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Atmospheric Measurement Techniques Discussions

Interactive comment on "Laser frequency stabilization based on an universal sub-Doppler NICE-OHMS instrumentation for the potential application in atmospheric Lidar" *by* Y. Zhou et al.

Anonymous Referee #1

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Zhou et al present a system for laser stabilization based on NICE-OHMS. Instead of directly feeding back to the laser, they use a single-sideband modulator as a frequency actuator. This increases the flexibility of the system, as demonstrated by the similar performance achieved with two different lasers. While the system is well designed and implemented, I'm not sure that the results presented relevant enough to the atmospheric community or novel enough for publication in AMT.

For the applicability to the atmospheric community, more details need to be provided about the potential application to LIDAR:

- First, what frequency stability is required for LIDAR and why?

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- My initial thought is that NICE-OHMS is overly complicated for this application. The motivation for using NICE-OHMS was not well justified. What performance has been achieved with a wavemeter and with other schemes such as WMS/FM spectroscopy in a cavity? Why is NICE-OHMS necessary?
- What gas is expected to be used for the LIDAR application (C_2H_2 is not the most atmospherically relevant)? How will the performance compare (i.e., what are the linestrengths, expected linewidths, etc.)?

For the novelty, the included Gatti et al reference has already demonstrated a wide bandwidth PDH lock using a single sideband modulator. This fact should be clarified in the current paper and the differences between this and the Gatti work should be discussed (e.g., the feedback bandwidth was higher in Gatti et al). Also, why was a lower bandwidth VCO used for VCO1? Demonstrating the ability to use a DFB or ECDL would make this a stronger paper.

In addition, before publication the language could use some editing.

Finally, I have some more specific comments/questions as well:

1. "DVB" and "F-P cavity" are not defined in the caption to Figure 1
2. Why were OAPs used instead of lenses?
3. For the LIDAR output, will the frequency need to be tuned, e.g., to do an on-line/off-line measurement? If so, how will this be accomplished?
4. For Figure 2, it would be better to give the noise PSD. Also, I assume that this is an in-loop measurement? This should be clarified. In addition, I believe that this should be corrected for the cavity low-pass filter effect (e.g., Fig 5 in Gatti et al)?
5. What causes the upturn in the Allan deviation past 200 seconds?

6. What was the temperature stability of the lab? How would the performance be affected by reduced temperature stability?

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