

Microsphere Lasers

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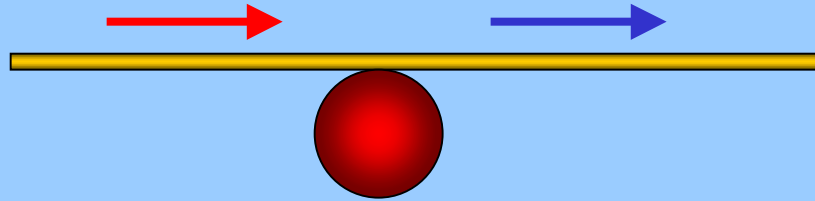
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Fiber Coupled Microsphere Laser



All optical fiber delivery of pump power and extraction of lasing emission \Rightarrow avoids difficult fiber-to-chip coupling.

Lasing emission in the 1500 nm telecom band \Rightarrow compatibility with existing fibercom systems.

Tandem laser oscillators on a single fiber \Rightarrow potential application as a multi-wavelength source.

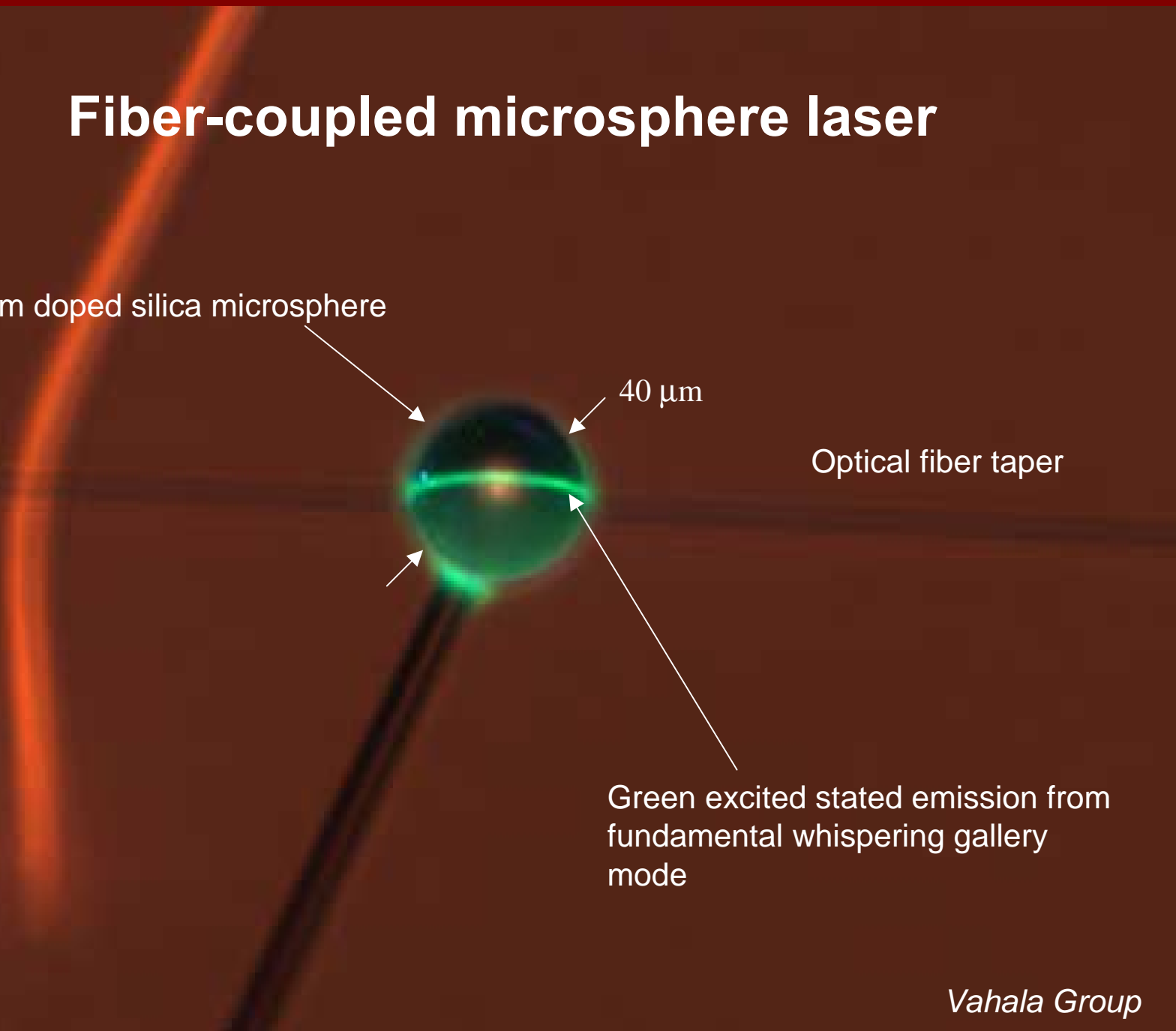
Fiber-coupled microsphere laser

Erbium doped silica microsphere

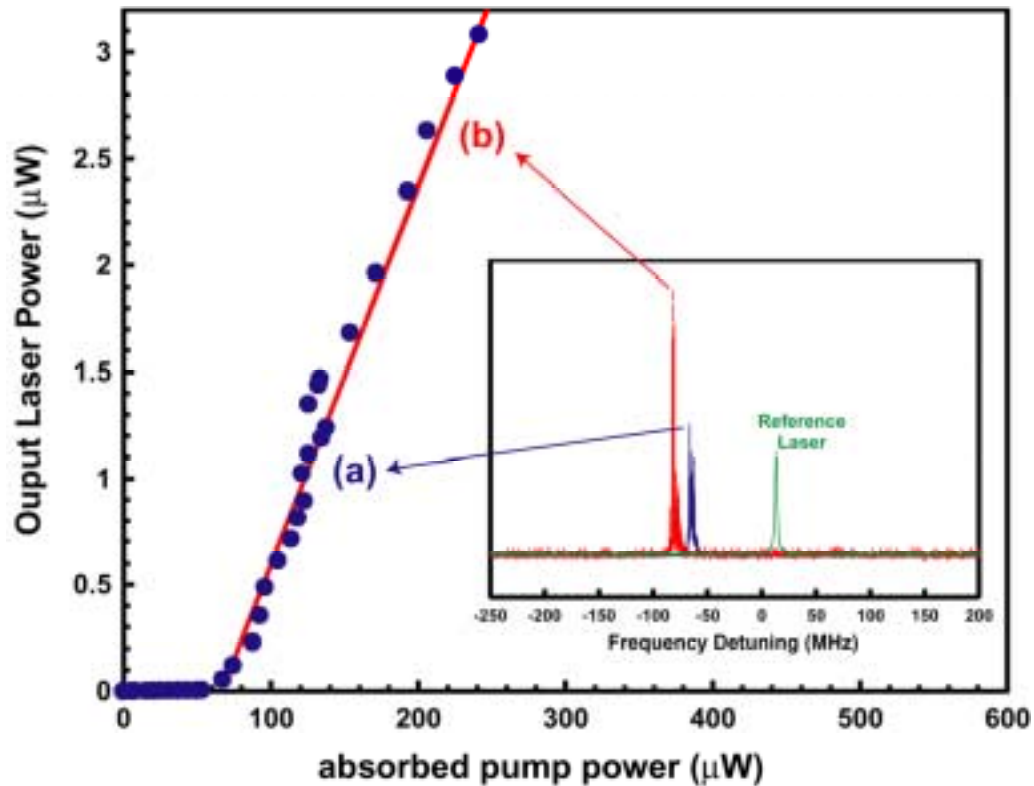
40 μm

Optical fiber taper

Green excited state emission from
fundamental whispering gallery
mode

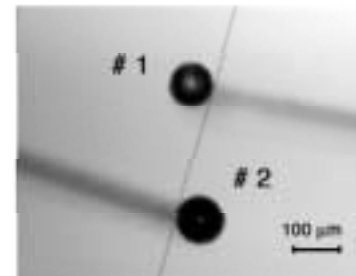
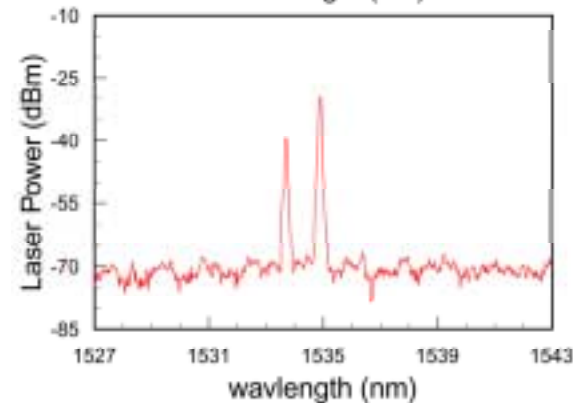
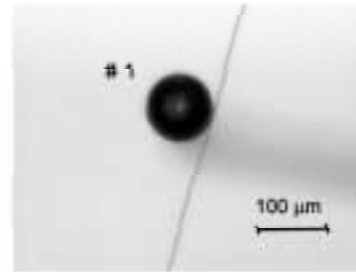
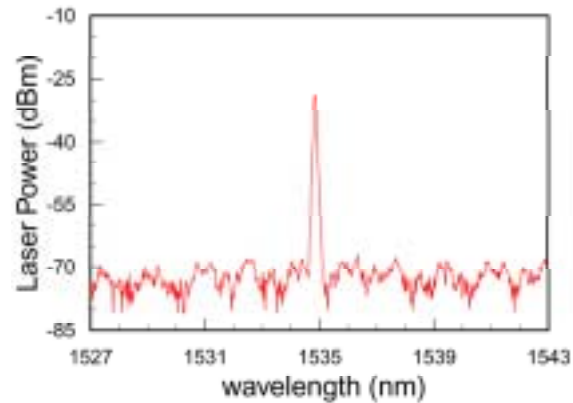


Threshold Characteristic



Diff. quantum efficiency $\approx 2\%$

Tandem Microsphere Lasers

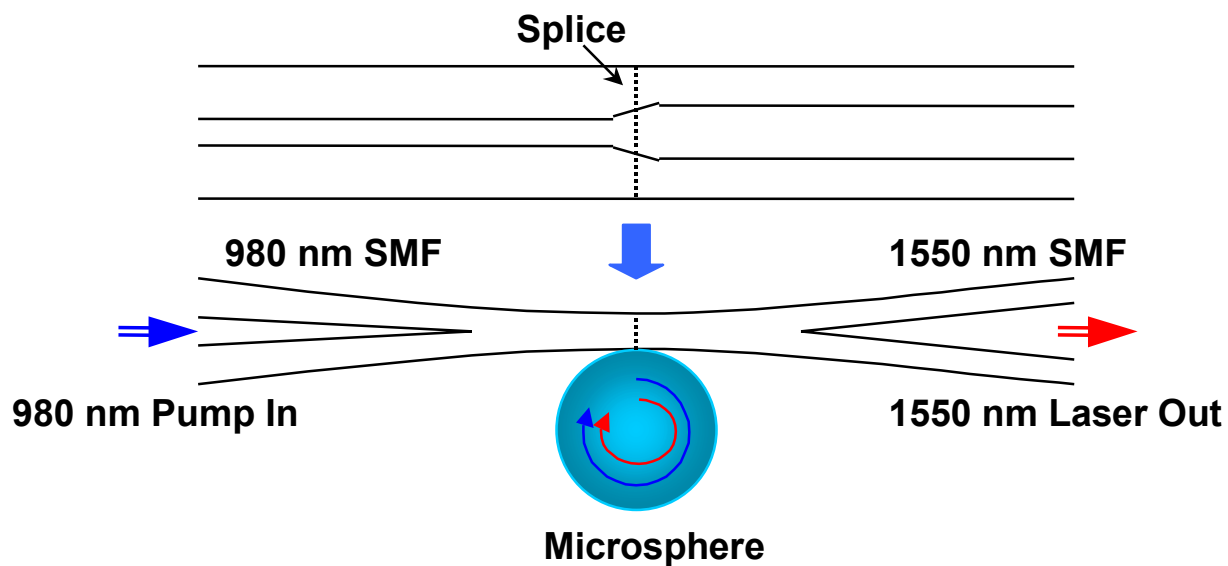




Hybrid Taper Coupled Microsphere Laser

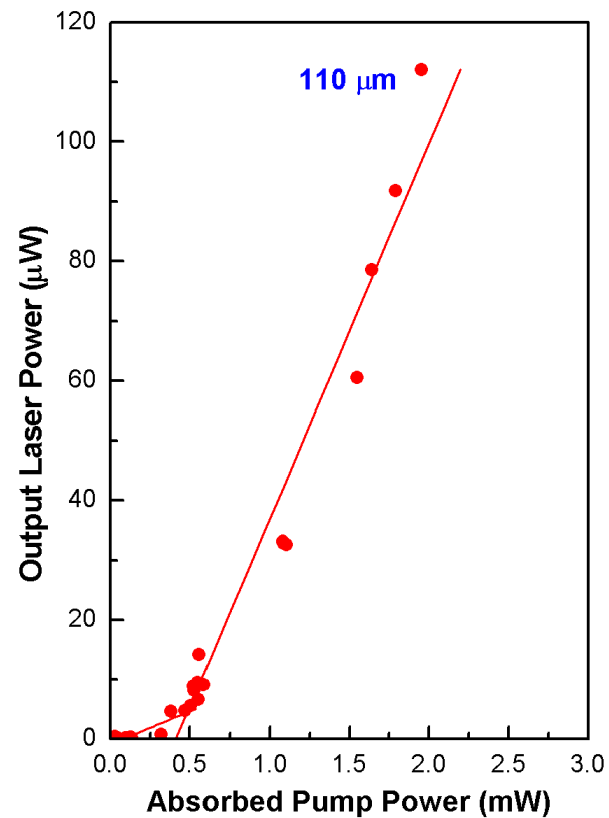
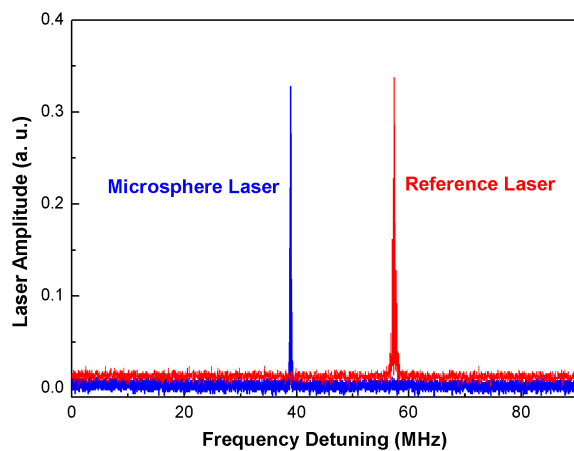
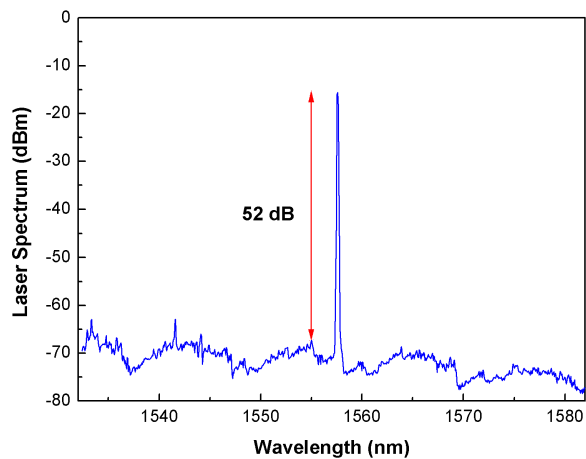
Desirable laser coupler:

*980-nm SMF in
1550-nm SMF out*



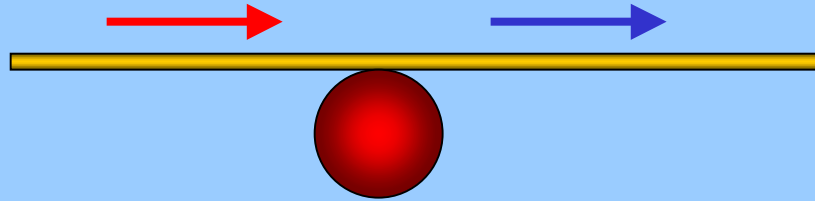


Hybrid Taper Coupled Microsphere Laser Performance



Diff. Quantum Eff. = 12%

Microsphere Laser Performance



Current performance:

Output Power 0.1 mWatt with 12% quantum efficiency

Single frequency operation (non tunable)

Target Performance:

Output power 1 mWatt

Tunable over 30 nm in 1500nm band

Publications

Ming Cai, Kerry Vahala, Optics Letters, June 2001.

Ming Cai, Oskar Painter, Kerry Vahala, Pete Sercel, Optics Letters, October 2000.

Ming Cai, Oskar Painter, Kerry Vahala, Phys. Rev. Lett. July 2000.