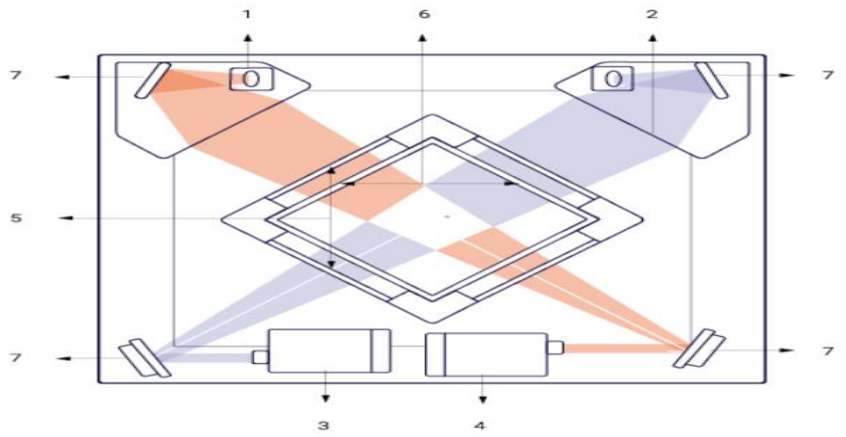
2DVD – Two-Dimensional Video Disdrometer

Advanced Instrument for Precipitation Microphysics and Drop Size Distribution Analysis

INTRODUCTION:

The **Two-Dimensional Video Disdrometer (2DVD)** is an advanced optical instrument designed to measure the **size, shape, fall velocity, and distribution of hydrometeors** (such as raindrops, snowflakes, and hail) in real time. It captures detailed images of each particle using two orthogonally mounted high-speed line-scan cameras, providing accurate and comprehensive precipitation characterization. The 2DVD is widely used in atmospheric research, model validation, and radar calibration.

It operates continuously in all seasons, offering valuable insight into precipitation microphysics. Its precise, high-resolution data support hydrological modelling, weather prediction, and climate studies.



1 Illumination **3** Camera A **5** Outer Slit Plates **7** Mirror
2 Fresnel lens **4** Camera B **6** Inner Slit Plates

OBJECTIVE:

- Characterization of Precipitation Microphysics
- Validation of Weather Radar and Satellite Observations
- Hydrological and Flood Modeling
- Climate and Atmospheric Research
- Particle Shape and Fall Velocity

DATA OUTPUT:

- Drop-by-drop measurements of **size (equivalent diameter)** and **shape (axis ratio)**
- **Fall velocity** of individual hydrometeors
- Derived parameters: **Rain rate**, **Drop Size Distribution (DSD)**, **Kinetic Energy**, and **Z-R relationships**
- **Two-dimensional images** of each particle from orthogonal views

KEY SPECIFICATIONS:

- **Drop Size Range:** ~0.2 mm to ~8 mm HORIZONTAL
- **Vertical & Horizontal Resolution:** Better than 0.17 mm for velocity < 10 m/s
- **Vertical Velocity Accuracy:** Better than ±4% for velocity < 10 m/s
- **Rain Rate Accuracy (vs. Tipping Bucket):** Typically, within ±10%
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- **Measurement Area:** Approx. 10 × 10 cm
- **Integration Time for Rain Rate:** User-defined, between 15 seconds to 12 hours
- **Interface:** USB or Ethernet to PC-based data acquisition system

MEASUREMENT & WORKING PRINCIPLE:

The 2D Video Disdrometer (2DVD) measures the **size, shape, and fall velocity of individual hydrometeors** (rain, snow, hail) using two orthogonally aligned high-speed line-scan cameras. As precipitation passes through the sensing area illuminated by LED arrays, the cameras capture **two perpendicular shadow images** of each drop.

By analyzing these shadows:

- **Drop size and shape** are determined from the silhouette dimensions.
- **Fall velocity** is calculated from the time difference as the drop moves across successive lines.
- **Precipitation type** can be inferred based on shape, size, and velocity characteristics.
- Each hydrometeor is measured independently, allowing high-resolution **Drop Size Distribution (DSD)** and kinetic energy calculations.

This optical method ensures **non-intrusive, high-precision measurements** crucial for microphysical precipitation studies.

KEY FEATURES

- **Dual-Camera System:** Captures two orthogonal views for accurate drop size and shape measurement
- **High Measurement Accuracy:** Resolution better than 0.17 mm and velocity accuracy within 4%
- **Real-Time Data Output:** Provides drop size distribution (DSD), fall velocity, and rain rate
- **Hydrometeor Classification:** Differentiates between rain, snow, and mixed-phase precipitation
- **Non-Intrusive Design:** Optical detection using LED line illumination, no airflow disturbance

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