

Polarimetric Calibration of Large-Aperture Telescopes

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1. Calibration procedure

1. Place small calibration optics of radius r_0 at entrance aperture.
2. Slide mask with clear aperture of radius r_0 at any position in a collimated beam. Only “polarized” light passes through.
3. Calibration Stokes vectors are measured:

$$\vec{S}_{cal}^{out} = (\mathbf{xt})\vec{S}_{cal}^{in} . \quad (1)$$

4. From (known) inputs \vec{S}_{cal}^{in} and (measured) outputs \vec{S}_{cal}^{out} , determine (\mathbf{xt}) .
5. Remove calibration optics, *but leave mask in*.
6. Observe solar source of polarization (e.g., a sunspot) through mini-aperture r_0 :

$$\vec{S}_{solar}^{out} = (\mathbf{xt})\vec{S}_{solar}^{in} . \quad (2)$$

7. Calibrate solar data with (\mathbf{xt}) determined above:

$$\vec{S}_{solar}^{in} = (\mathbf{xt})^{-1}\vec{S}_{solar}^{out} . \quad (3)$$

8. Remove mask and repeat same observation using full aperture:

$$\vec{S}_{full}^{out} = (\mathbf{XT})\vec{S}_{full}^{in} . \quad (4)$$

9. Note that $S_{full}^{in} = S_{solar}^{in}$. Use previously calibrated solar data to obtain full (\mathbf{XT}) .

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