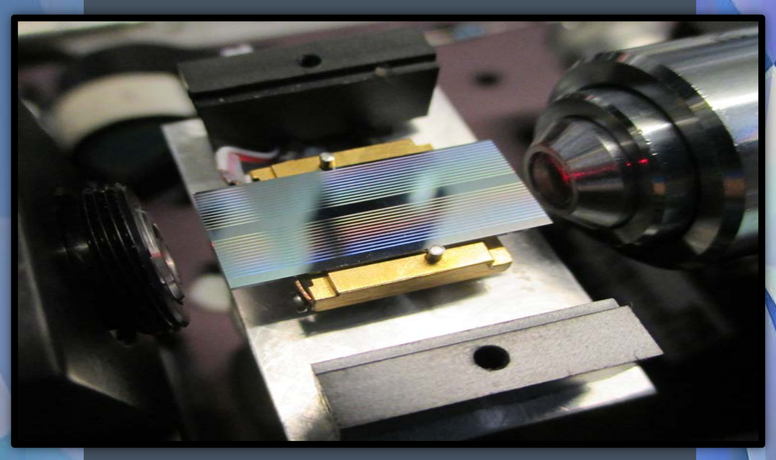
Engineered Nonlinear Crystals for Quantum Technologies

Chloe Watson Optoelectronics Research Centre, University of Southampton

What?

- Nonlinear crystals provide a means of converting between wavelengths and producing single or paired photons.
- Provides valuable resources used within quantum technologies.
- Current manufacturing techniques have limitations on how to engineer these crystals.
- This research will develop new ways to engineer crystals working to advancing quantum technologies.



How?

- In its natural state the crystal has a single polarization, applying a grating and voltage to the crystal creates a periodically poled structure, seen in figure 1.
- Alternating the polarization in this way employs quasi-phase matching (QPM) which improves the efficiency of the wavelength conversion.
- There are a variety of processes through which the conversion occurs, depending on the application

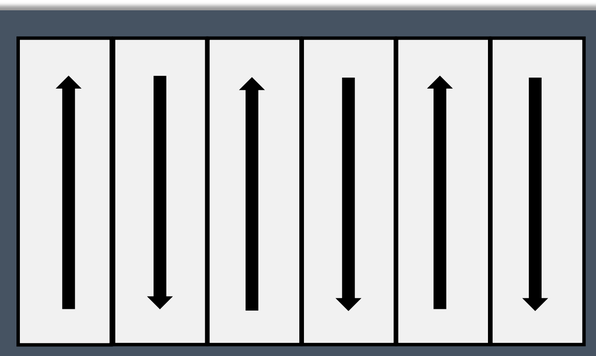
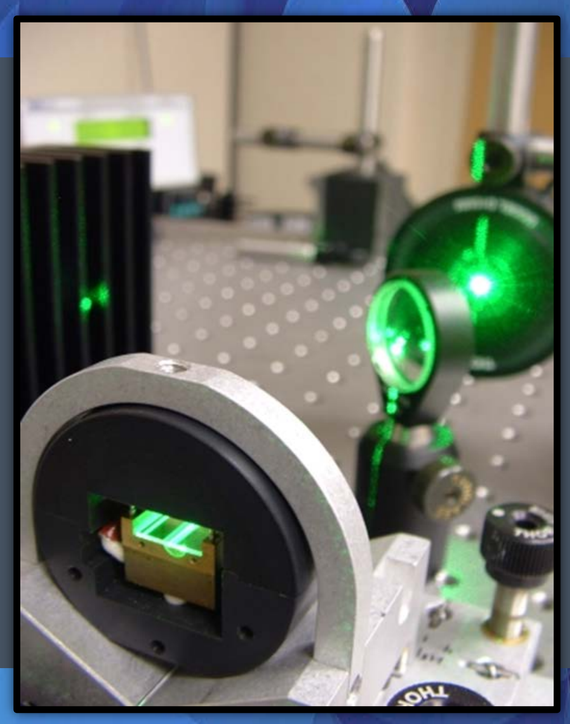
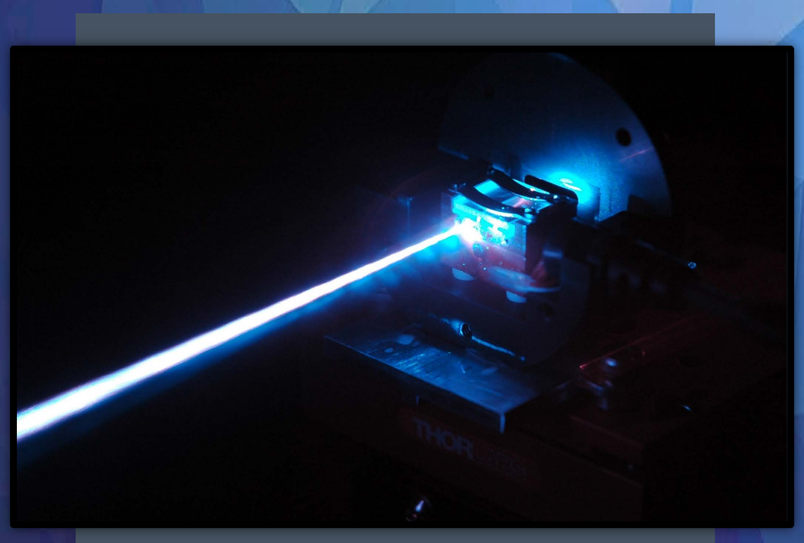


Figure 1: Periodically poled structure

Why?

- Networked quantum computers - The current ion trap technology is based on a different wavelength than the telecoms band which could be used to communicate between multiple traps and classical machines.
- Producing pairs of indistinguishable photons - By designing the grating applied to the crystal it is possible to create such a pair.





Next?

- Limitations with the current processing, especially in periodically poling relative to different crystal axis.
- Especially important when trying to create a device that will be able to produce indistinguishable photons.
- New techniques need to be developed to allow for a greater freedom in applying the gratings and in turn the poling.

Many Thanks To:

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EPSRC

covesion

Talk To Me: C.J.Watson@soton.ac.uk