Acousto-optic and its application in quantum circuits

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Introduction to Acousto-Optics

❖**Definition of Acoustic-Optics**

The interaction between light waves and acoustic waves in materials

❖**Basic principles of interaction between acoustic waves and light**

Photoelastic effect

❖**Applications in various fields**

Classic: Laser Modulation, Optical Signal Processing, Imaging and Microscopy…

Quantum: Acousto-Optics Transducer

Overview of Quantum Circuits

- **Definition of quantum circuits**

  The building block of quantum computation, qubit

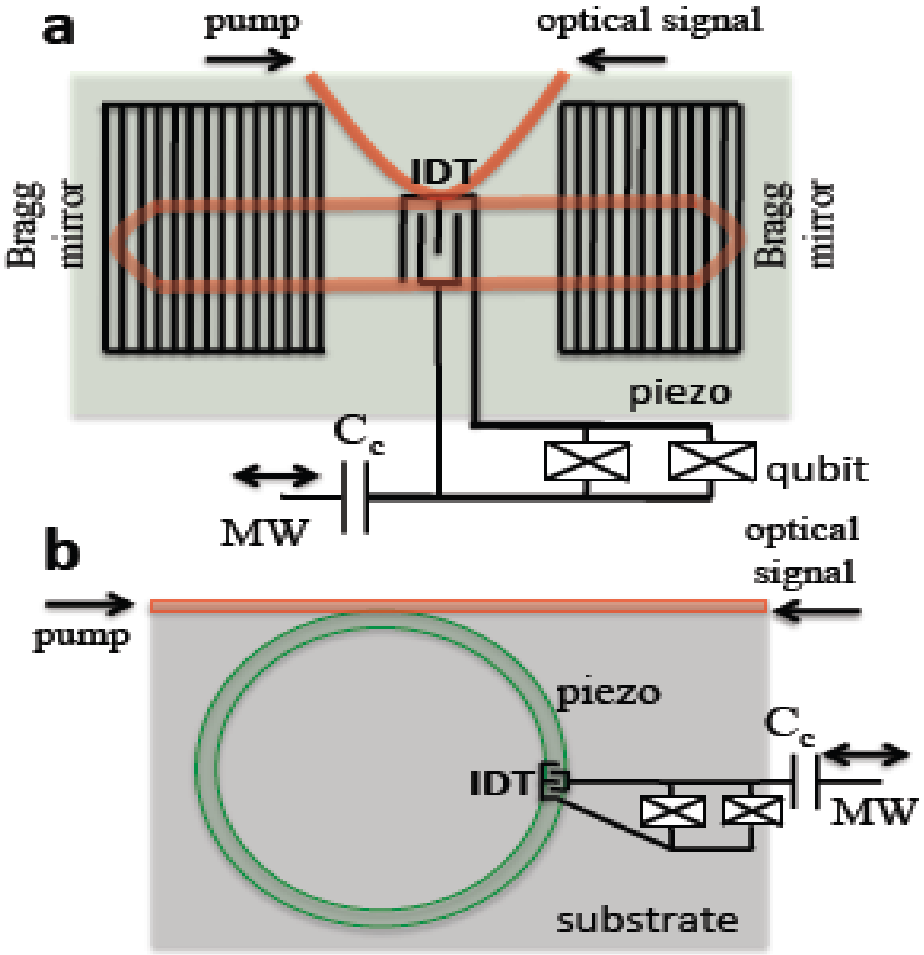
- **Role of superconducting qubits**

  Quantum information processing, storing information

- **Importance in quantum computing and communication**

  Information Processing, Quantum Gates, Entanglement, Quantum Communication

Acousto-Optic Transducers

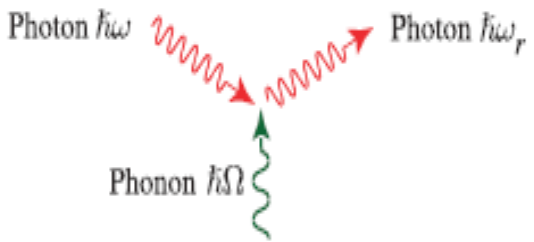


Phonon-Photon Conversion

$\omega_P = \omega_S - \Omega$ Anti-Stokes Scattering

$$\mathcal{H}_{SBS} = -\hbar\sqrt{N_p}(g_0 e^{-i\omega t} a^\dagger b + {g_0}^* e^{i\omega t} a b^\dagger)$$

$\omega_P = \omega_S + \Omega$ Stokes Scattering



$$\mathcal{H}_{SBS} = -\hbar\sqrt{N_p}(g_0 e^{-i\omega t} a^\dagger b^\dagger + {g_0}^* e^{-i\omega t} a b)$$

Challenges and Future Directions

- Current challenges in implementation
- Future research directions
- Technological advancements needed for improvement

Conclusion

- Summary of the importance of acousto-optics in quantum circuits

- Potential impact on the future of quantum technology

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Thanks to your attention