ASEN 6519. Lidar Remote Sensing
HWK Report #2

Please write a HWK report on the following reading materials:
1) Chapter 5.2 by Xinzhao Chu in textbook "Laser Remote Sensing" (for resonance fluorescence Doppler technique and Boltzmann technique)
2) Rayleigh temperature lidar paper by Hauchecorne and Chanin [1980] "RayleighTempLidar.pdf" (for Rayleigh integration technique)
3) Vibrational Raman lidar paper by Keckhut et al. [1990] "RamanLidar.pdf" (for Raman integration technique)
4) Rotational Raman lidar paper by Behrendt "RotationRaman.pdf" (for pure rotational Raman technique)
5) Our lecture notes on temperature lidars

Note: Papers 2-4 can be downloaded at the class website.

In the report, please address the following aspects:

1. Summarize the temperature lidar techniques (see Summary slide in lecture notes #18), and give a concise description of the measurement principles of each technique. If necessary, equations and figures can be used to give a better illustration.

2. What is the key point in lidar techniques for temperature measurements? In other words, what is the common point of various forms of temperature lidar techniques? Based on this common point, how do you expect future techniques for temperature measurements? – You may do a brainstorm to suggest some potential phenomena or effects for temperature measurements.

3. Please derive the integration technique equation from hydrostatic equation and ideal gas law. Also try to derive its error (variance) equation.

4. For resonance fluorescence Doppler, Boltzmann, Rayleigh integration, Raman integration techniques, give an example of actual lidar system, describing its basic instrumentation, primary requirements on the hardware (e.g., wavelength, frequency accuracy, laser power and bandwidth, receiver bandwidth, etc.), and applicable atmosphere range.