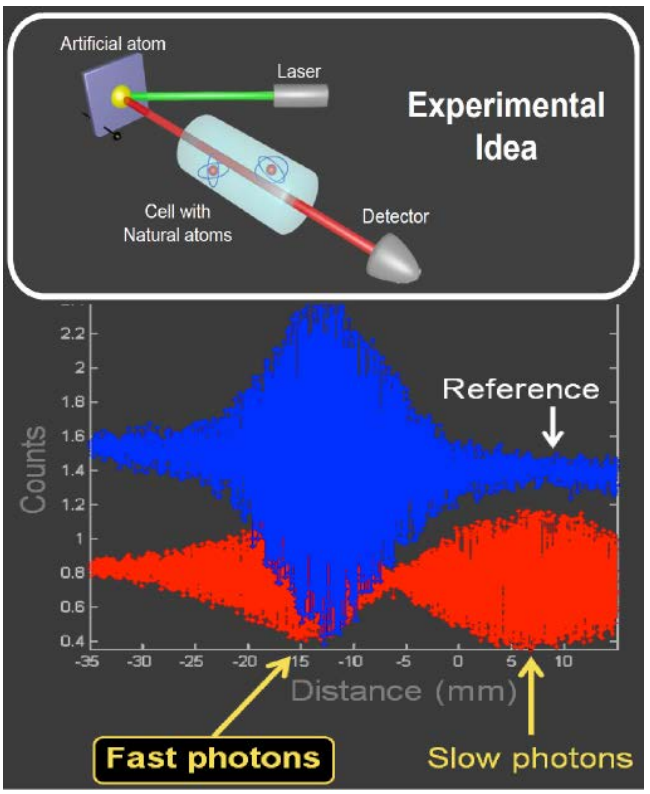


B.Sc. (including Fagprojekter) **or M.Sc. project**

the level of the project can be adapted to the study program

Fast single photons

The aim of this project is to develop a theoretical model to investigate the fast light effect on a single photon level and to simulate the experimental results



Can single photons travel faster than c, the speed of light? "Fast" light, or light that goes faster than it should, is a well known phenomenon for laser light and it does not contradict special relativity. But what about single photons? There are still debates on if single photons can travel faster than light, and if possible, on whether or not we can actually measure them. We have clear experimental evidence that show faster-than-light single photons and we want to understand the physics behind these results and create a model that can replicate them.

Goals of the project (which may be modified according to the interests of the student):

- develop an understanding of the change in light velocity through media, with focus on fast single photons;
- understand how the special relativity constrains apply to single photons through fast-light media;
- develop a theoretical model that can fit the experimental evidence for fast and slow single photons.

Skills/knowledge acquired through the project:
Single-photon interference, Fourier decomposition of single-photon wavepackets, interference-based single-photon detection, superluminal light and information transfer, modeling of single-photons in vacuum/media.

Background requirements:
Knowledge of quantum mechanics (e.g. from 10112 Advanced Quantum Mechanics) and Matlab programming.

Supervisor:

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Nika Akopian (nikaak@fotonik.dtu.dk, office B345v/271)

Reference:

[1] HKUST Professors Prove Single Photons Do Not Exceed the Speed of Light

[2] Akopian, N., et al. "Hybrid semiconductor-atomic interface: slowing down single photons from a quantum dot." Nature Photonics 5.4 (2011): 230-233.