

Lighting Micro-cavities using Micro-fibers

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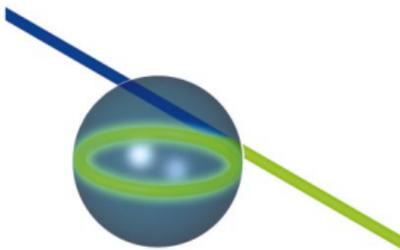
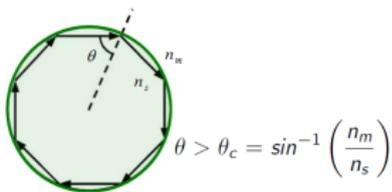
May 8, 2018

Whispering Gallery Modes in Sound Waves

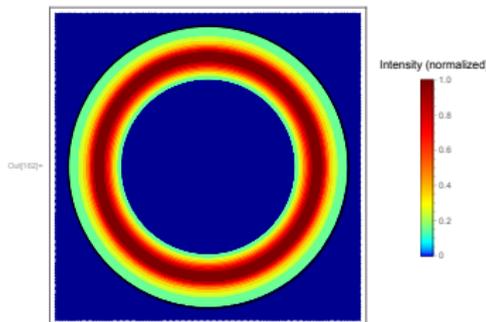
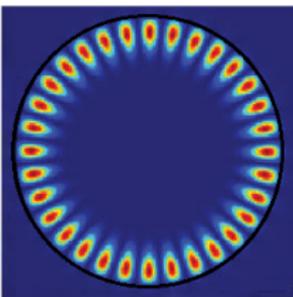
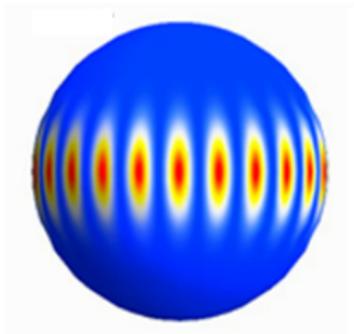


St Paul's Cathedral Church in London

Whispering gallery Modes in Light Waves



Eigenmodes of circular cavities which get excited when a light beam gets trapped due to a series of total internal reflections and after orbiting the cavity, it returns to its starting point in phase.

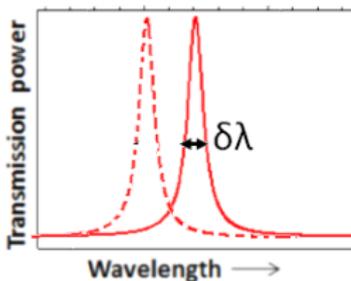


Features of WGMS

- High Quality factor

$$Q = \frac{\text{Energy stored}}{\text{Energy Dissipated per cycle}}$$

- Very Small mode volume

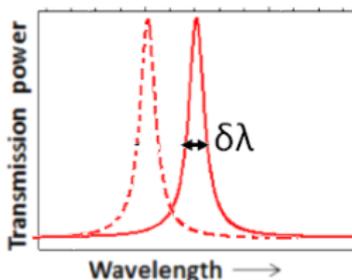


Features of WGMS

- High Quality factor

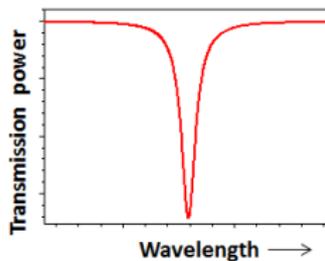
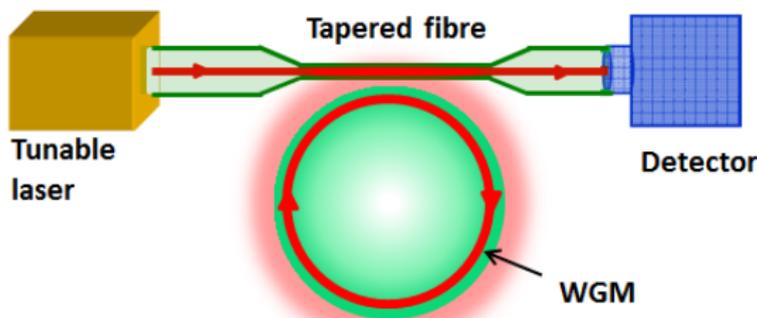
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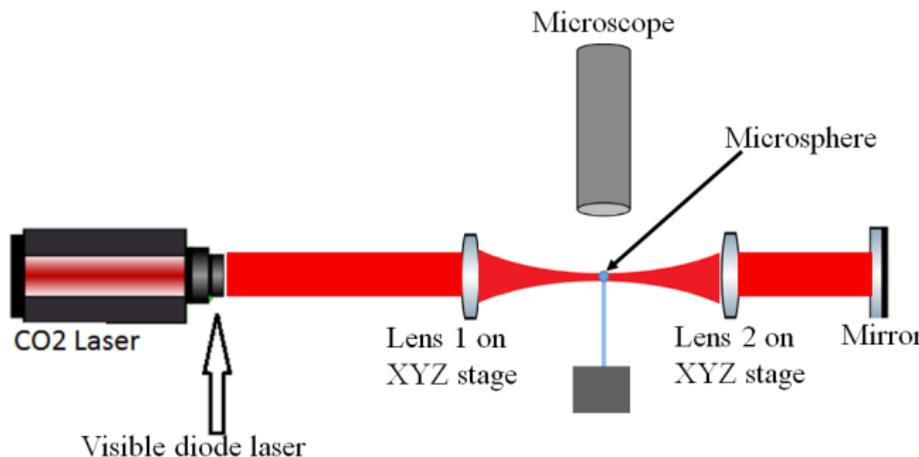


- These factors lead to enhanced field amplitude and a long photon lifetime.
- **Physics and Applications:** CQED, Non-linear optics, Microlasers, Temperature, Pressure, Refractive index, Humidity and Bio Sensors.

How to couple light inside Micro-cavities?

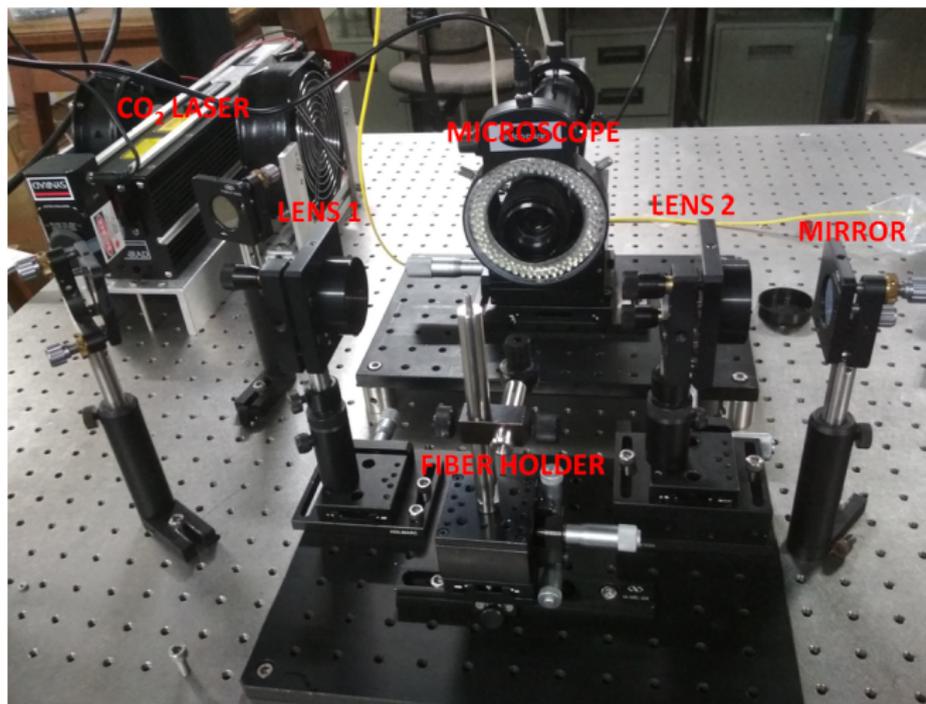


Fabrication of Micro-cavities



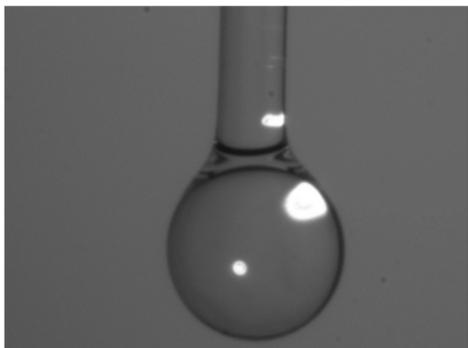
Schematic of experimental set up for fabrication of microspheres

Fabrication of Micro-cavities



Experimental set up for fabrication of microspheres

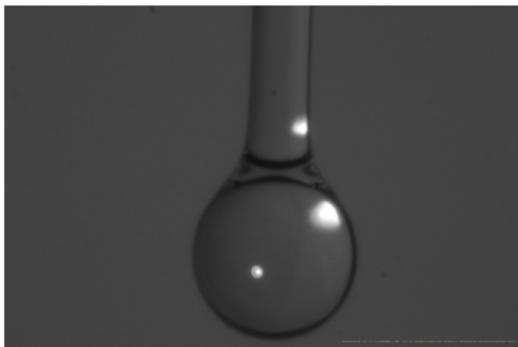
Fabrication of Micro-cavities



(a) Diameter $\approx 300\mu$

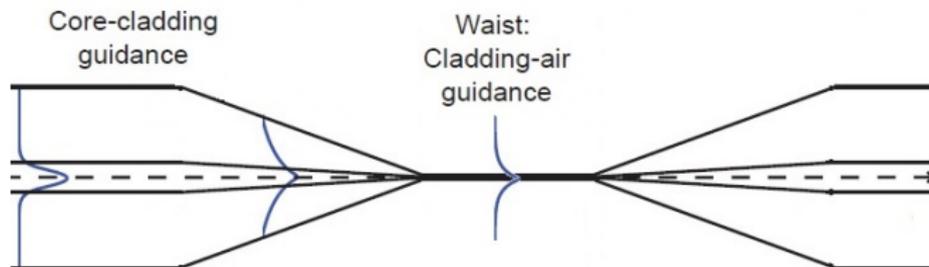
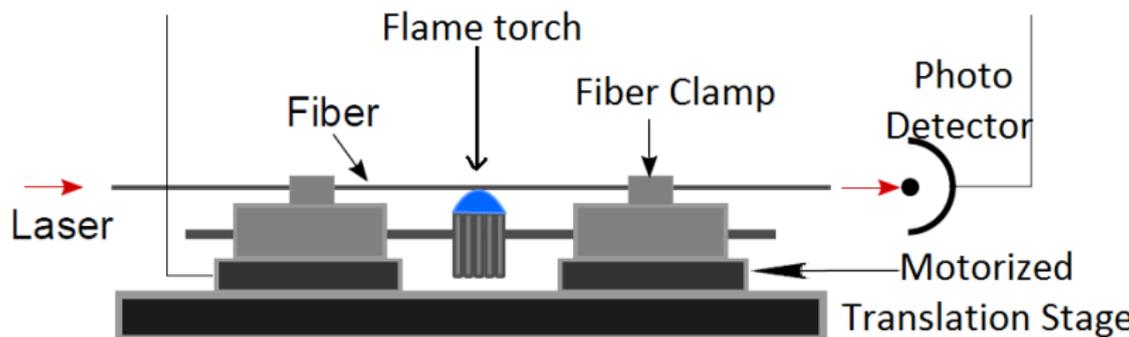


(b) Diameter $\approx 200\mu$

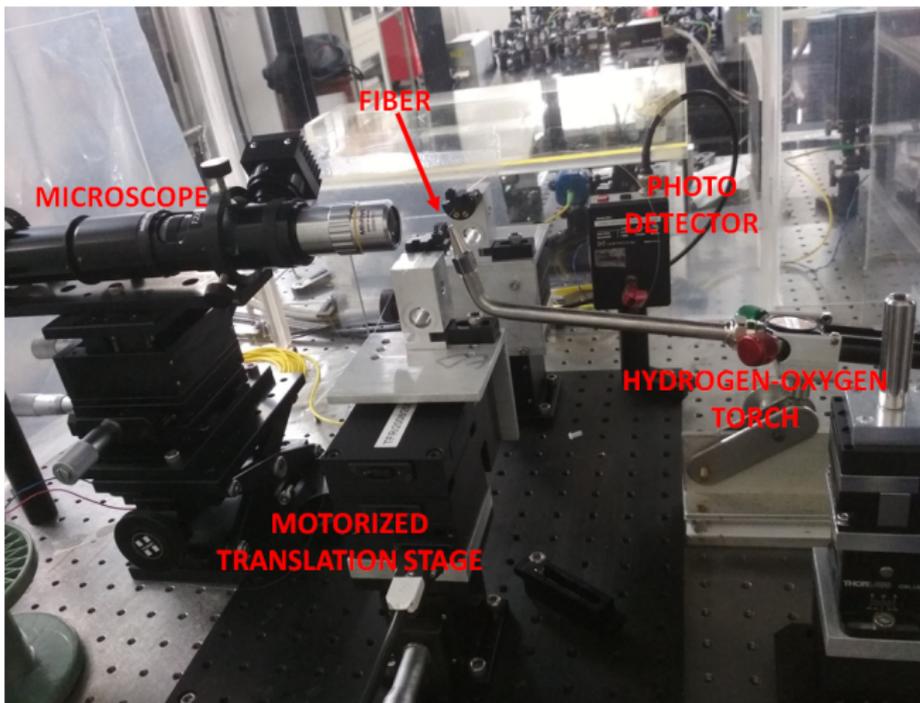


Diameter $\approx 150\mu$

Fabrication of Micro-fibers

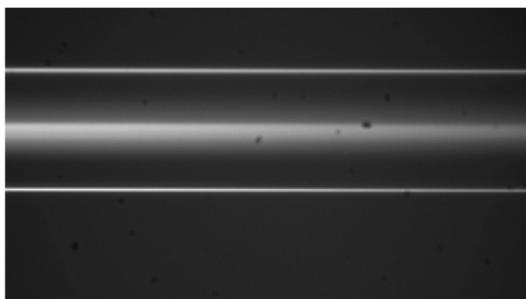


Fabrication of Micro-fibers

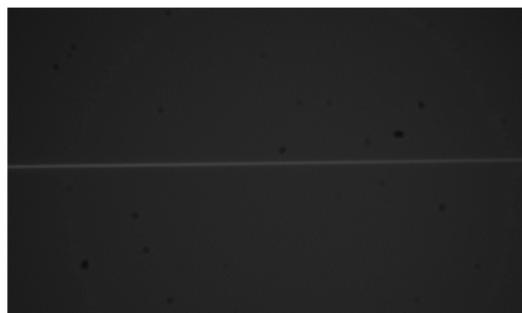


Experimental set up for fabrication of micro-fibers

Fabrication of Micro-fibers

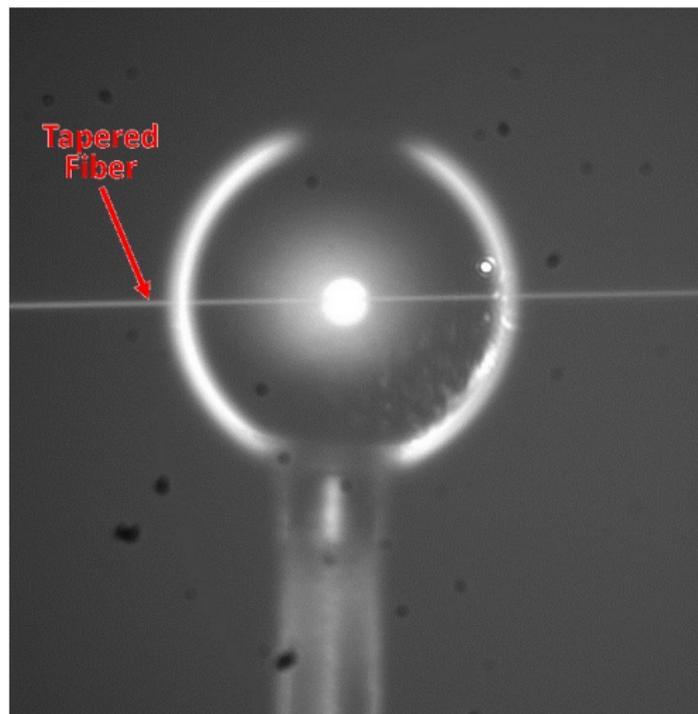


(a) Fiber before tapering, diameter \approx 125 microns



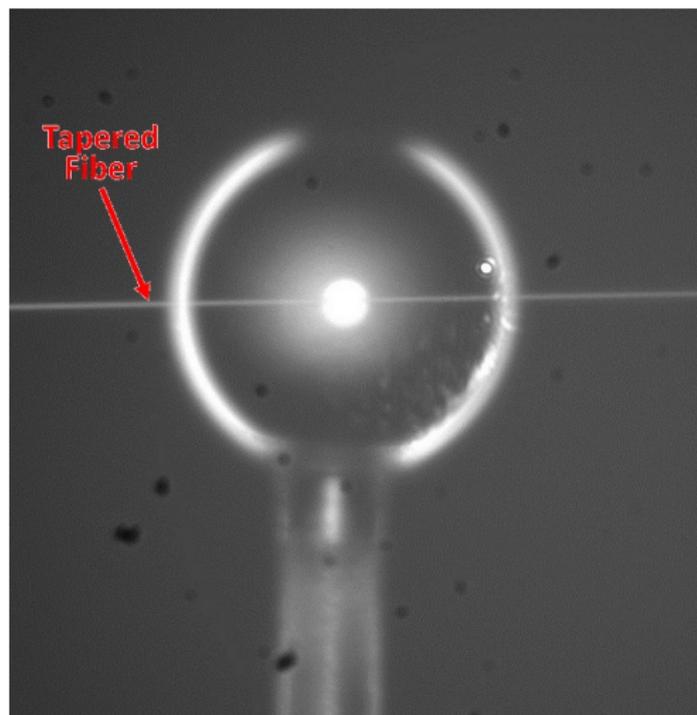
(b) Fiber after tapering, diameter \approx 1 micron

Exciting WGMs in Microspheres

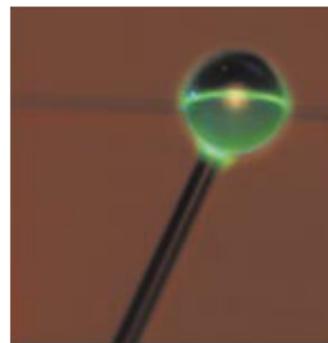


(a) Microsphere-fiber coupled system

Exciting WGMs in Microspheres

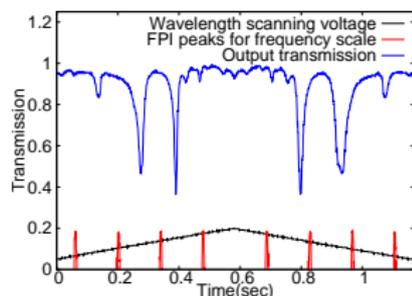


(a) Microsphere-fiber coupled system

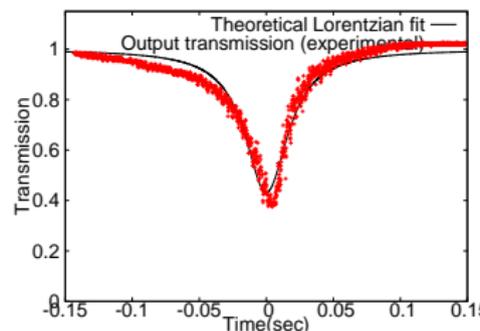


(b) WGM in an Erbium doped microsphere (M. Cai (2001))

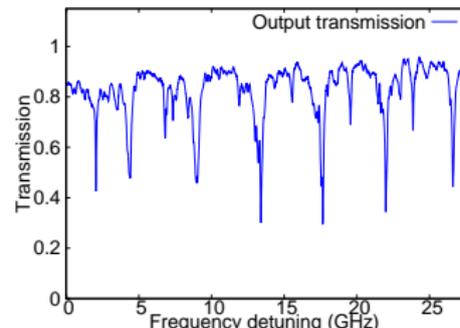
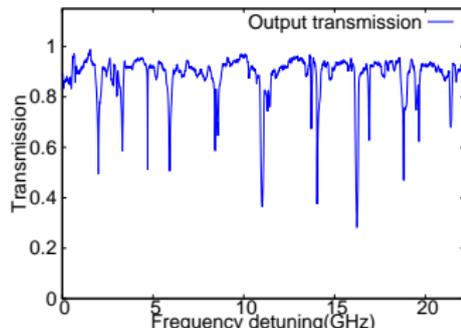
Exciting WGMs in Microspheres



(a) 4 GHz frequency scan up and down



(b) Fitted quality factor, $Q \approx 10^7$



Different WGMs of different Q value with two different microspheres.

THANK YOU