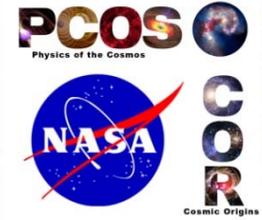


Laser Stabilization with CO

PI: John Lipa/Stanford University



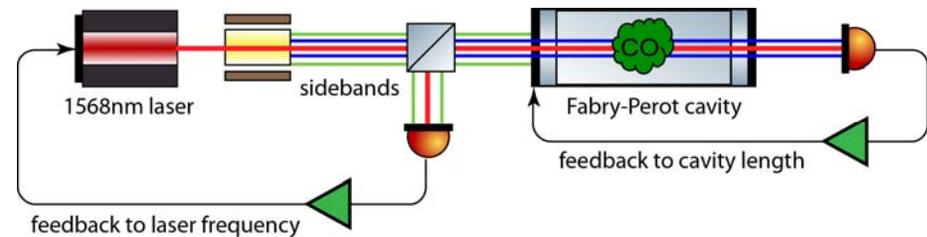
Objectives and Key Challenges:

- Develop a laser operating near 1570 nm with improved noise performance and mid-term frequency stability, for missions that could use a highly coherent light source near the telecom band.
- Performance goals are to achieve substantially lower noise than Iodine-stabilized lasers, the current gold standard for transportable systems. Goal is to achieve an Allan deviation of $\sim 2 \times 10^{-15}$ in a one second measurement time.

Challenge: Noise performance and frequency stability of lasers on short and intermediate time scales: requires dual locking scheme shown on right.

Significance of Work:

- A highly stable laser simultaneously locked to a cavity and a molecular transition at a Telecom wavelength.



Dual sideband laser locking optics

Approach:

- Set up a bench-top model of laser system for CO based on existing system at JILA for C2HD near 1064 nm
- Perform functional tests on system
- Set up a system to allow detailed noise performance measurements
- Upgrade optics and electronics to achieve noise performance goal

Key Collaborators:

- Jan Hall, JILA
- Bob Byer, Sasha Buchman, Stanford
- Shailendhar Saraf, SN&N Electronics, CA

Funded Period of Performance:

- Jan 2013 – Jan 2015

Accomplishments:

- First demonstration of CO stabilized laser in the telecom wavelength band (~ 1550 nm) ($\sim 06/14$)
- Noise measurements to 2×10^{-14} stability @ 1000 sec (10/15)
- Performance upgrades with frequency comb reference (11/15)
- Publication of results (submitted) (11/15)

Next Milestones (separately funded):

- Testing with lower noise resonant photodetector ($\sim 03/16$)
- Documentation of final TRL ($\sim 11/16$)

Application:

- Applications would be tests of fundamental physics, gravity wave observation, precision spectroscopy and Doppler, formation flying, trace gas detection.

TRL_{In} = 3 TRL_{PI-Asserted} = 3+ TRL_{Target} = 4