Coupled Photonic Resonators for High-Performance Optomechanical Sensors

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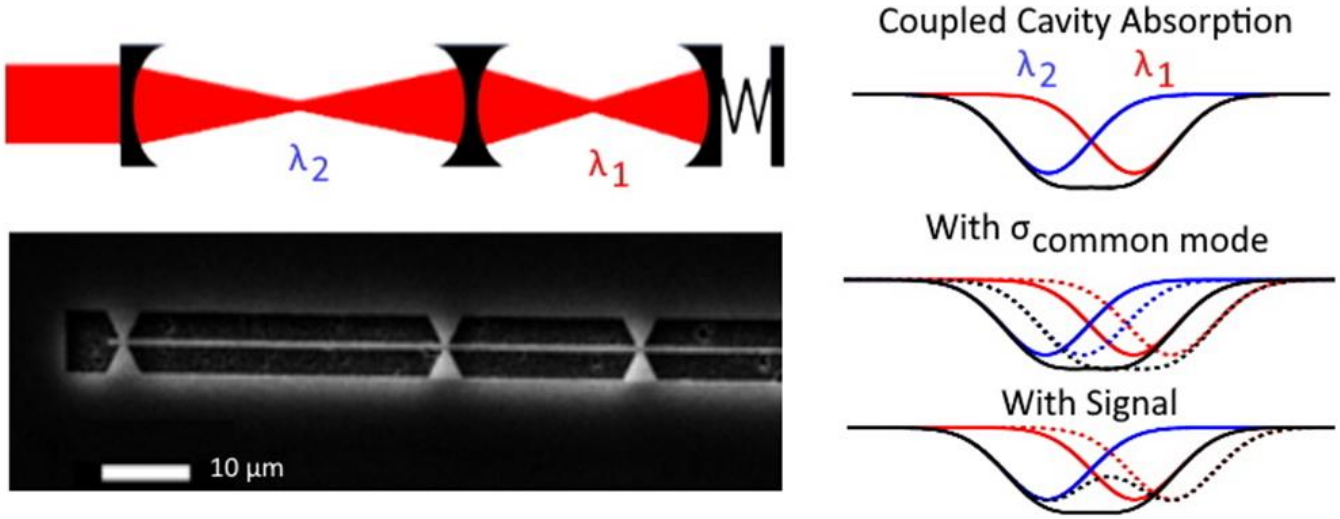
Optomechanics provides an appealing mechanism for detecting various stimuli at or even below the classical limits to sensitivity [1]. On-chip optomechanical sensors with integrated photonic components are nearing readiness for deployment across a wide range of areas, including mass [2], inertial [2], magnetic [3], and acoustic [4] sensing. Though recent developments have overcome many performance-limiting effects (*e.g.*, shot noise and the standard quantum limit [5]), classical laser phase noise presents an ongoing limitation to the efficacy of high-sensitivity, photonic-based sensors [5].

In this work we present a method of overcoming such issues by utilising non-degenerate coupled photonic cavities, only one of which is sensitized to the desired stimulus. Through careful choice of the cavities' frequency difference and coupling rate, we can dramatically suppress the contribution of laser phase noise without significantly degrading the device's response (see figure). This work further improves the performance of compact high-sensitivity measurement devices.



[1] Barzanjeh, S., Xuereb, A., Gröblacher, S. *et al*, *Nature Physics* **18**, 15–24 (2022).

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