A fixed-angle spectropolarimeter capable of determining the Mueller matrix elements of light scattered from particle deposits (and standard optical elements) over the 300–1100 nm spectral range has been built, calibrated and extensively used. A second generation of this instrument is under development which will provide the capability to scan from ≈ 0° to ≈ 360°, enabling measurements of the bidirectional Mueller matrices of nanoparticle arrays, atmospheric aerosol deposits, and nano- and microstructured surfaces. This system also provides a metrology capability for fully characterizing the performance of optical devices and device components from the near infrared through the medium wave ultraviolet.

Abstract

Mueller matrices and Stokes parameters

\[
\begin{bmatrix}
P' \\
Q' \\
U' \\
V'
\end{bmatrix} =
\begin{bmatrix}
M_{11} & M_{12} & M_{13} & M_{14} \\
M_{21} & M_{22} & M_{23} & M_{24} \\
M_{31} & M_{32} & M_{33} & M_{34} \\
M_{41} & M_{42} & M_{43} & M_{44}
\end{bmatrix}
\begin{bmatrix}
I \\
Q \\
U \\
V
\end{bmatrix}
\]

Dual Rotating Retarder Polarimeter

\[ S' = M_1 M_2 M_3 S \]

Results

Mueller matrix of Meadowlark half wave retarder (at 557nm)

Mueller matrix of Fresnel Rhomb quarter wave retarder (achromat)

Mueller matrix of Al mirror

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