**Why HSRL**

The standard backscatter lidar:
1 measurement and 3 unknowns

\[ s(r) = \eta(r) \beta(r) t(r)^2 \]

- Measured range dependent signal
- Instrument effects
- Atmospheric Backscatter
- Atmospheric Transmission

Solving with only one measurement:
- Assume relationships between atmospheric terms
- Assume, ignore or indirectly infer instrument term
- No diagnostic for the accuracy of these assumptions

HSRL (and Raman lidar) use a second molecular-only signal as a backscatter reference which:
- Reduces the impact of instrument effects
- Enables direct calibration of residual instrument effects (HSRL only)
- Enables two measurements for two remaining atmospheric unknowns

**Next Generation**

The next generation airborne HSRL at NCAR should address the practical limitations of the current GV-HSRL. Diode-laser-based architectures similar to the MicroPulse DIAL (MPD) provide an effective path forward.

The concept for a diode laser based HSRL was demonstrated in 2017 by NCAR.

Five diode laser based HSRLs are currently part of the operational MPD instrument package.

**Potential Benefits:**
- Reduced install footprint
- Platform flexibility (GV and C-130)
- Reduced maintenance requirements
- Design for RT situational awareness
- Simultaneous up/down profiling

**Risks:**
- Reduced signal-to-noise
- Development time, staff and resources

**References**


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