

This device provides a way to characterize the performance of victim detecting radars objectively and quantitatively. It dramatically reduces the cost of testing in multiple-victim scenarios. The programmable victim simulator can be used to assess the sensitivity of the radar

accurately, and can be placed for long periods of time in environments that would be unsafe for a human subject (e.g., buried for 24 to 48 hours in flowing mud, or within a burning building).

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## Hydrometeor Size Distribution Measurements by Imaging the Attenuation of a Laser Spot

**Measurement of the DSD's second moment is made by way of the Beer-Lambert law.**

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The optical extinction of a laser due to scattering of particles is a well-known phenomenon. In a laboratory environment, this physical principle is known as the Beer-Lambert law, and is often used to measure the concentration of scattering particles in a fluid or gas. This method has been experimentally shown to be a usable means to measure the dust density from a rocket plume interaction with the lunar surface. Using the same principles and experimental arrangement, this technique can be applied to hydrometeor size distributions, and for launch-pad operations, specifically as a passive hail detection and measurement system.

Calibration of a hail monitoring system is a difficult process. In the past, it has required comparison to another means of measuring hydrometeor size and density. 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 hail (or dust in the rocket case) yields an estimate of the second moment of the particle cloud, and hydrometeor size distribution in the terrestrial meteorological case. With the exception of disdrometers, instruments that measure rain and hail fall make indirect measurements of the drop-size distribution. Instruments that scatter microwaves off of hydrometeors, such as the WSR-88D (Weather Surveillance Radar 88 Doppler), vertical wind profilers, and microwave disdrometers, measure the sixth moment of the drop size distribution (DSD).

By projecting a laser onto a target, changes in brightness of the laser spot against the target background during rain and hail yield a measurement of the DSD's second moment by way of the Beer-Lambert law. In order to detect the laser attenuation within the 8-bit resolution of most camera image arrays, a min-

imum path length is required. Depending on the intensity of the hail fall rate for moderate to heavy rainfall, a laser path length of 100 m is sufficient to measure variations in optical extinction using a digital camera. For hail fall only, the laser path may be shorter because of greater scattering due to the properties of hailstones versus raindrops. A photodetector may replace the camera in automated installations.

Laser-based rain and hail measurement systems are available, but they are based on measuring the interruption of a thin laser beam, thus counting individual hydrometeors. These systems are true disdrometers since they also measure size and velocity. The method reported here is a simple method, requiring far less processing, but it is not a disdrometer.

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