

ASEN 6519. Lidar Remote Sensing**HW Report #3. Temperature Lidar Principles and Technologies**

Please write a HW report on temperature lidars using the following reading materials:

- 1) Our textbook Chapter 5 (Sections 5.1 and 5.2) and Chapter 7 (Section 7.4.2) on resonance fluorescence and Rayleigh integration lidars for temperature measurements and direct-detection lidars.
- 2) Our lecture notes (#10 to #16) on temperature lidars that introduce all.
- 3) Several papers at the Reading Materials website are good reference for your reports as they may provide a better description of technical details when compared to lidar chapters. These papers include
RotationalRamanLidar.pdf
RamanIntegrationTempLidar.pdf.
ILRC25_Chū_FeDopplerLidar.pdf
ILRC25_Chū_BestPaperAward.pdf
2001AO_Hair_HSRLIodineFilter.pdf
2009OL_Huang_NaDEMOFtheory.pdf
2009OL_Huang_FieldDemoNaDEMOF.pdf.

In the report, please address the following aspects:

1. Use the Table “Comparison of Temperature Technique” in Lecture notes 10 or 16 as a clue to summarize the temperature lidar technologies. *You may ignore the DIAL technique.* Please summarize the basic principles of these technologies in your own words, and give equations or figures if necessary. What is the common point of all temperature lidar technologies?
2. What are the application altitude ranges of each temperature lidar technology you describe above? If you are asked to use lidar to measure temperature from ground to 120 km, what kind of lidar or lidars will you use? Please explain why.
3. What are the advantages and disadvantages of each technology? What are the challenging points of each temperature lidar technology, considering from the aspects of realization of the technology, data retrieval reliability and errors?
4. In Doppler temperature technique, why do we use 1 time of Doppler broadening in the absorption/effective cross section of resonance fluorescence lidar but use 2 times of Doppler broadening in the Rayleigh scattering signal? Please derive equations to prove this is right.
5. *Extra Assignment -- Rayleigh Doppler lidar technique is a growing field as new ideas of using multiple frequencies have been introduced into the field. Please summarize the various Rayleigh Doppler techniques to explain how they work in each case.*