Cryogenic operation of a polarisation converter and directional coupler in LiNbO$_3$ for quantum circuits

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1) Quantum Photonic Chip

**Source**
- z-cut Lithium Niobate:
  - Ti waveguides loss: 0.1dB/cm
  - 90% fibre overlap
  - large $\chi^2$-nonlinearity
  - electro-optical effect [1,2]

**Manipulation**

**Detection**

**SNSPDs: ~1K**

4) Directional Coupler

splitting ratio:
- $52\pm2.5\% @300K$
- $55\pm2.5\% @22K$

5) Polarisation Converter

- 23dB modulation depth
- 43% fibre-to-fibre transmission

2) Temperature Dependent Refractive Index Shift

a large index shift is expected [3]

phasematched wavelength shift for polarisation converter

3) Experimental Setup

References

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