

Drone polariscopy - towards remote sensing applications

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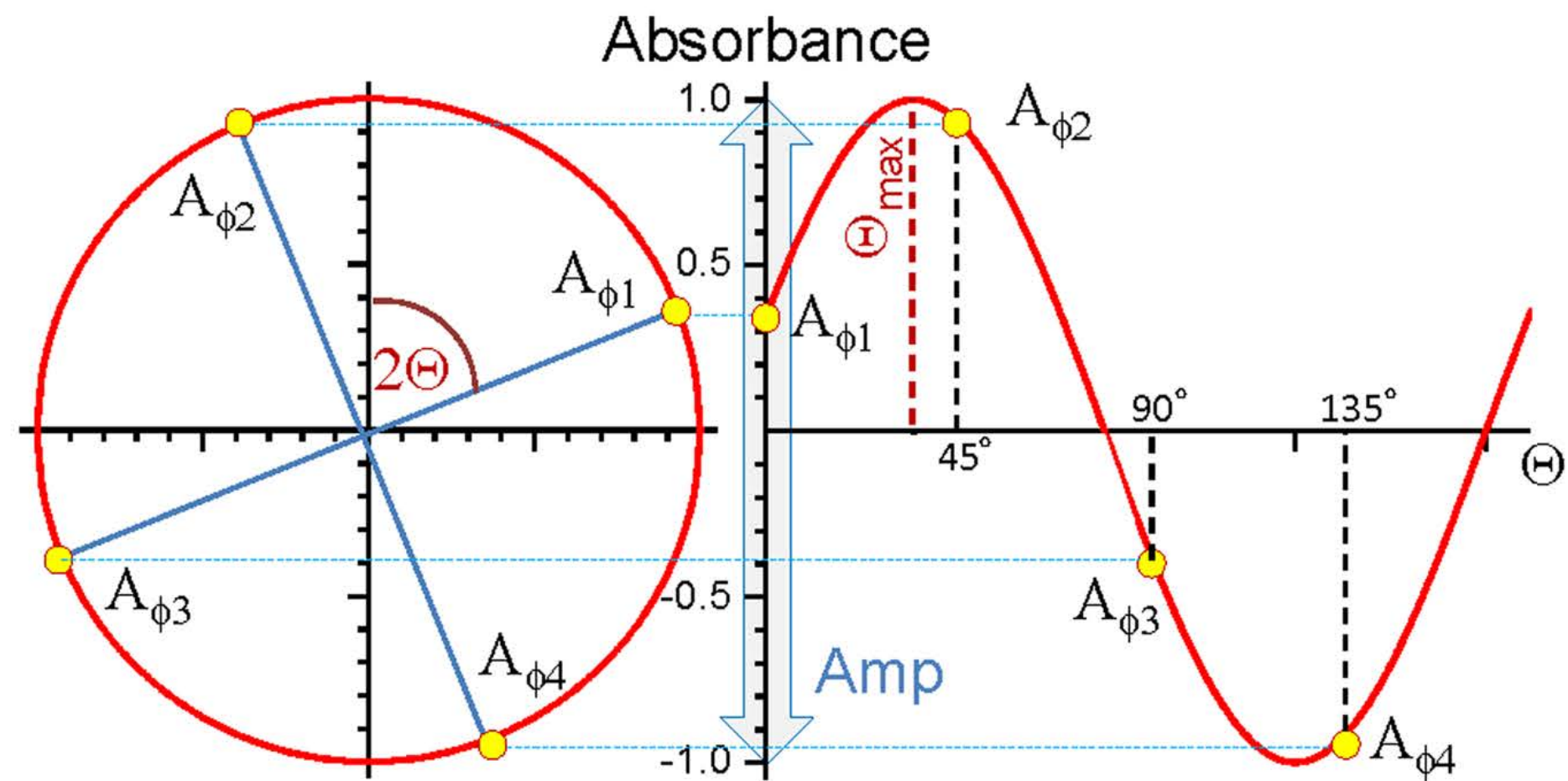
ASEC 2021 15-31 October 2021

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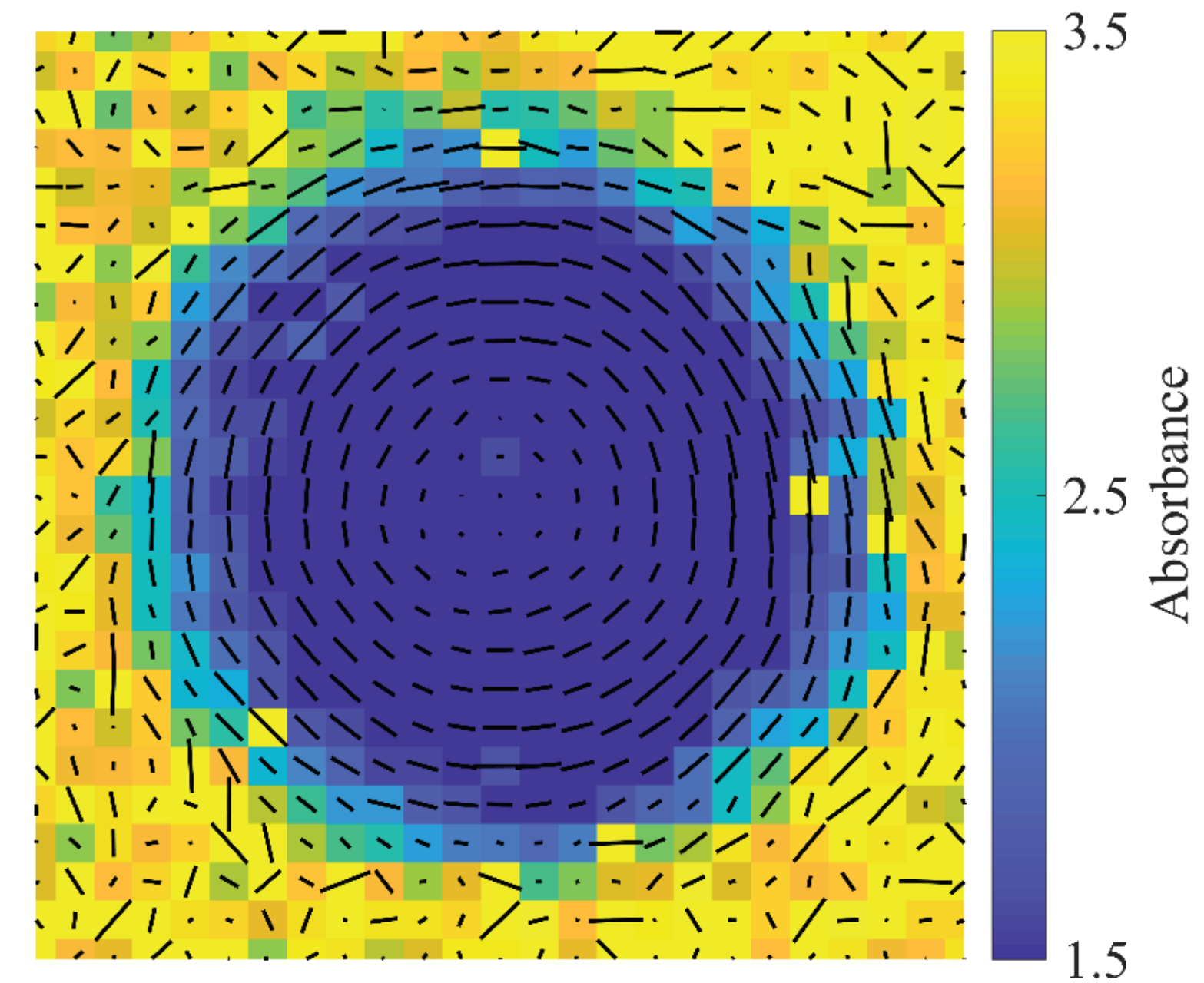
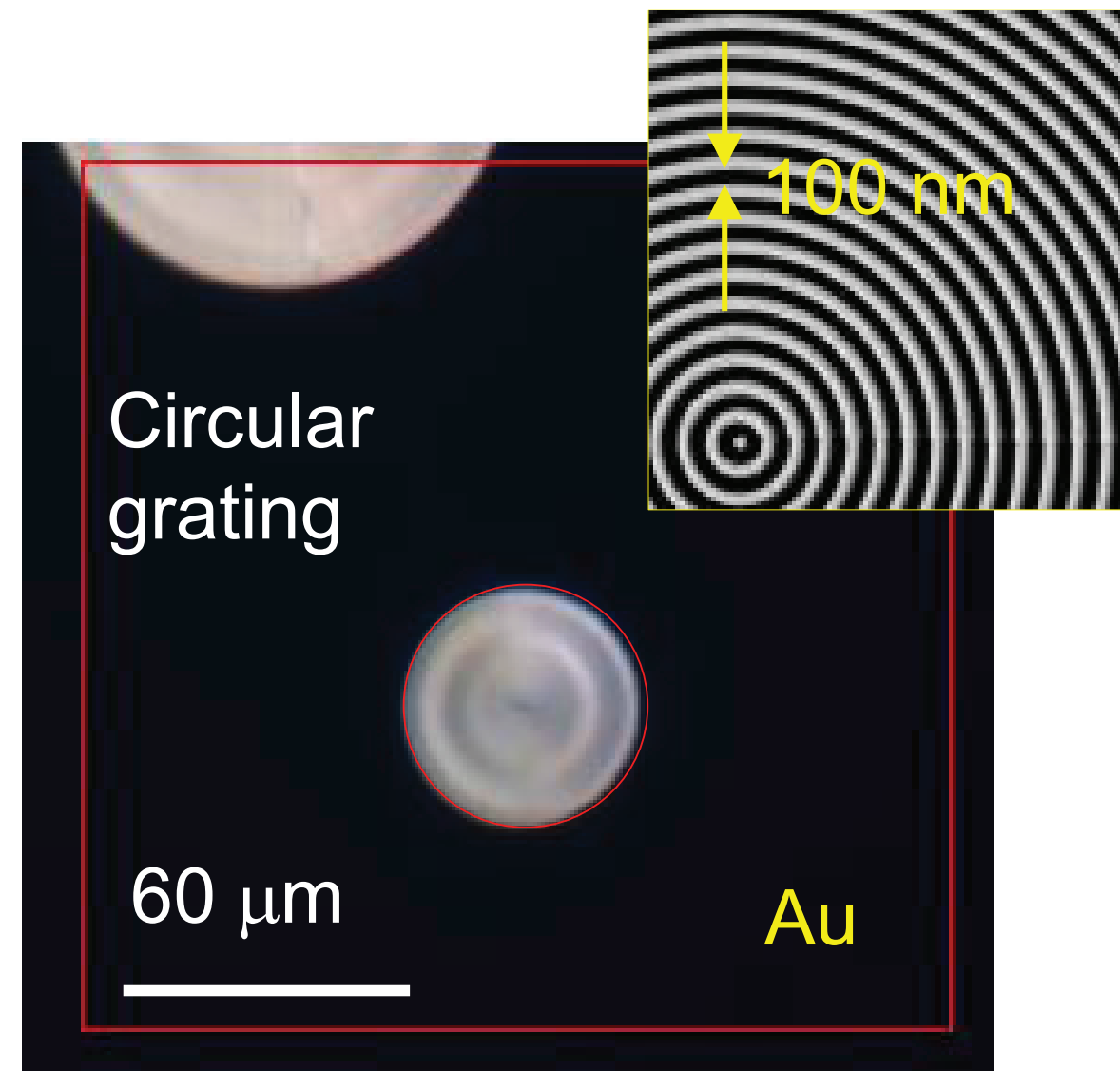
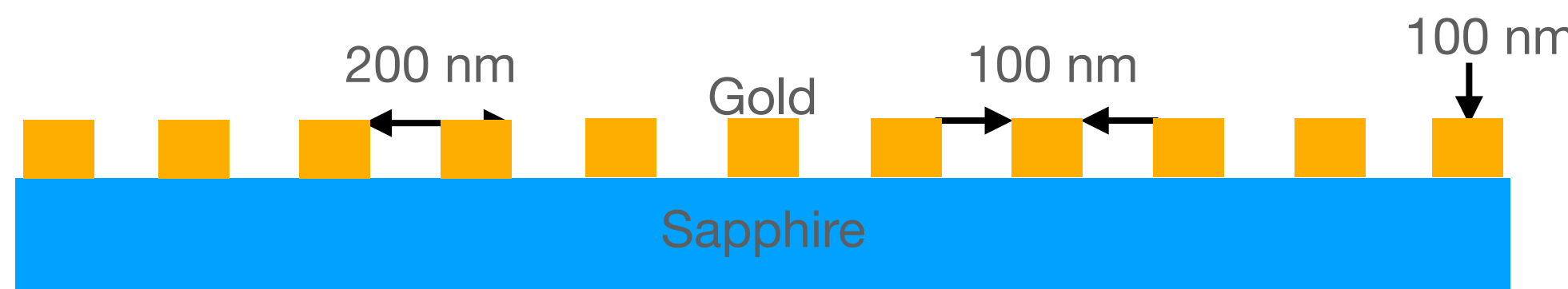
Four-polarisation method

Fourier transform infrared microscope
Wavenumber 3000 cm⁻¹ (3.3 μm)



$$Amp = \sqrt{(A_{\phi 1} - A_{\phi 3})^2 + (A_{\phi 2} - A_{\phi 4})^2}$$

$$\theta = \frac{1}{2} \tan^{-1} \left(\frac{A_{\phi 2} - A_{\phi 4}}{A_{\phi 1} - A_{\phi 3}} \right)$$



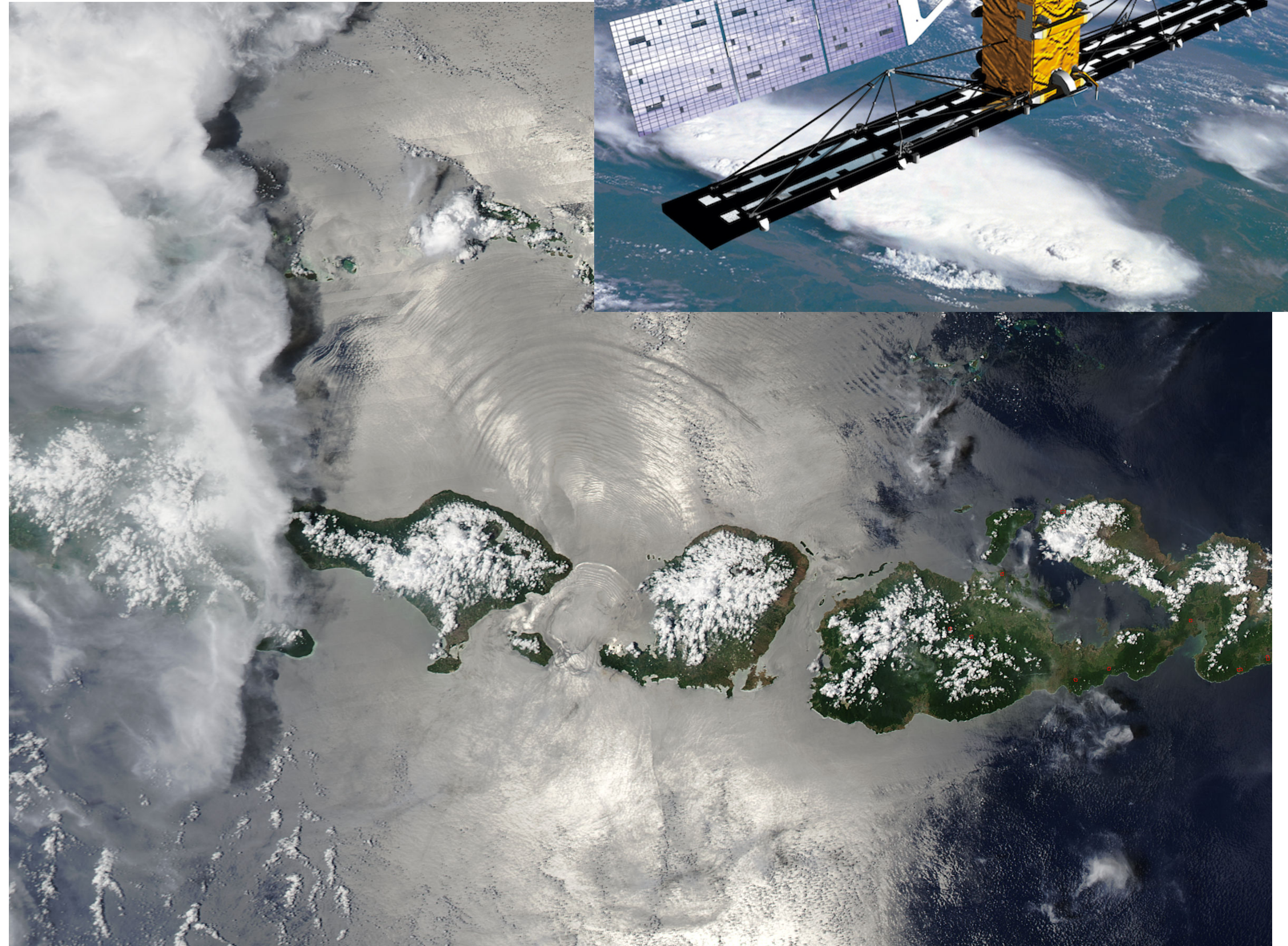
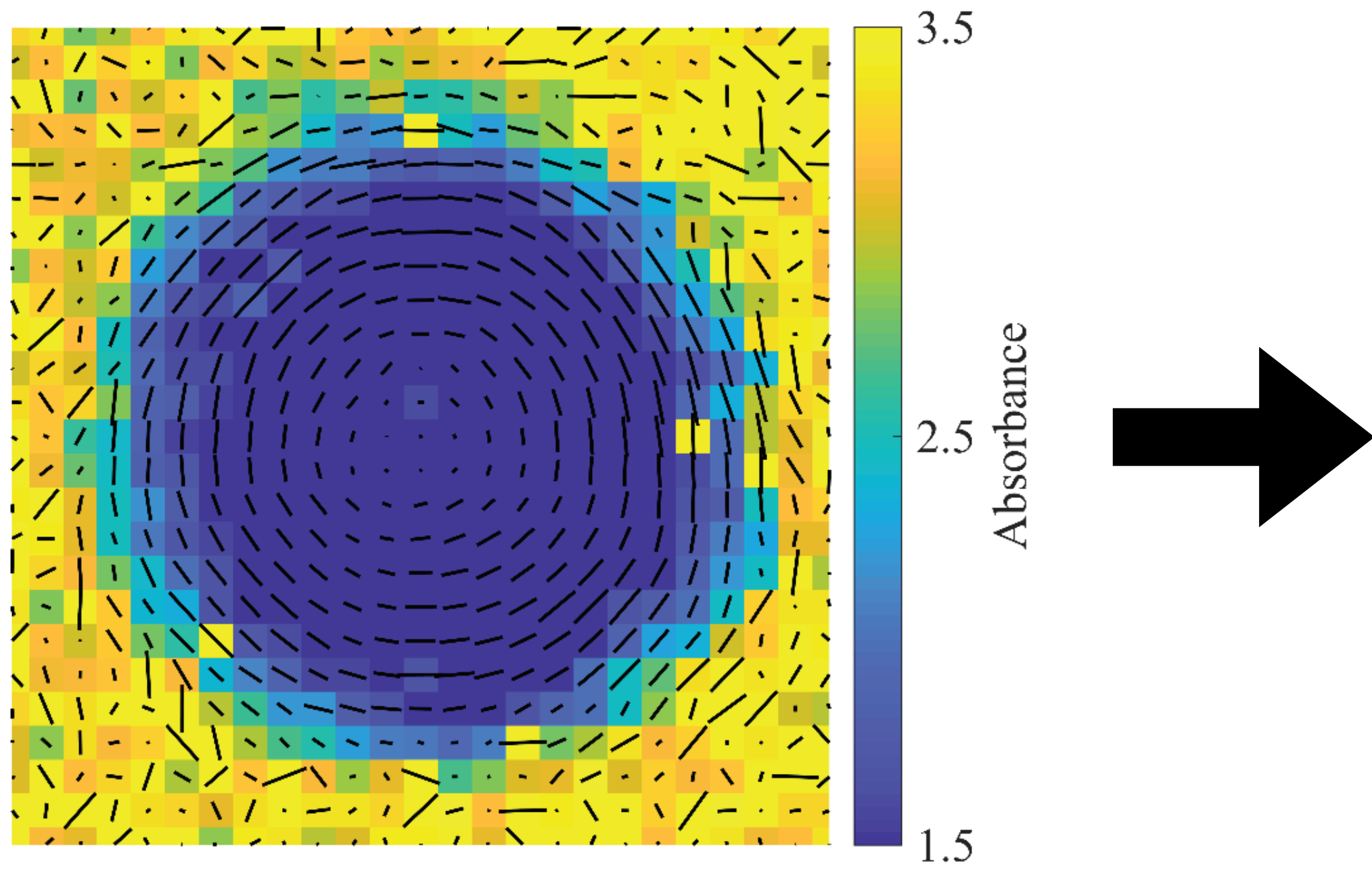
$$\frac{0.61\lambda}{NA}$$

$$NA = 0.4 \quad R \sim 5 \mu m$$

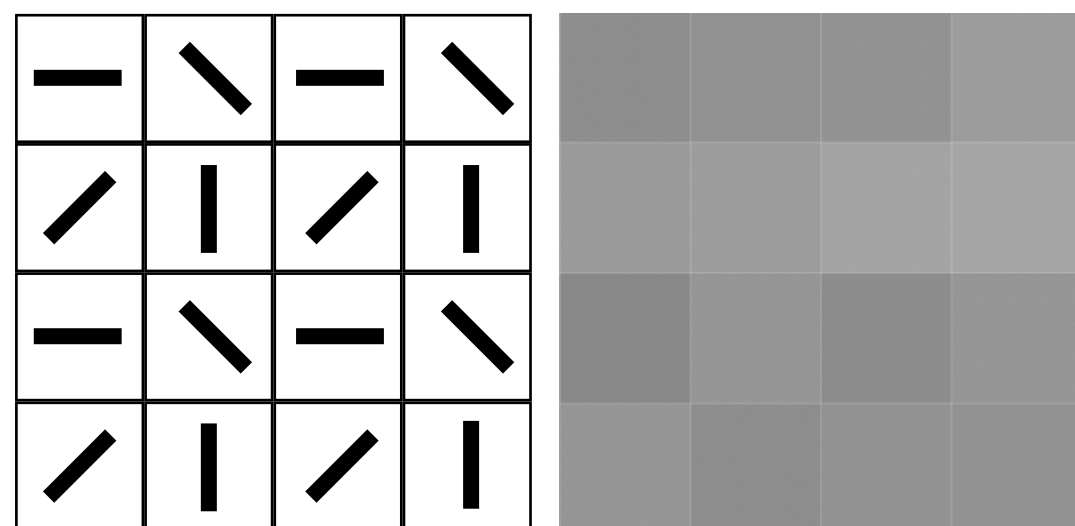
$$100 \text{ nm} \rightarrow 5 \mu m \rightarrow 50x$$

Remote Sensing

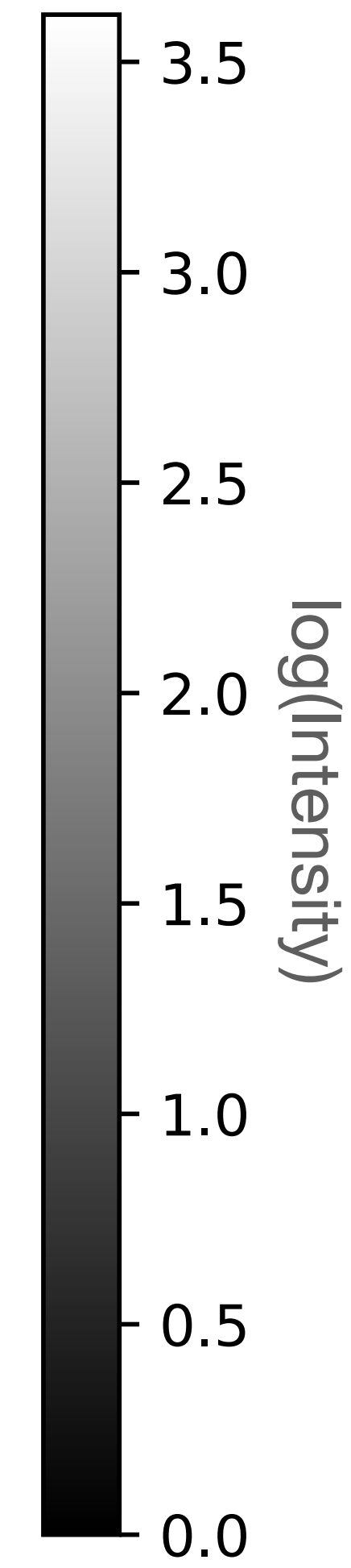
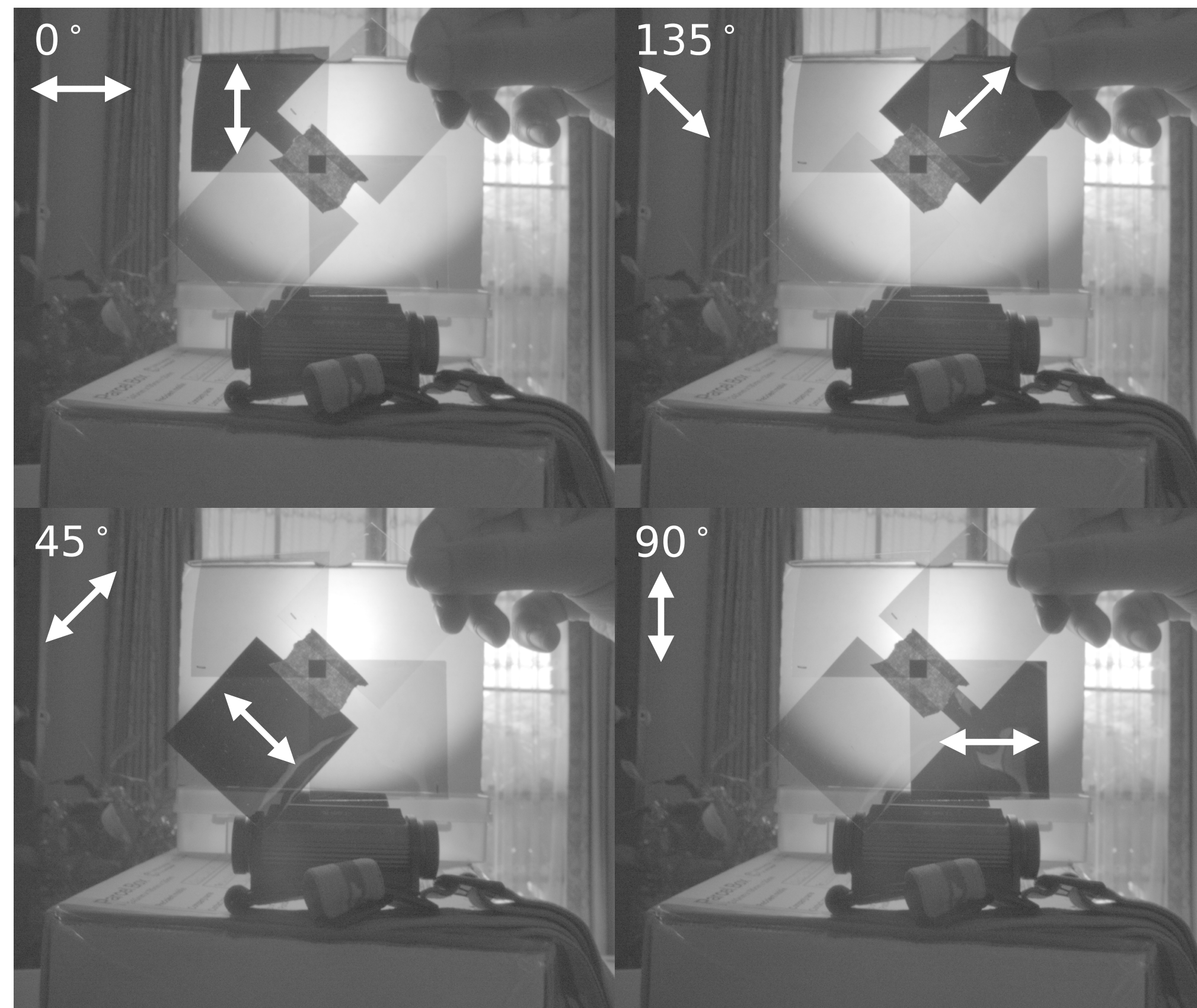
And four polarisation



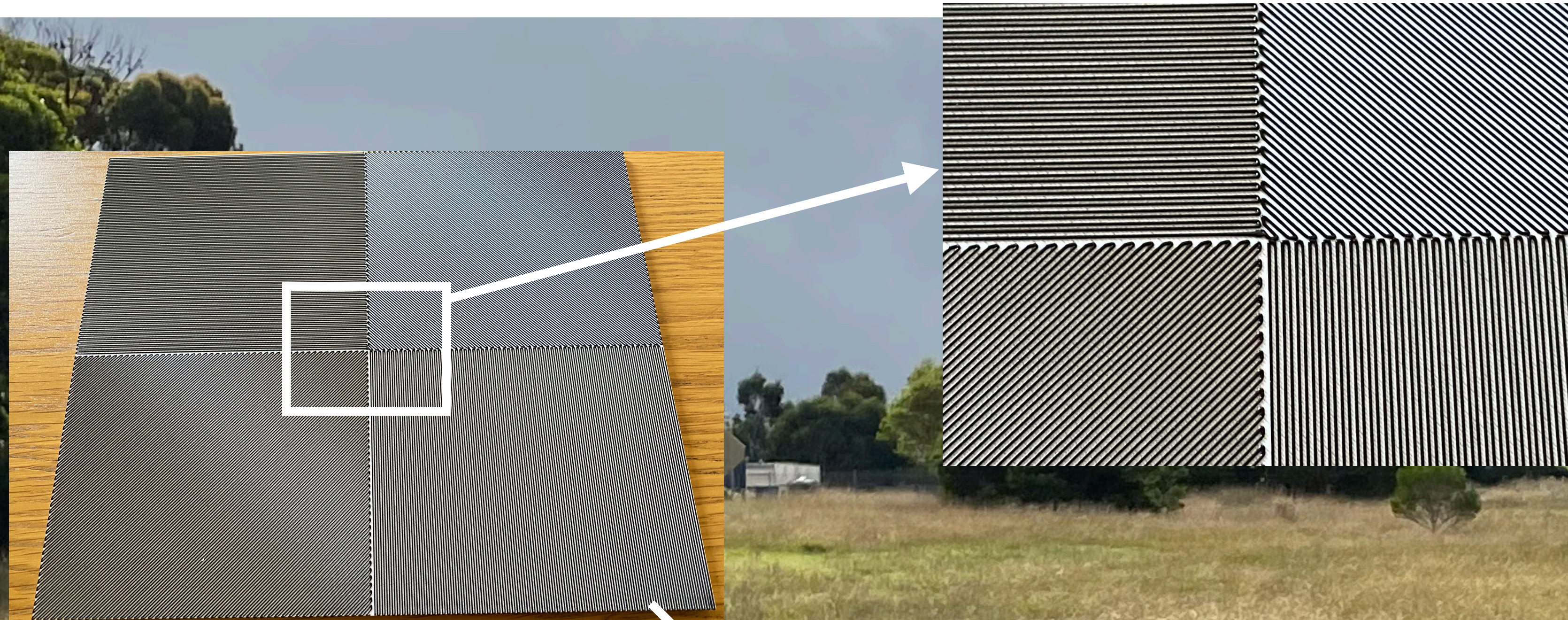
Four polarisation camera



2048x2448 px sensor
1024x1224 px per image



Drone flight

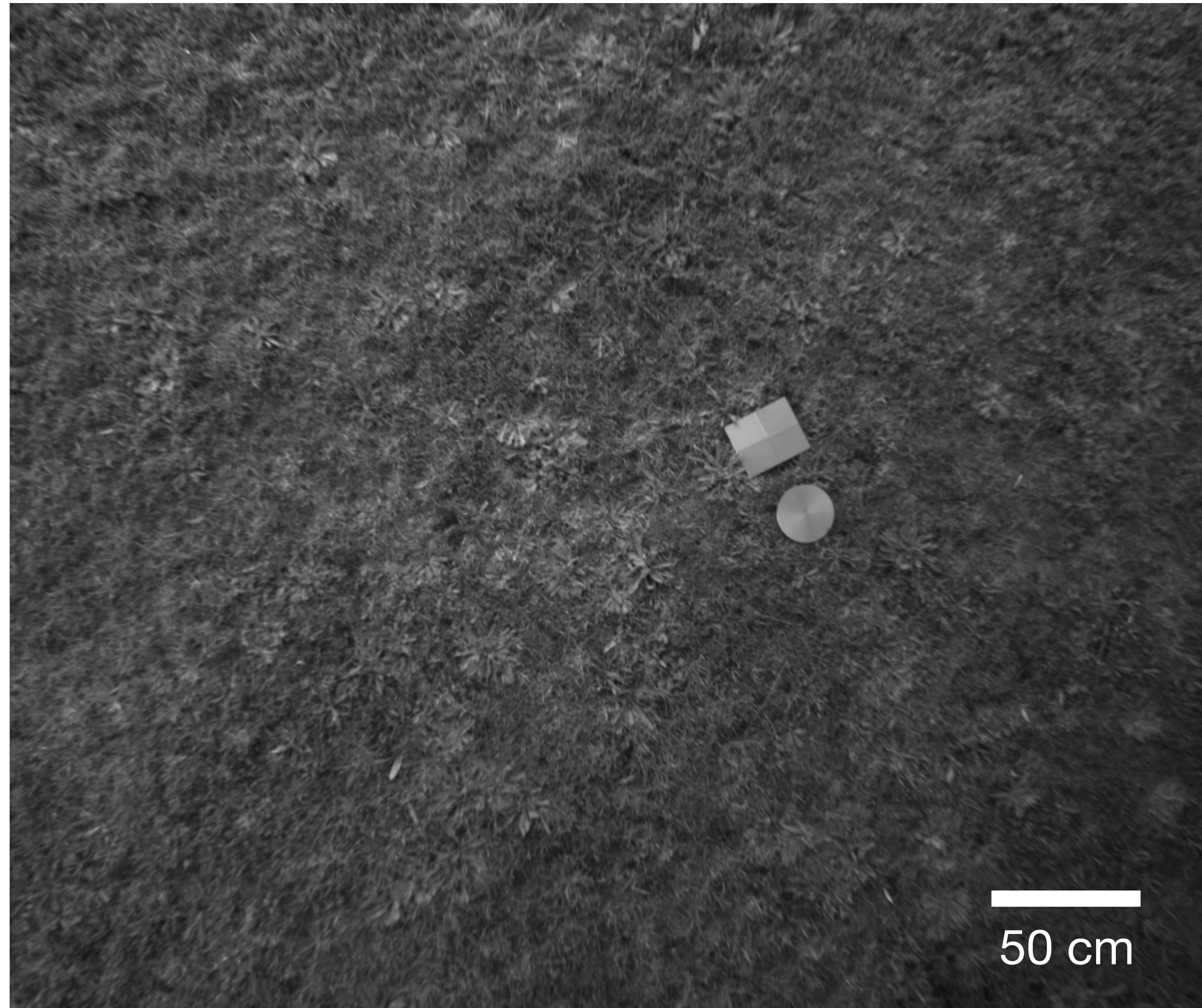


3D printed target

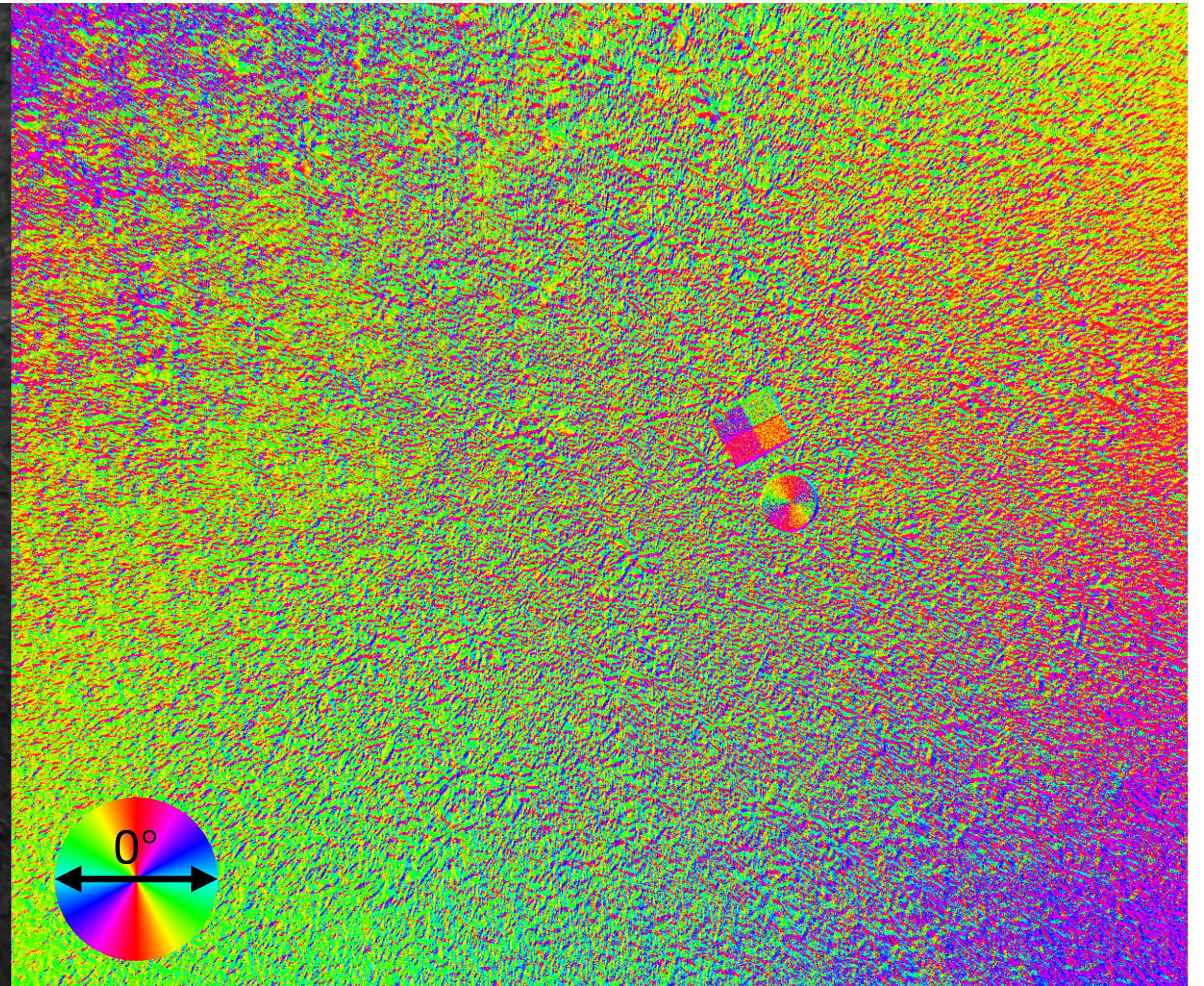
Polarisation camera module



Results



Intensity image

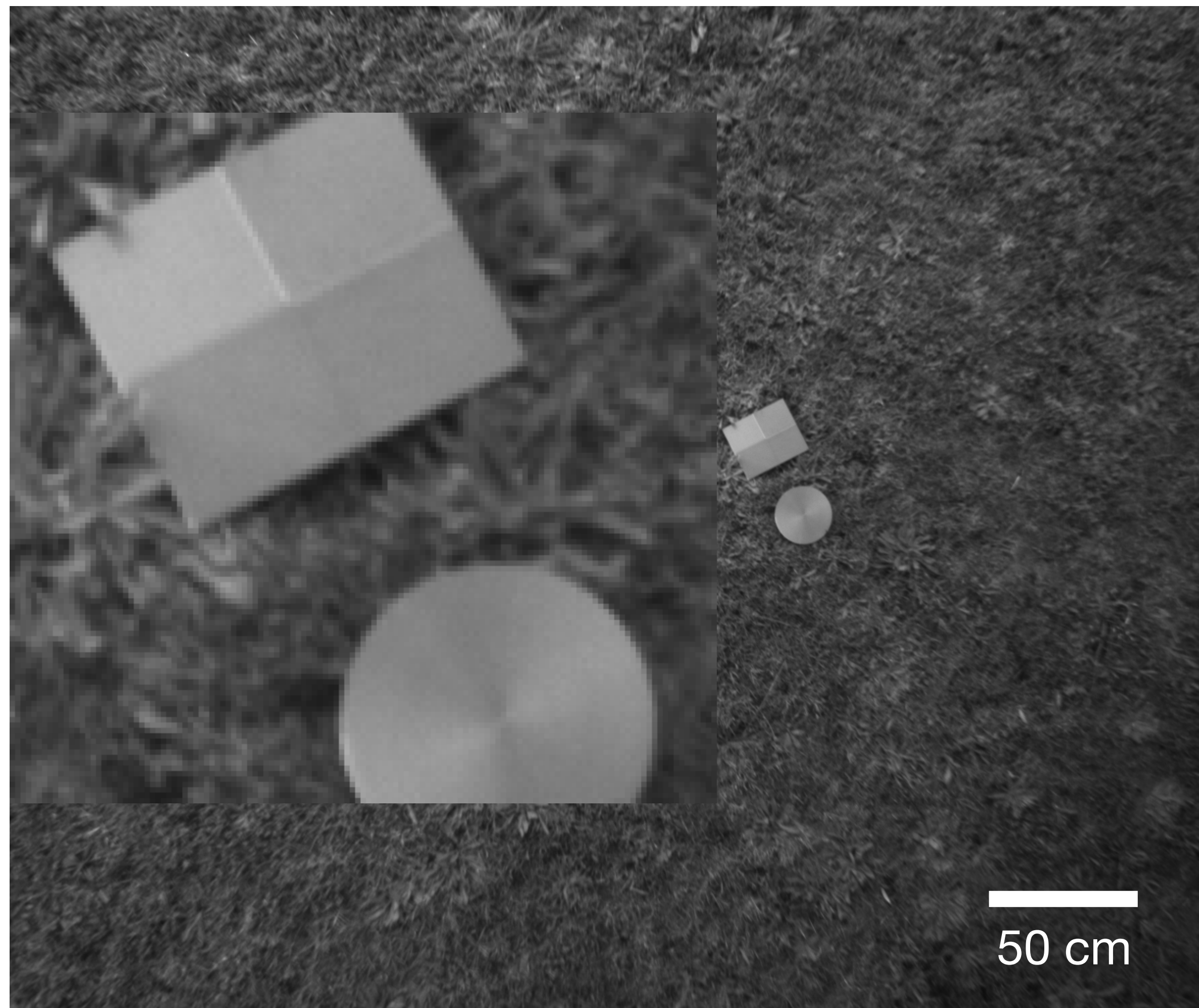


Azimuth image

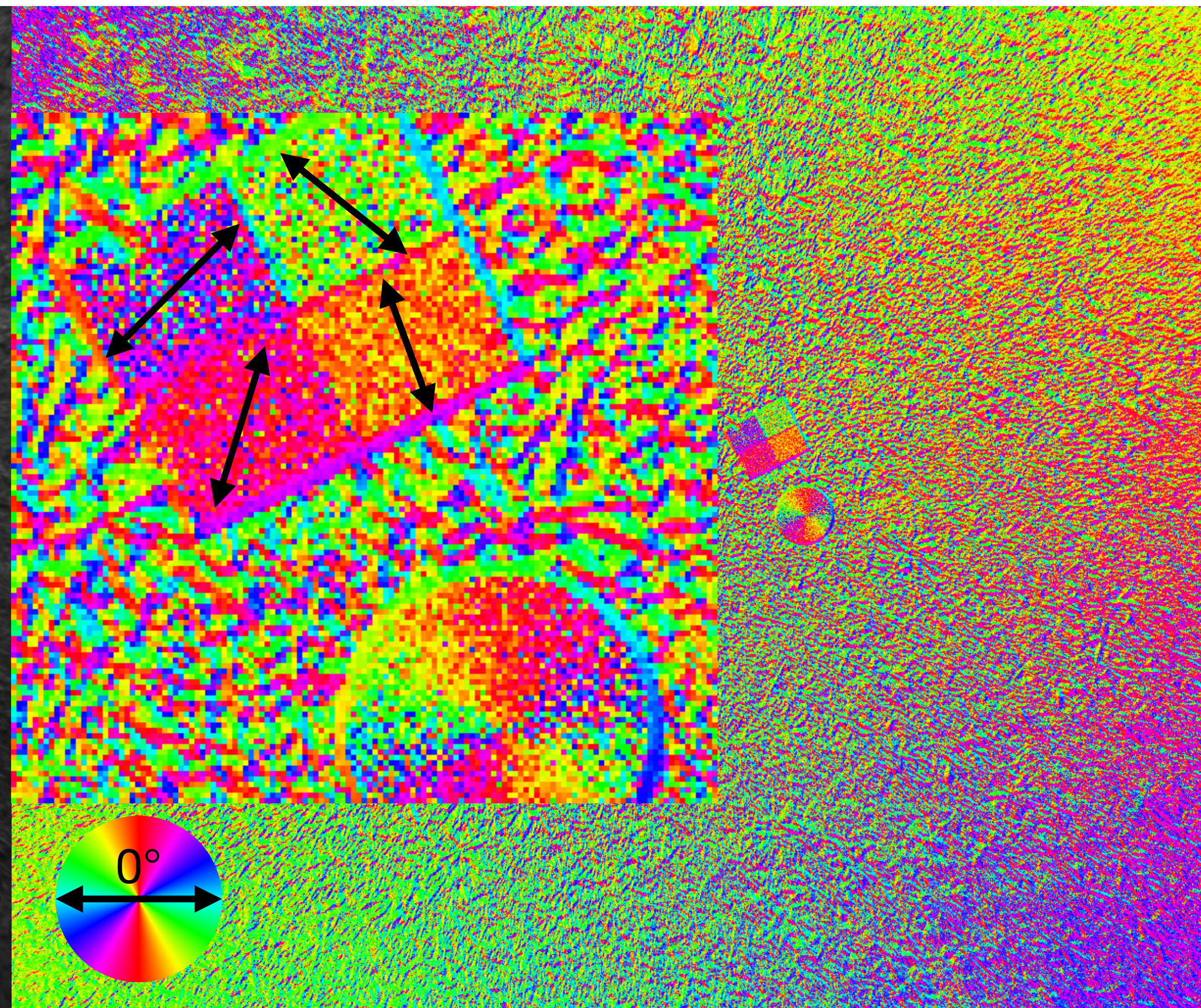
Results

$$I = \frac{I_{0^\circ} + I_{45^\circ} + I_{90^\circ} + I_{135^\circ}}{2}$$

$$\psi = \frac{1}{2} \arctan2 \left(\frac{I_{45^\circ} - I_{135^\circ}}{I_{0^\circ} - I_{90^\circ}} \right)$$

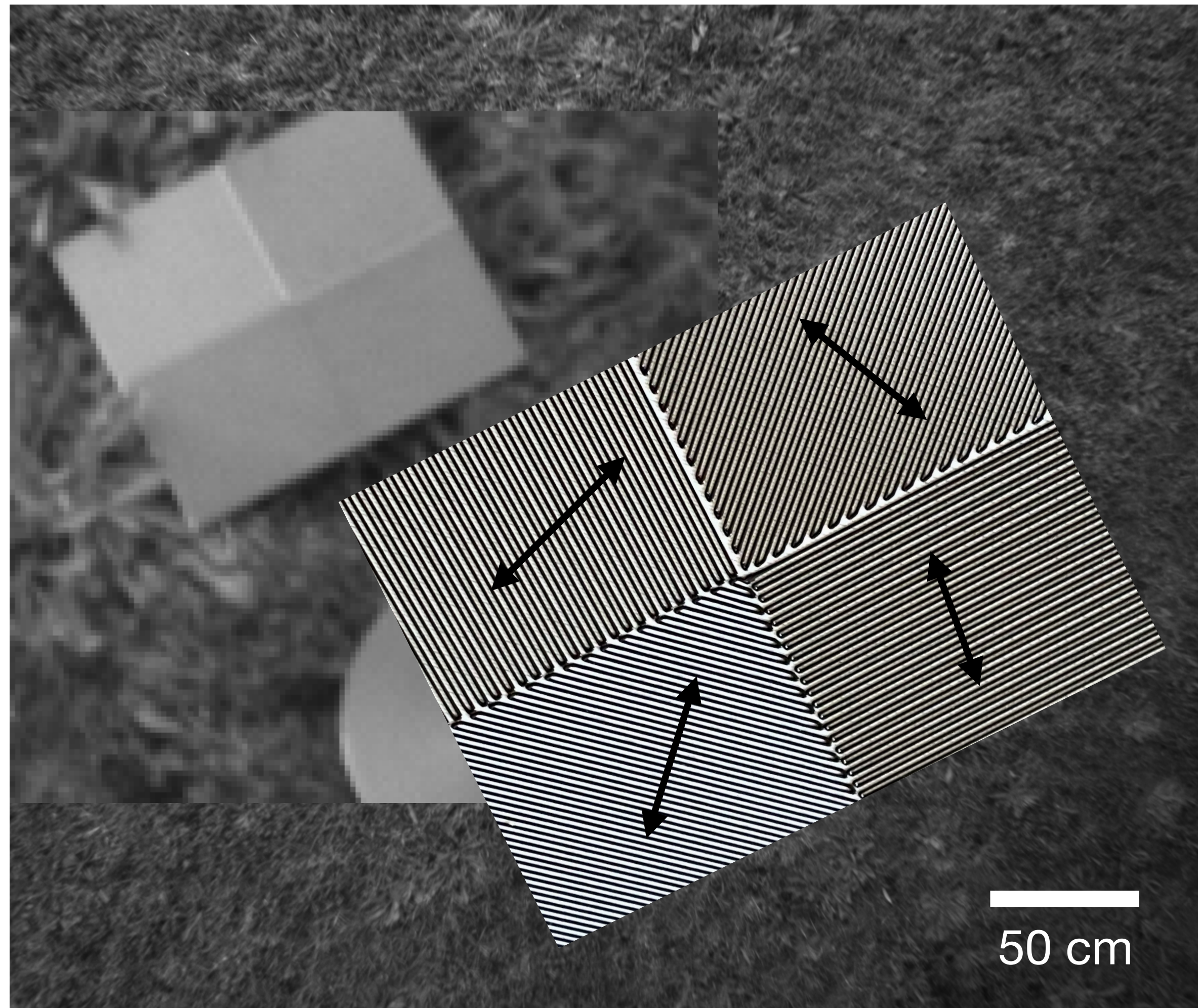


Intensity image

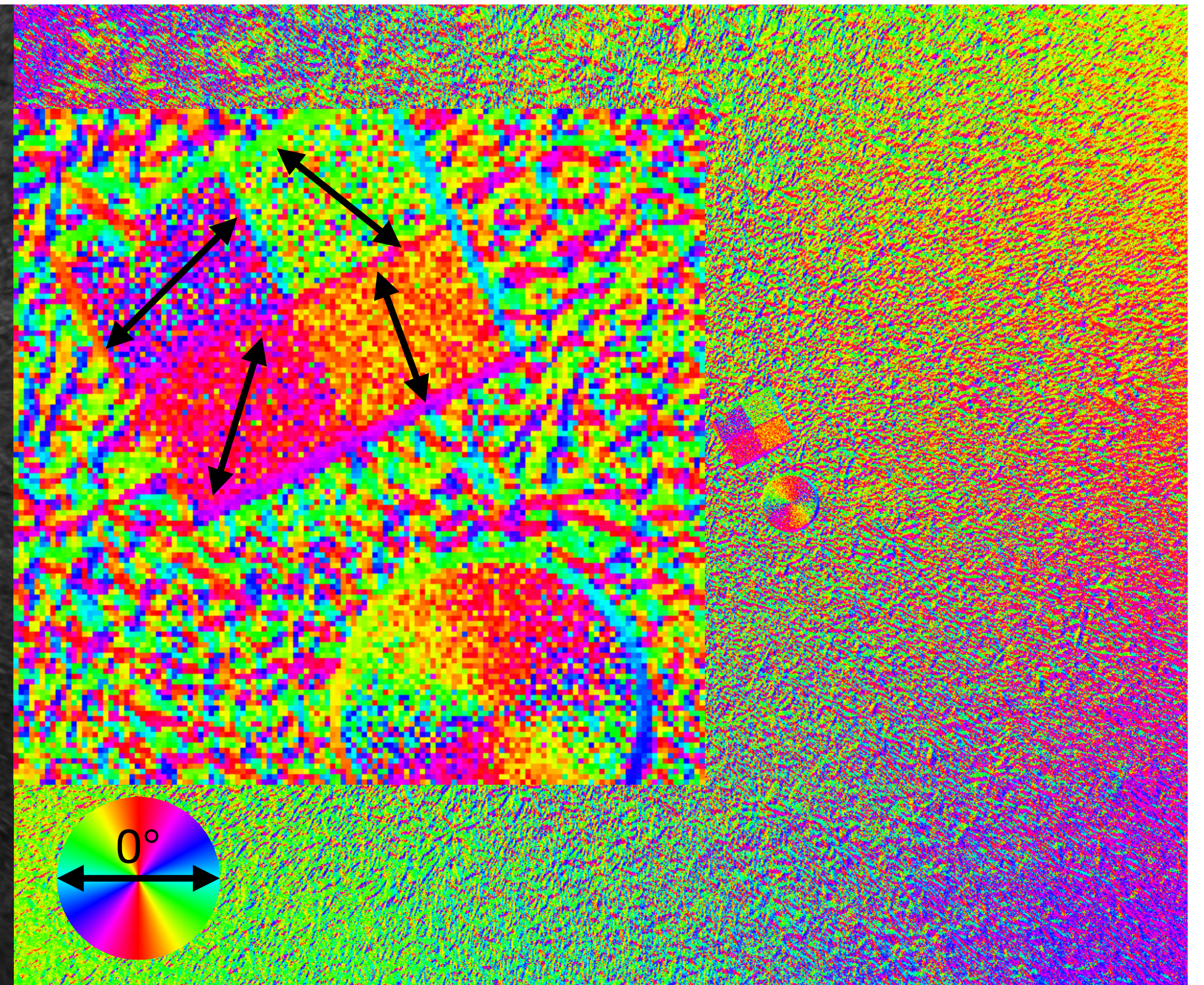


Azimuth image

Results

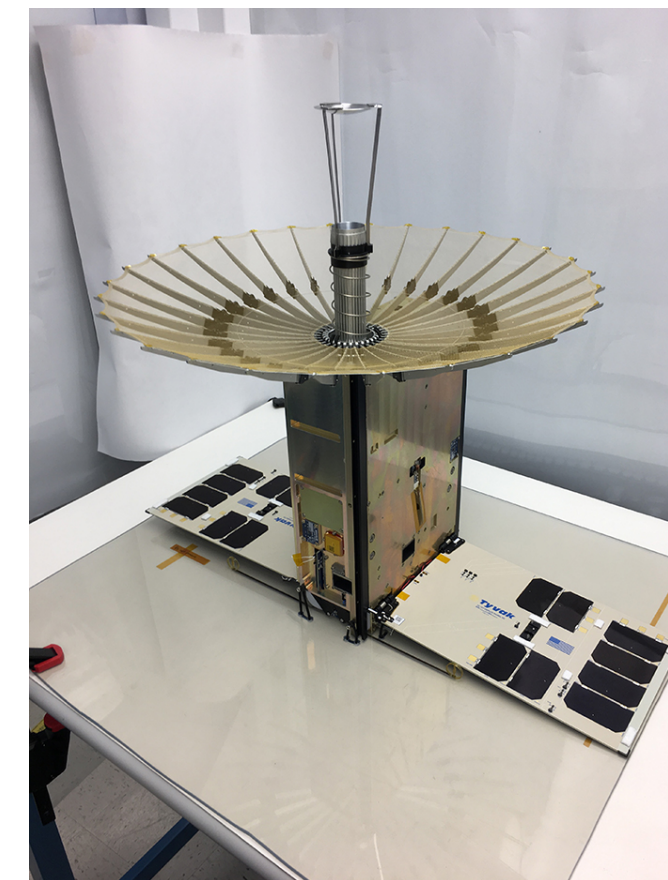
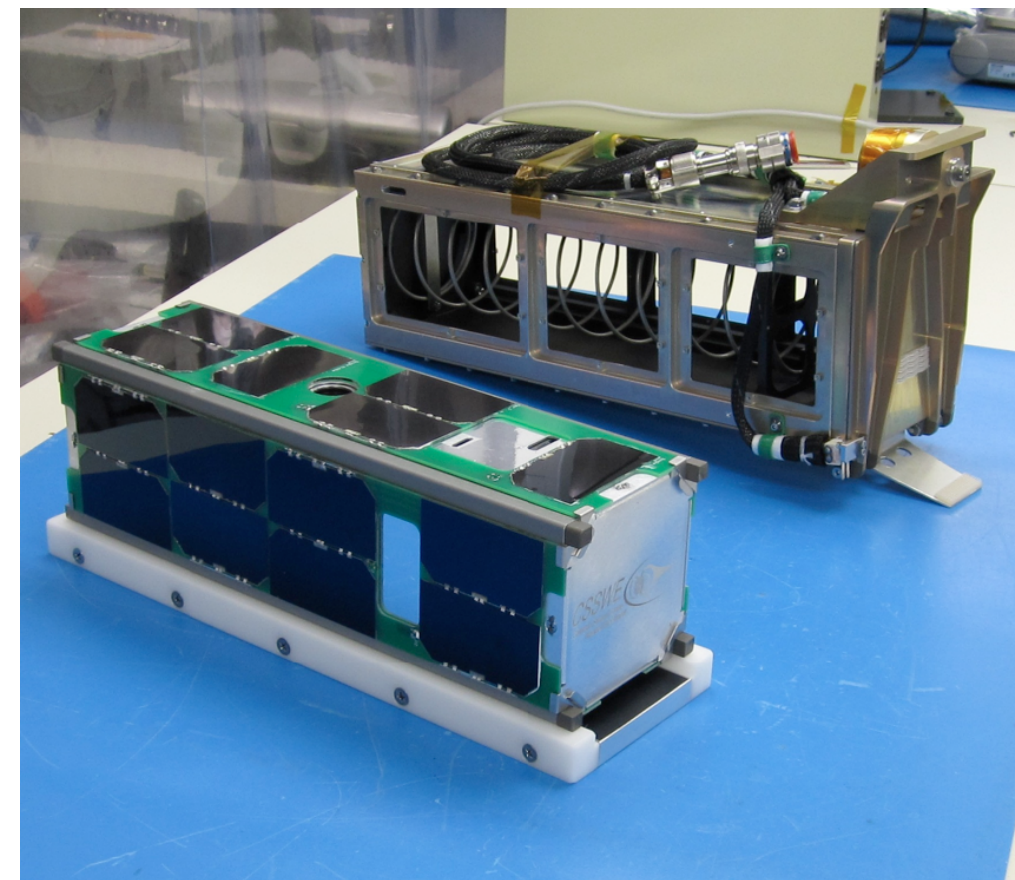


Intensity image



Azimuth image

Future Roadmap



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