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A Compact and Robust Method for Spectropolarimetry

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A compact and robust method for spectropolarimetry is described which lends itself, in principle, to application in the field and in space. With space-based spectropolarimetry in the Solar System, exploration and characterization opportunities are greatly enhanced. Spectropolarimetry offers diagnostics for dust (cometary, zodiacal, rings), surfaces (rocky, regolith, icy), aerosols (clouds, dust storms) and high energy plasma emission processes. Beyond the Solar System, space-based telescopic spectropolarimetry has important contributions to make in the search for extrasolar planets, their characterization and the presence of life. There are astrobiological applications for full Stokes polarimetry stemming from the chiral interaction of light with living organisms. The instrumental approach requires no moving parts and encodes the polarimetric information onto a single data frame, hence it is immune to time dependencies, free of fragile modulating components, has the potential for high sensitivity and offers a wide wavelength range with full Stokes spectropolarimetry. We are laying the groundwork for understanding the design and usefulness of space-based exoplanet spectropolarimetry through development of a Moon-based Earth observing instrument concept CLOVE (Camera for Lunar Observations of the Variable Earth), within NASA's Lunar Science Institute. The polarimetric method could also be implemented in LOUPE (Lunar Observatory for Unresolved Polarimetry of Earth), which is being developed in the Netherlands. Both of these concepts aim to use the Earth as a benchmark for interpreting future observations of extrasolar Earth-like planets.