Circular spectropolarimetric sensing of homochirality a unique and unambiguous biosignature

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Homochirality is a unique property of all life and is detectable through circular spectropolarimetry.
The observed signals have a distinctive spectral profile which are readily distinguishable from abiotic matter

►These signals additionally contain valuable physiological information.

TreePol



 Rapid modulation by Ferro-electric Liquid Crystals
Simultaneous recording of orthogonal polarization states in beam exchange through combination with dual fast line-detectors

► Crosstalk mitigation through 90 degrees rotatable outer cage and fast spinning half waveplate in front of the instrument

Observations in the field

Decaying leaves



Intact leaves show a strong decrease in signal over time
Faster decrease in polarization than decrease in chlorophyll a concentrations: breakdown of the supramolecular structure

► Allows to distinguish between healthy and stressed vegetation

Spatial polarizing features





► Vegation biosignatures are readily distinguishable from abiotic matter

Interspecific differences







The induced polarization by vegetation is the superposition of a negative and a positive band resulting from different chiral domains
The polarization by chloroplasts is spatially anisotropic
In leaf veins, there is a preferred orientation resulting in

a negative signal only rather than the typical split signal

Different species express a different complexity in their chloroplast supramolecular assembly, leading to distinguishable signals of different strength
These more delicate signals allows better insight into the structural composition and transformation

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