P43: Measurements of DSD Second Moment Based on Laser Extinction

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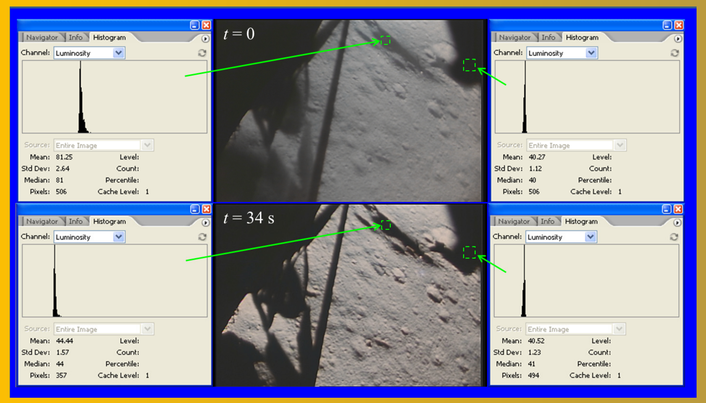
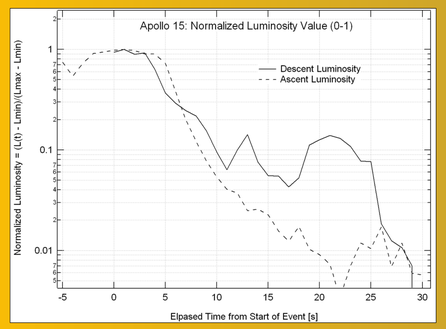
Measuring Density of Lunar Dust

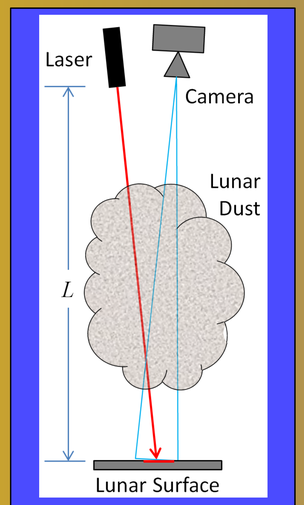


Luminosity measurements of Apollo 14 landing videos following engine cutoff.

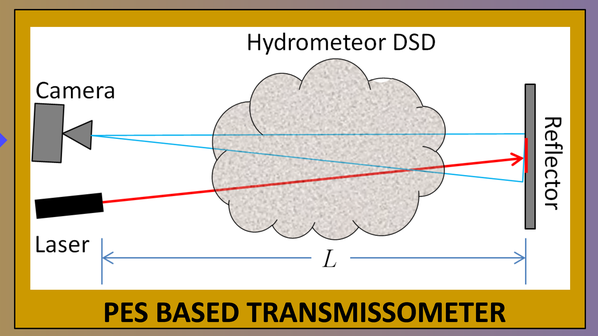


Luminosity comparisons from Apollo 14 landing and ascent videos.

Using a technique recently developed for estimating the density of surface dust dispersed during a rocket landing, measuring the extinction of a laser passing through rain (or dust in the rocket case) yields an estimate of the 2nd moment of the particle cloud, and rainfall drop size distribution (DSD) in the terrestrial meteorological case.



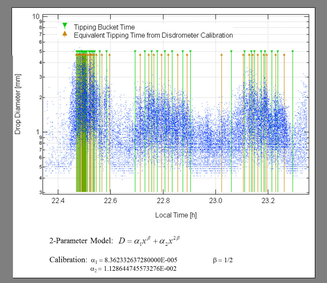
PLUME EROSION SENSOR (PES)



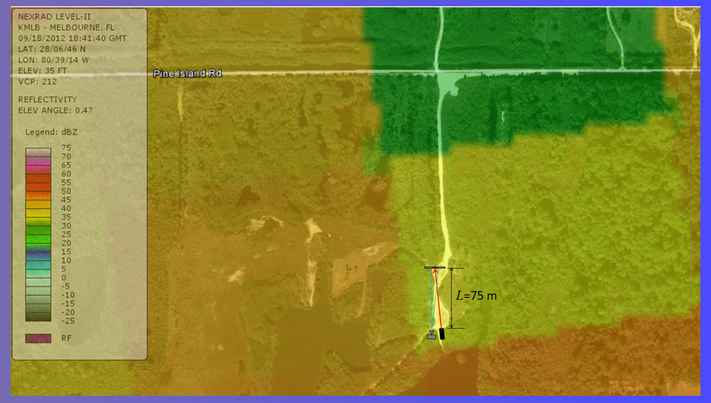
PES BASED TRANSMISSOMETER

$$E = w_1 \sum \left(M_{11/3}(n) - \hat{M}_{11/3}(n) \right)^2 + w_2 \sum \left(M_6(n) - \hat{M}_6(n) \right)^2 + w_3 \sum \left(M_2(n) - \hat{M}_2(n) \right)^2$$

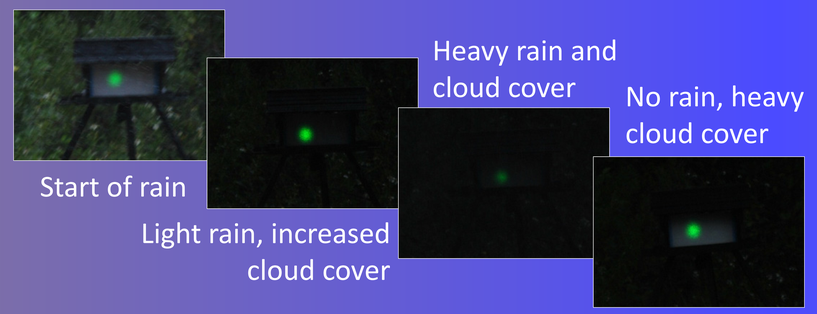
In situ disdrometer calibration by minimizing error function of weighted DSD moments using collocated tipping bucket (left term) + radar reflectivity (center term) + optical density (right term)



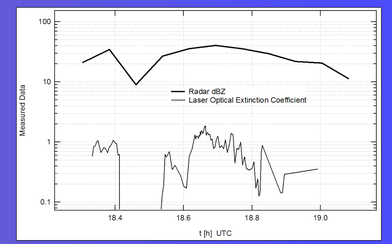
Measuring Rainfall DSD 2nd Moment

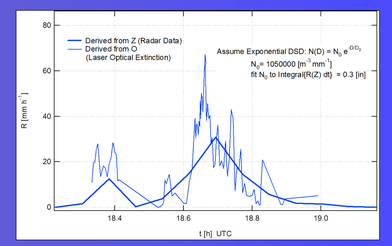


PES with 75 m distance to passive target, overlaid with September 18, 2012 Melbourne NEXRAD super-resolution data (250 m × 0.5 °).



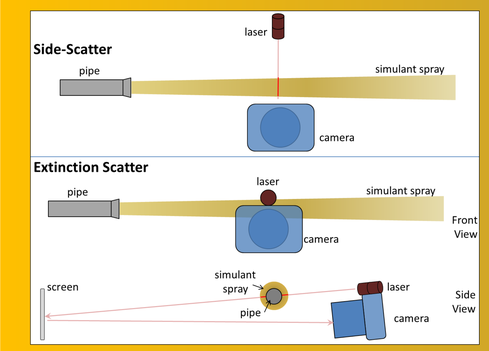
Laser luminosity during rain event, Sep 18, 012, 18:15 – 29:00, GMT using a 532 nm, 5 mW green laser, L = 75 m.

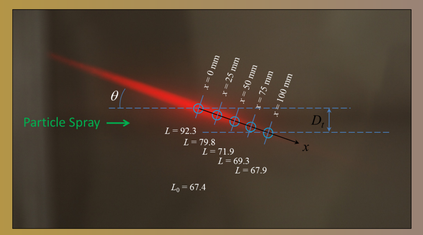




Using image processing algorithms, derived rainfall rate (assuming exponential DSD)

Experimental Lab Setup





Side-Scatter laser extinction through JSC-1A lunar simulant

UCF disdrometer and radiometer test site (roof of Eng Bldg) – JWD on far left, experimental disdrometer (JTD) center and right.