Docket #: S23-295

Nonlinear optics within macroscopic optical resonators for quantum computing

Stanford researchers in the Simon Lab have proposed integrating nonlinear optics within optical resonators in general, and within their small waist resonators in particular.
This approach is feasible because:
1. Proper anti-reflective (AR) coatings on nonlinear crystals and careful engineering of the resonator mode structure reduce losses from crystal reflections.
2. Our small waist resonators achieve desired levels of cooperativity without requiring very high finesse, thus they can handle the slight losses caused by nonlinear crystals inside the cavity.
Inclusion of these non-linear optics in the resonator allows for optical processes to be performed that cannot be performed otherwise. This invention addresses the critical challenge of control of light and can be a transformative tool for optical quantum science.

Stage of Development

- Early prototype

Figure

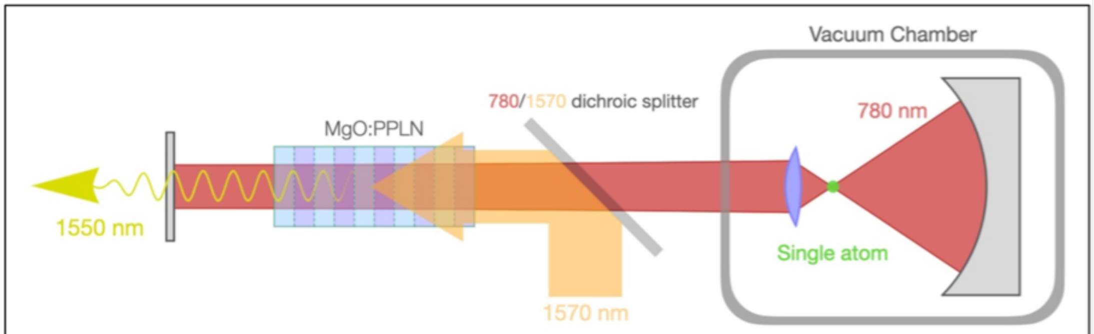

Figure 1: Tunable Optical Coupler for real-time photon in-/out-coupling at 1550nm.

Image credit - Simon Lab

Applications

- Quantum Computing
- Quantum Networking
- Quantum Sensing

Advantages

- **Advances quantum computing**
    - Enables optical processes to be performed that cannot be performed otherwise
    - Uses intracavity lenses to achieve a waist w(o) that is smaller than that achieved with the prior-art optical cavities
- **Tunable** – uses intra-cavity electro-optic modulators (EOMs) to quickly adjust resonator frequency
- Can be a **transformative tool** for optical quantum science

Innovators

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