



# Optical Instruments for Solar Eclipse Measurements

## Spectro – Polarimeter

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# Optical Instrument Projects

- Spectro – Polarimeter: Jon
- Aurora Detector: Kendra
- Solar Radiometer: Logan



# Spectro – Polarimeter

- Spectro: range of wavelengths
- Polarimeter: measures the polarization of light
- Hence, measuring polarization as a function of wavelengths

# Polarization of Skylight

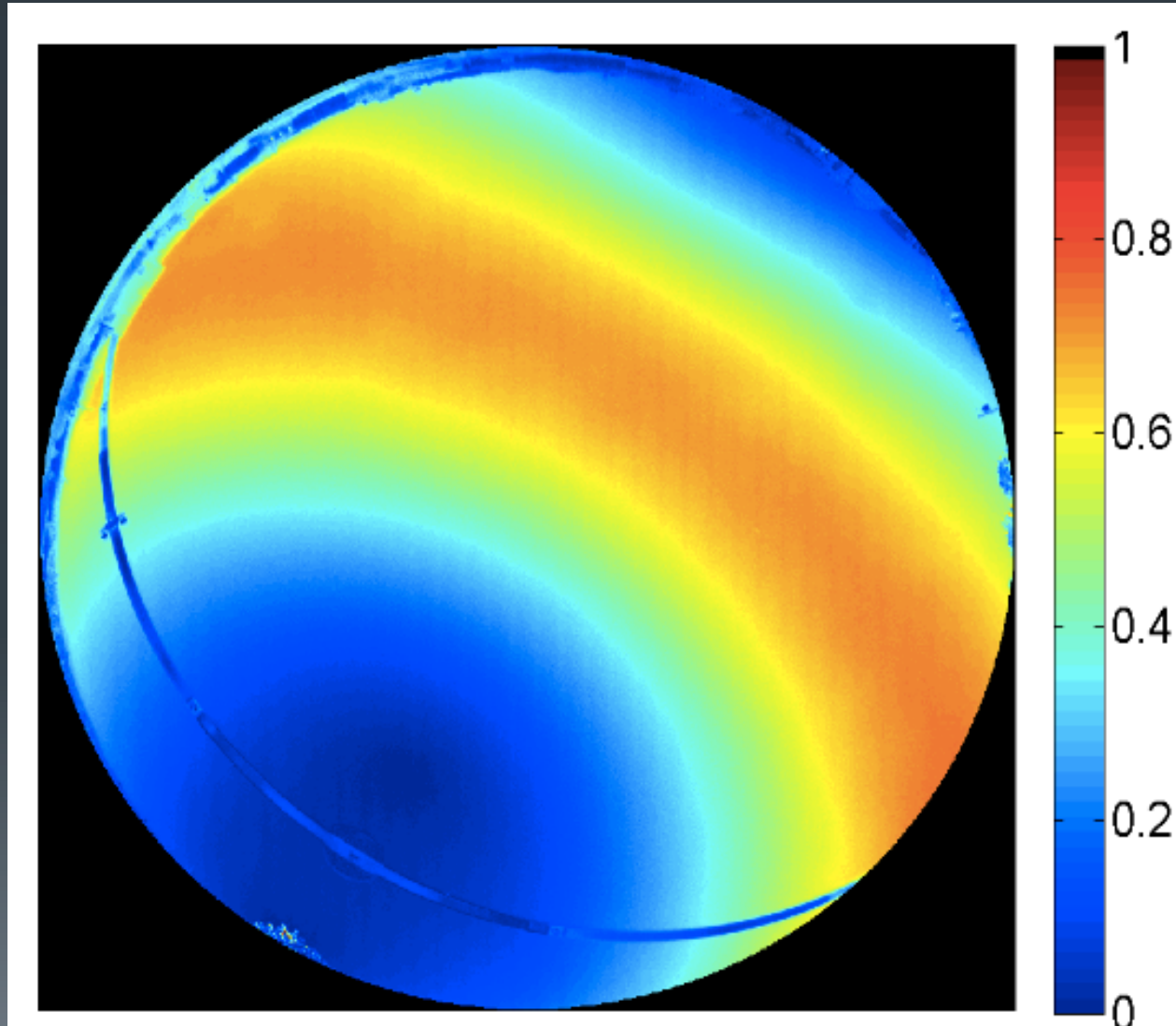


Image by Dr. Joseph Shaw

# Stokes Vector & Parameters

The Stokes vector has 4 Stokes parameters

$$\mathcal{S} = \begin{bmatrix} s_0 \\ s_1 \\ s_2 \\ s_3 \end{bmatrix} = \begin{bmatrix} I \\ Q \\ U \\ V \end{bmatrix}$$

- Total Irradiance
- Vertical or horizontal component
- 45° or 135° component
- Circular component

# Spectro – Polarimeter Goals

- Measure the Stokes vector
- Compare to atmospheric parameters

$$\mathcal{S} = \begin{bmatrix} s_0 \\ s_1 \\ s_2 \\ s_3 \end{bmatrix} = \begin{bmatrix} I \\ Q \\ U \\ V \end{bmatrix}$$

# Spectro – Polarimeter Instrument

- ASD Spectroradiometer with range of 350-2500 nm
- Linear polarizer attached to a rotation stage
- Equatorial mount



# Spectro – Polarimeter Procedure

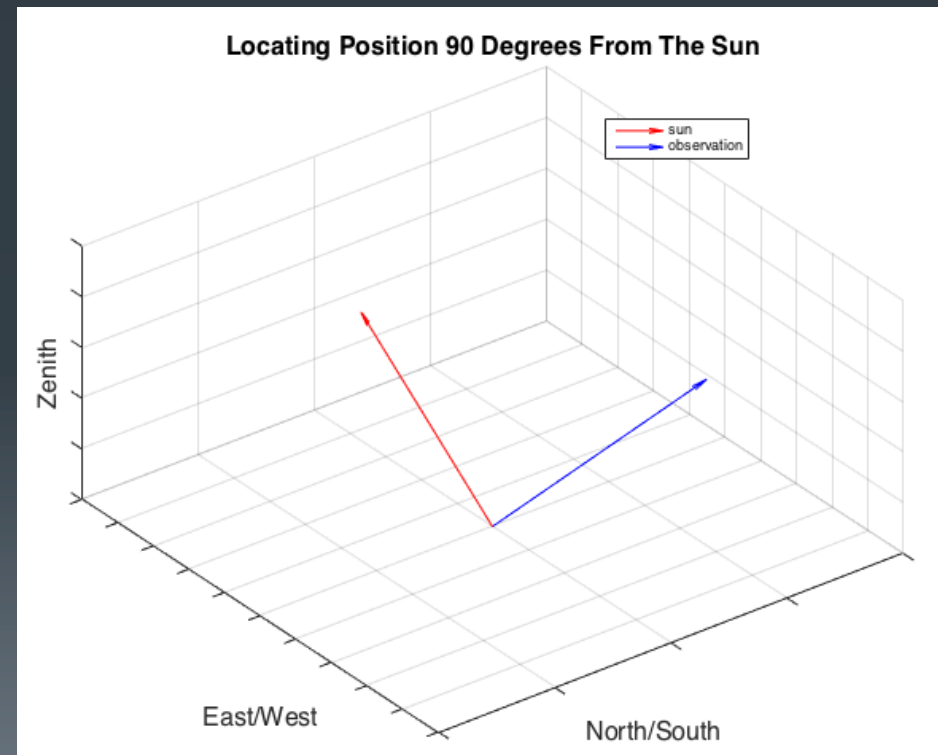
- Calibration of the mount
- Current azimuth and elevation of the sun
- Comparing solar Az/EI from calculator and mount
- Locating a position  $90^\circ$  away from the sun
- Take measurements for 2 minute intervals





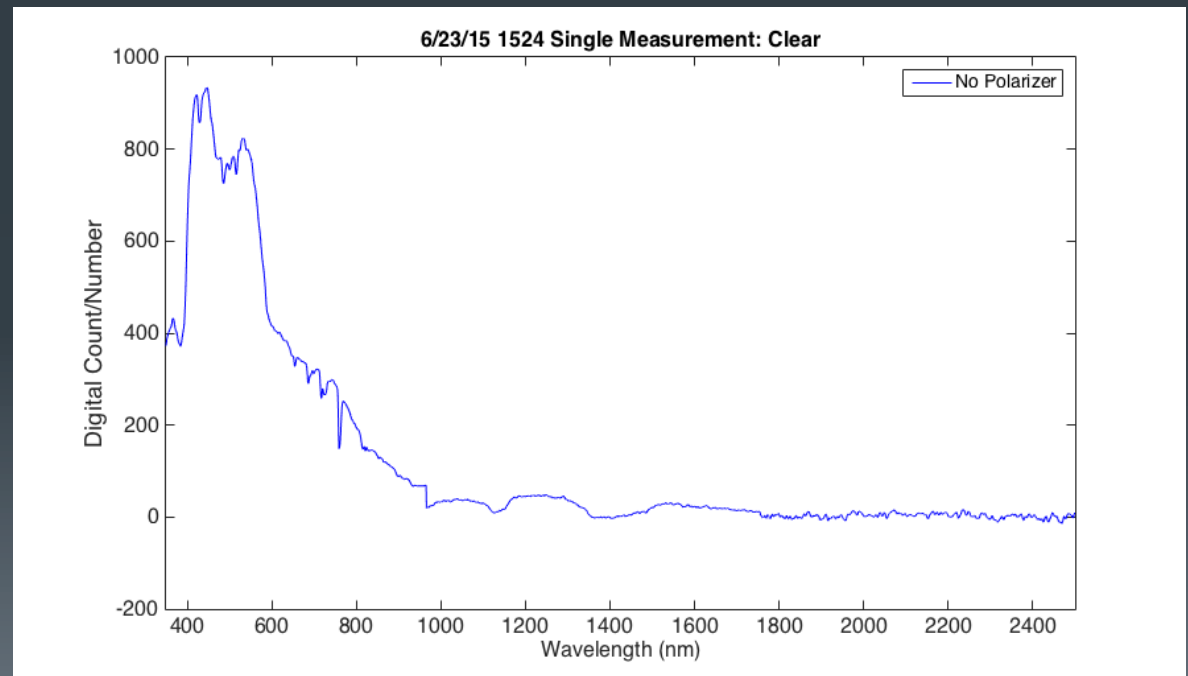
# Programming & Analysis

- Locating 90° from the sun:
- Example:
  - Sun's Location –  
Az: 234.06 and El: 58.66
  - Observation –  
Az: 10.0 and El: 23.63



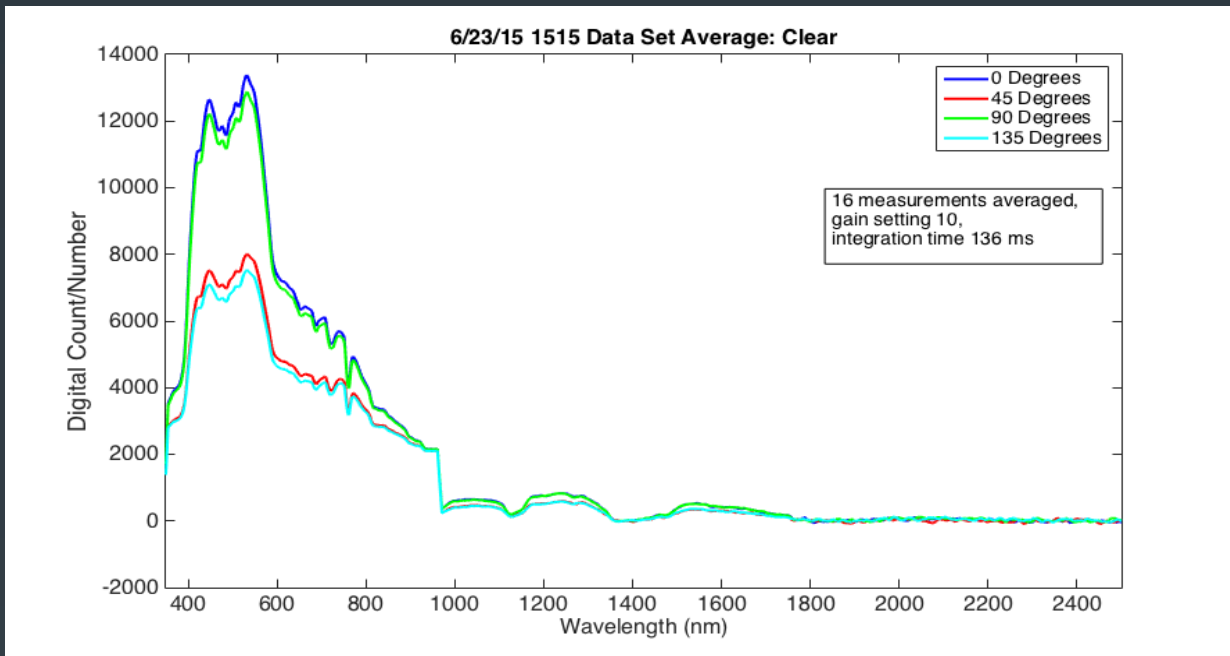
# Programming & Analysis

- Averaging multiple measurements
- Smoothing the data



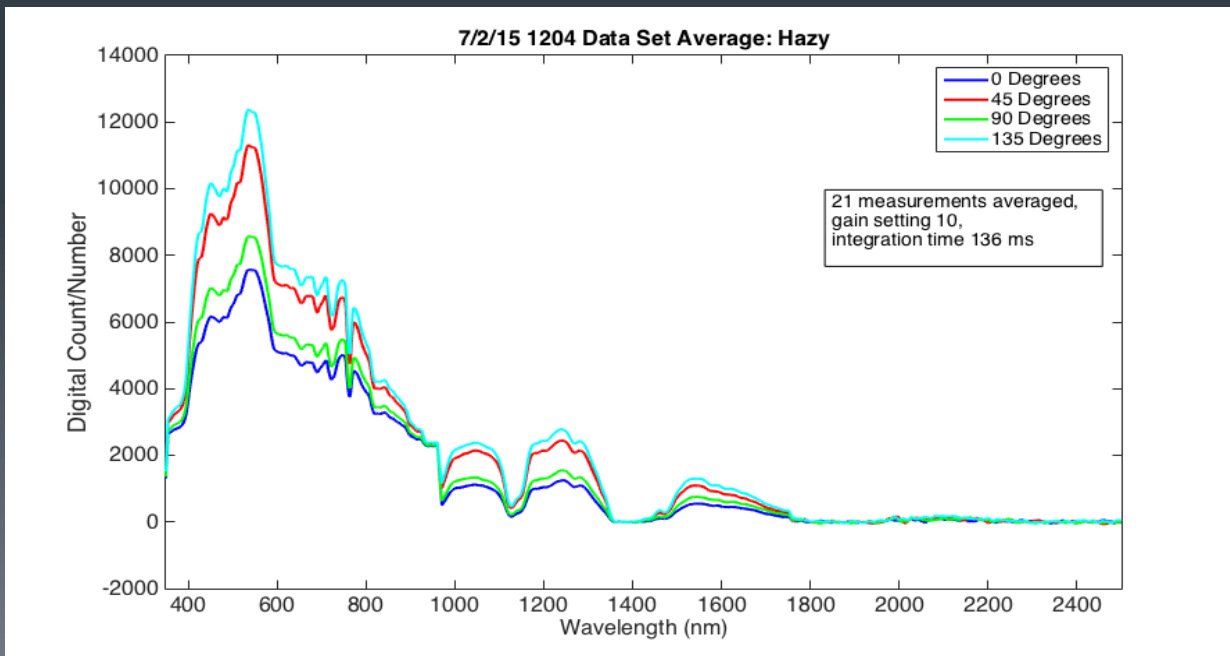
6/23/15

Clear



7/2/15

Hazy





# Current Challenges

- Measurements in SWIR1 and SWIR2
- Equatorial mount
- Computer to mount communication



# The Next Steps

- Solving the equatorial mount problem
- Comparison to aerosol data
- Calculations of Stokes vectors