New developments on resonance lidars

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The first scanning Lidar was introduced for potassium Doppler temperature measurements in 1995. By combining the measurement of the frequency of each single laser pulse with the backscattered signal very high accuracy can be achieved. The direct measurement of the pulsed laser avoids any bias by the mean shift and chirp of the pulsed laser compared to the seeder laser. Furthermore by calculating a model spectrum during the data analysis at the measured frequencies it is possible to reproduce each measurement without assuming that the laser is running on an idealized single frequency.

After initial Doppler temperature measurements in 2002 at the 386 nm Iron resonance the former potassium Doppler Lidar was converted to an Iron-Doppler Lidar with extended capabilities. The Iron-Doppler Lidar can measure simultaneously Doppler Resonance, Doppler Rayleigh and Doppler Mie at day and night without significant background. All measurements are performed with a very small field of view of only 0.06 mrad and narrow band filtering in the order of the backscattered signal. A compact rubidium saturation spectroscopy at 780 nm allows spectral measurements with sub-MHz resolution.

The now 25 year old mobile system will be replaced within the next few years. The heart of the system is a very efficient and compact pulsed laser which is under development. Beside maintenance free and automatic operation the main goal of the currently build prototype is the demonstration of a table sized Doppler Resonance/Rayleigh/Aerosol Lidar at low cost. Low cost, fast assembling and automatic operation pave the way for the construction of future Lidar Arrays, sampling the atmosphere in 3-D at a single location, similar to the capability of modern radars. Identical system could also be used for monitoring the atmosphere at spaced location as a Lidar Grid.