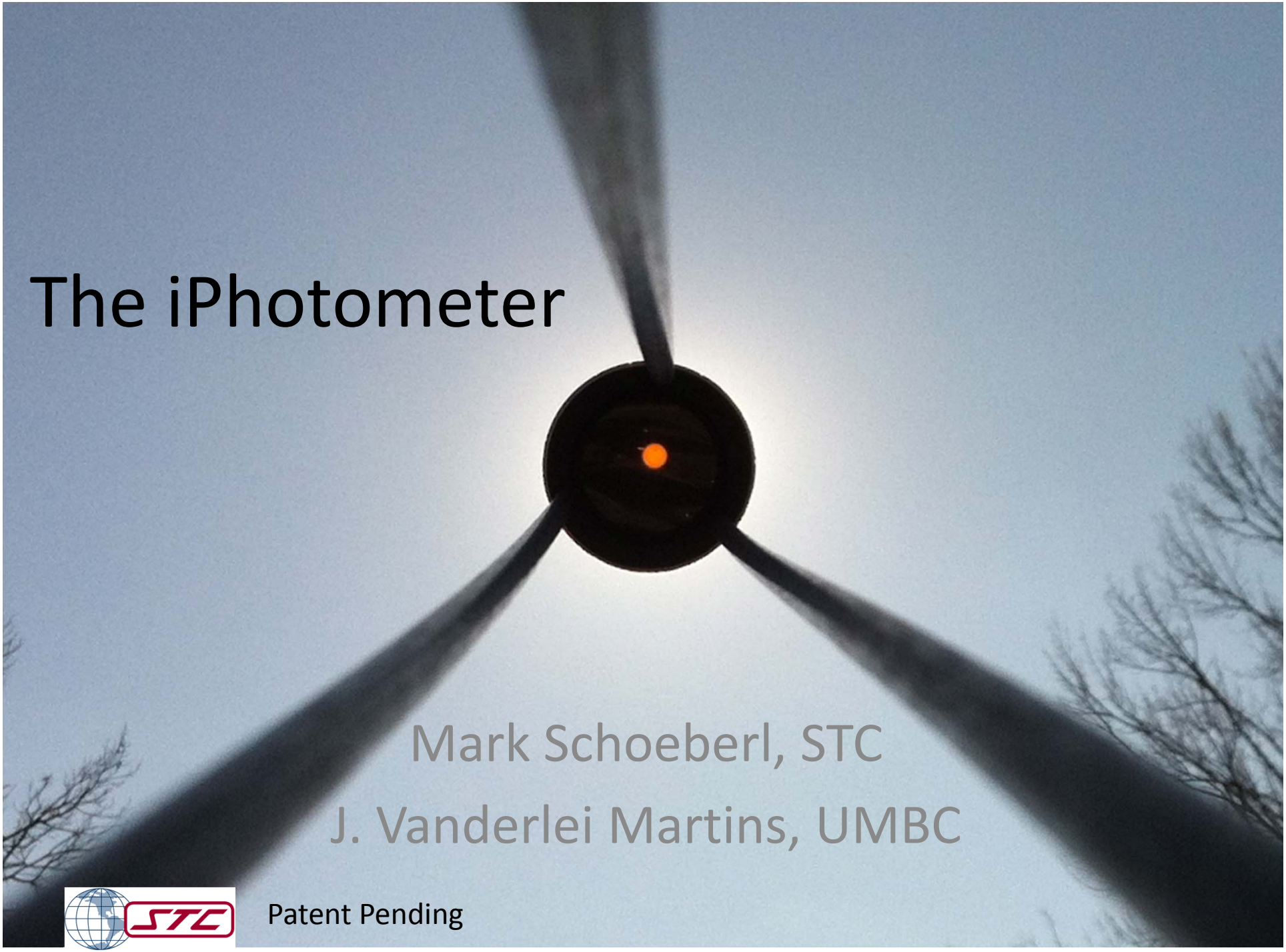

The iPhotometer

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Patent Pending

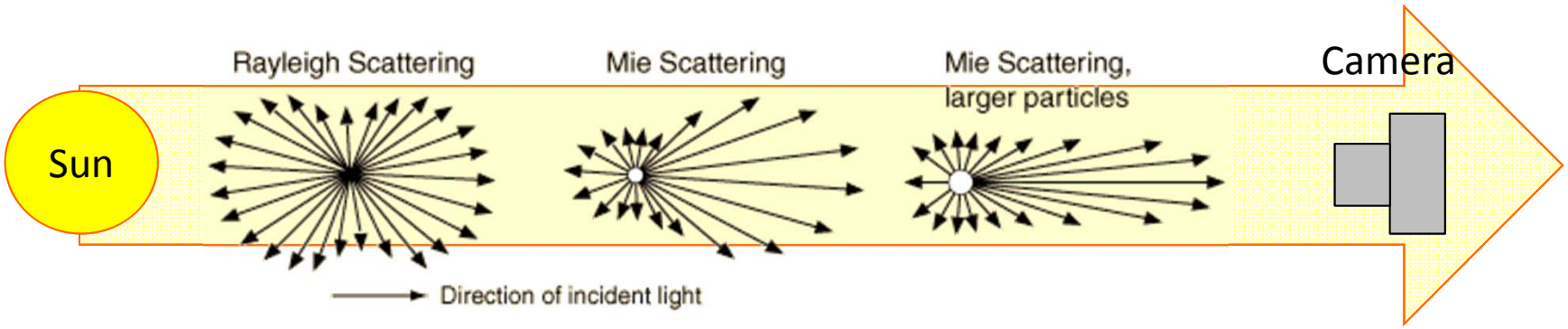
What is the iPhotometer?

- Low cost method for measuring aerosols using the iPhone or equivalent
- Simple to set up and use
- Uses standard apps for photos
- Upgradable to auto-suntracking
- Data processing is quick
  - Potential for iphone app (TBD)
  - Current lap top processing in seconds
- Produces bimodal aerosol size distribution
- Produces sky images

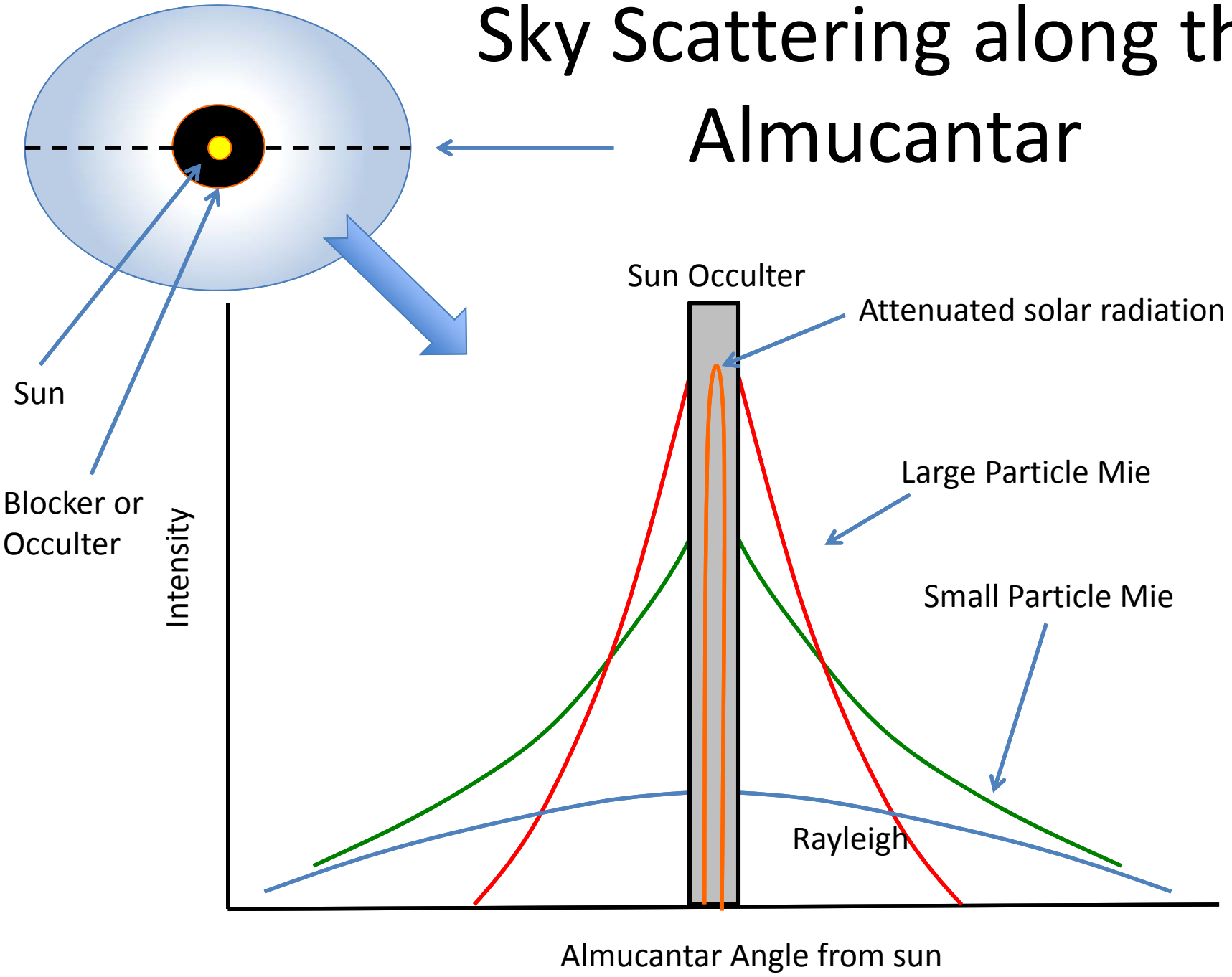
Patent Pending

How does the iPhotometer work?

- The iPhotometer uses sunlight forward scattered by aerosols – Mie scattering
- Mie scattering produces increased sky brightness around the sun. More aerosols – more light around the sun.

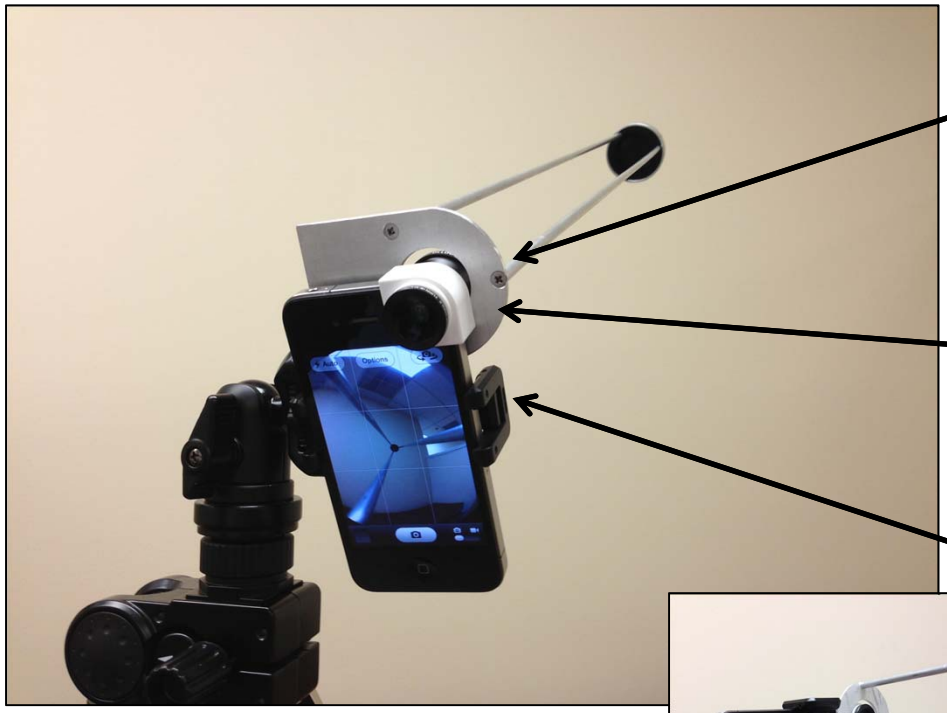


Sky Scattering along the Almucantar



iPhotometer

Back View



Light weight aluminum mount

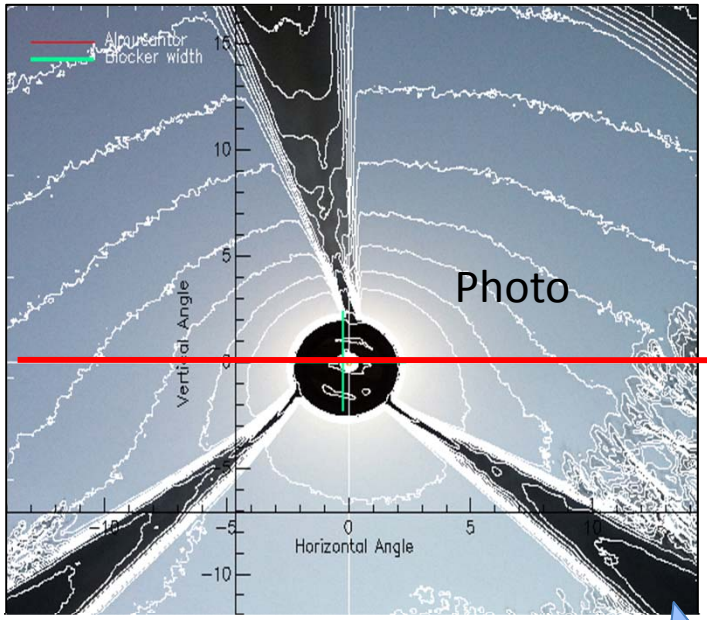
Aperture can accommodate wide angle lenses or screw in filters

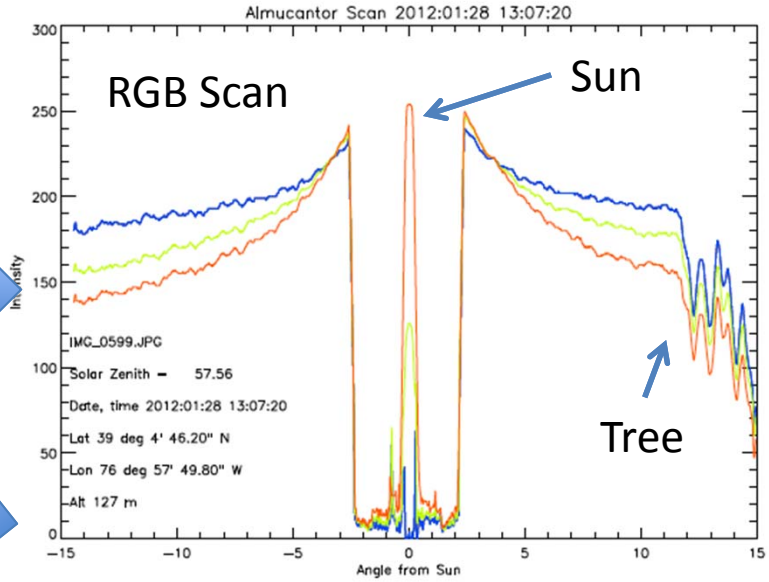
Larger and more flexible phone holder

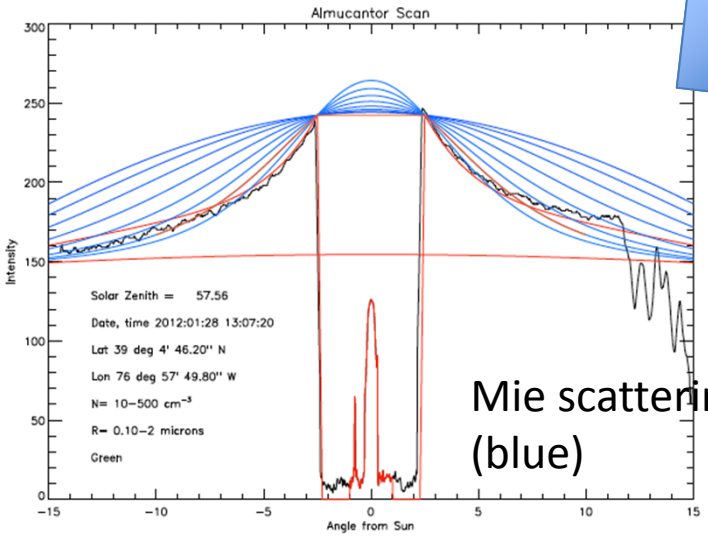
Front View

Phone can be mounted each way

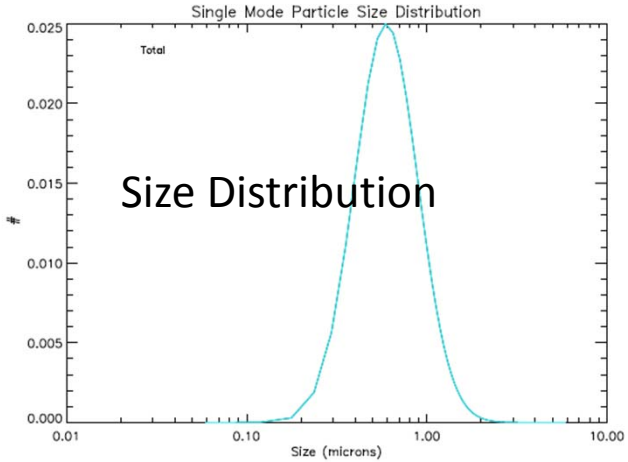
Sample iPhotometer results







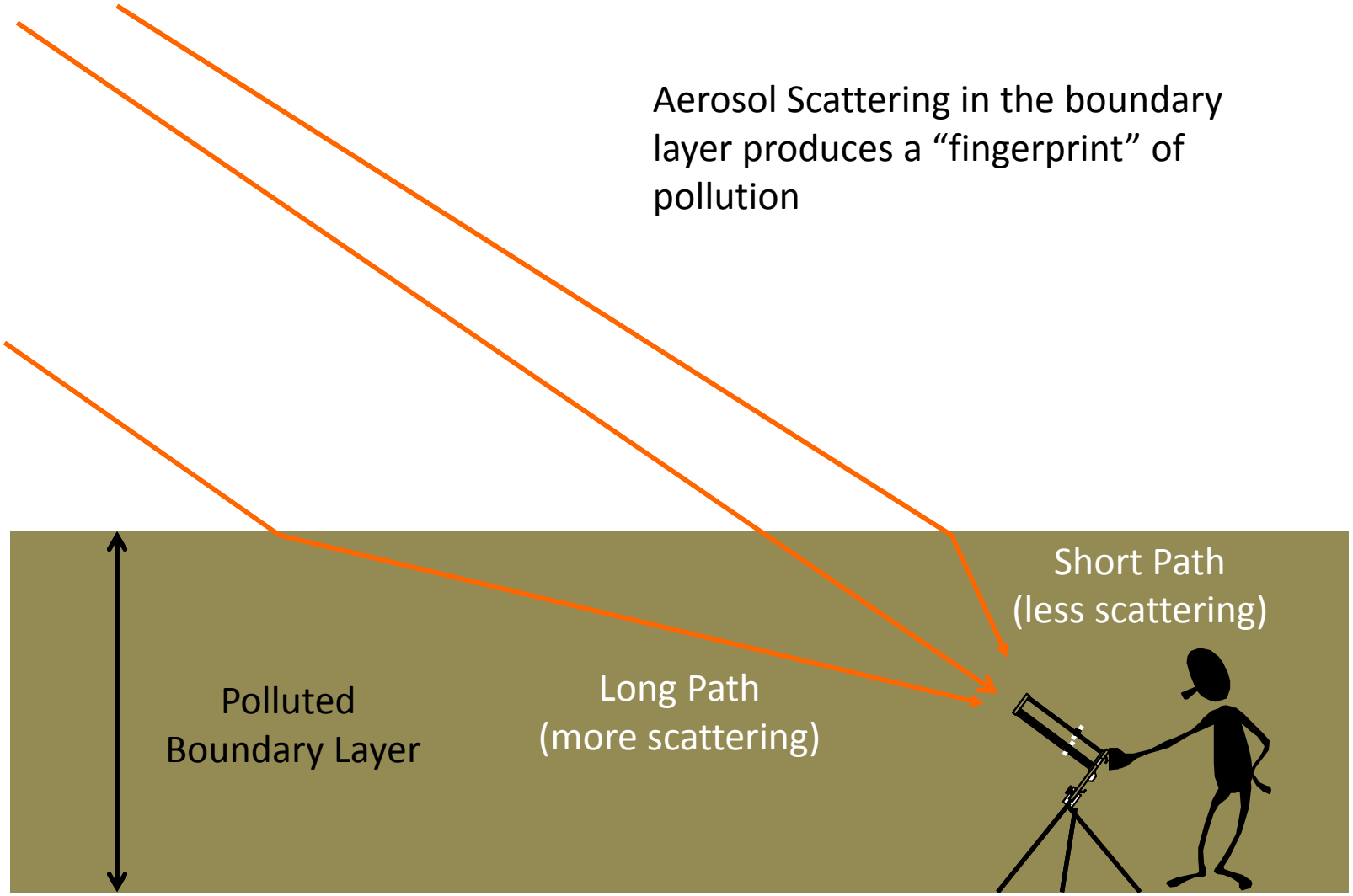
Mie scattering fit (blue)



Laptop processing time ~2 sec

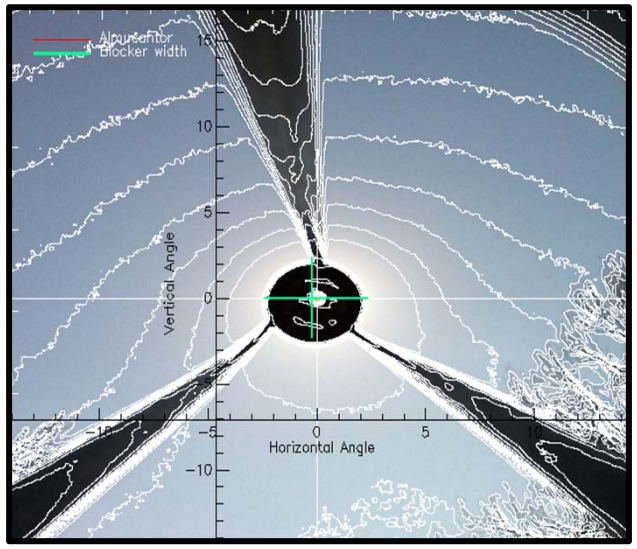
Aerosol Scattering

Aerosol Scattering in the boundary layer produces a “fingerprint” of pollution

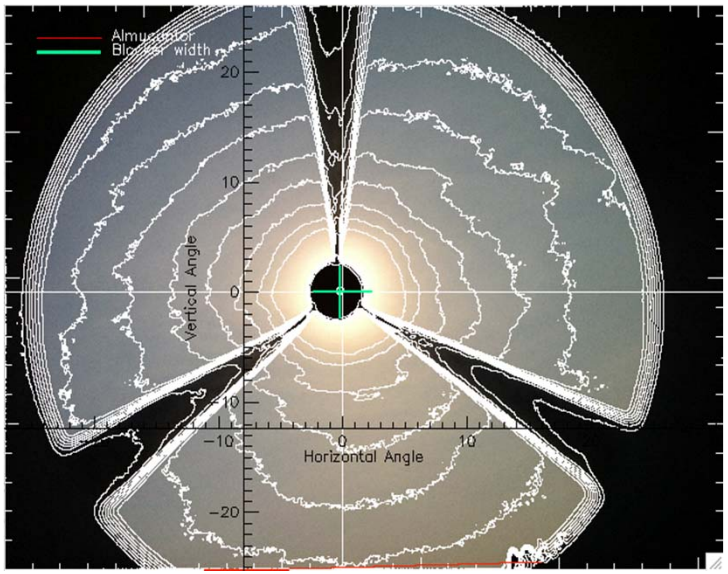


Typical Pictures

Below is a photo in the presence of aerosols



Below is a photo in the presence of sub-visible cirrus



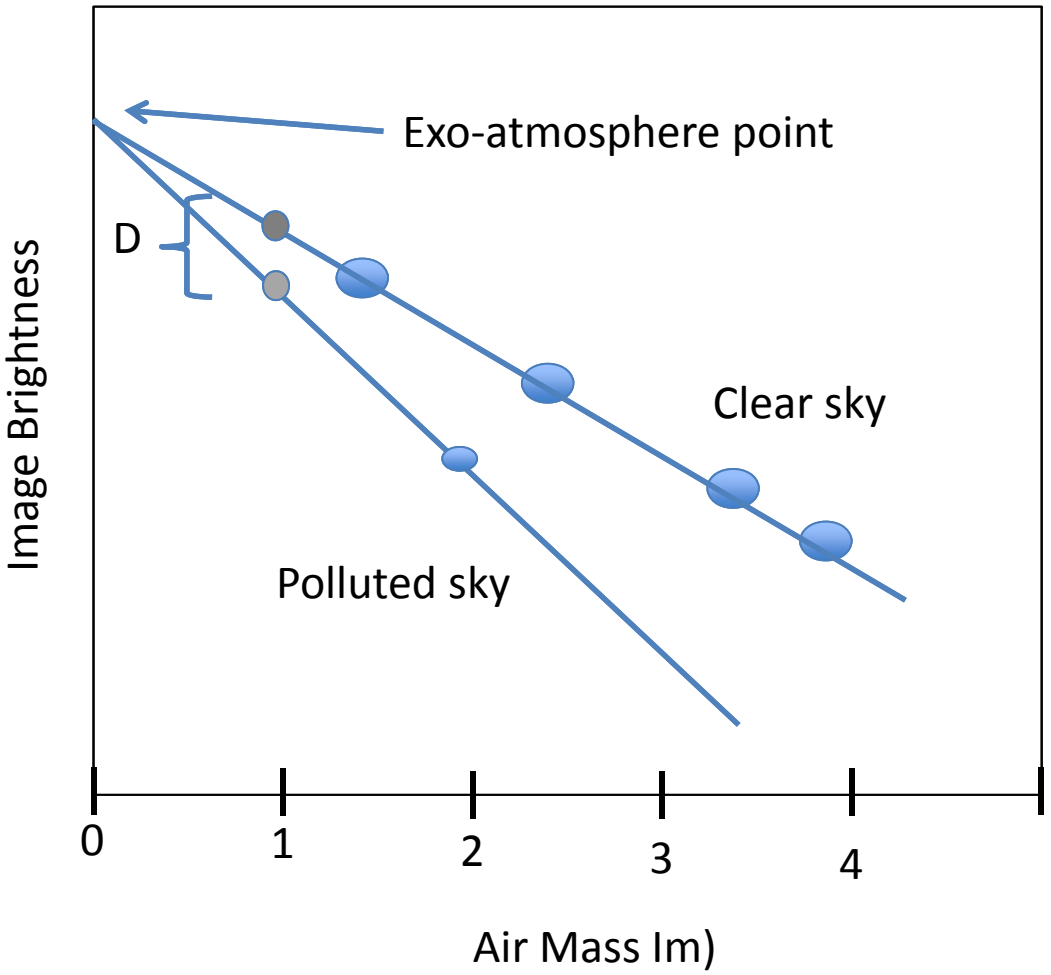
Aerosol Optical Depth (AOD)

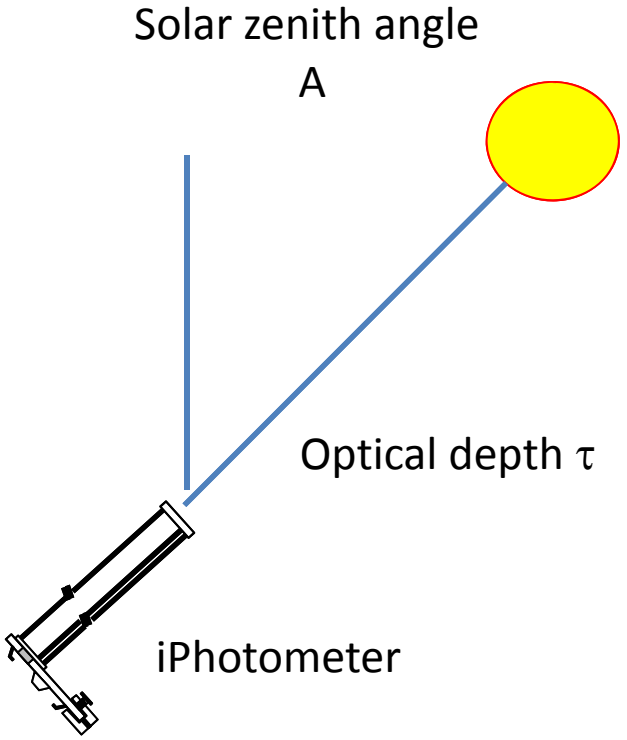
The blocker measurements of the sun can be used to estimate the aerosol optical depth. This is done two ways:

(1) Langley plot – use at least two sky photographs

(2) Calibrate the blocker and look at relative attenuation

Langley Plot



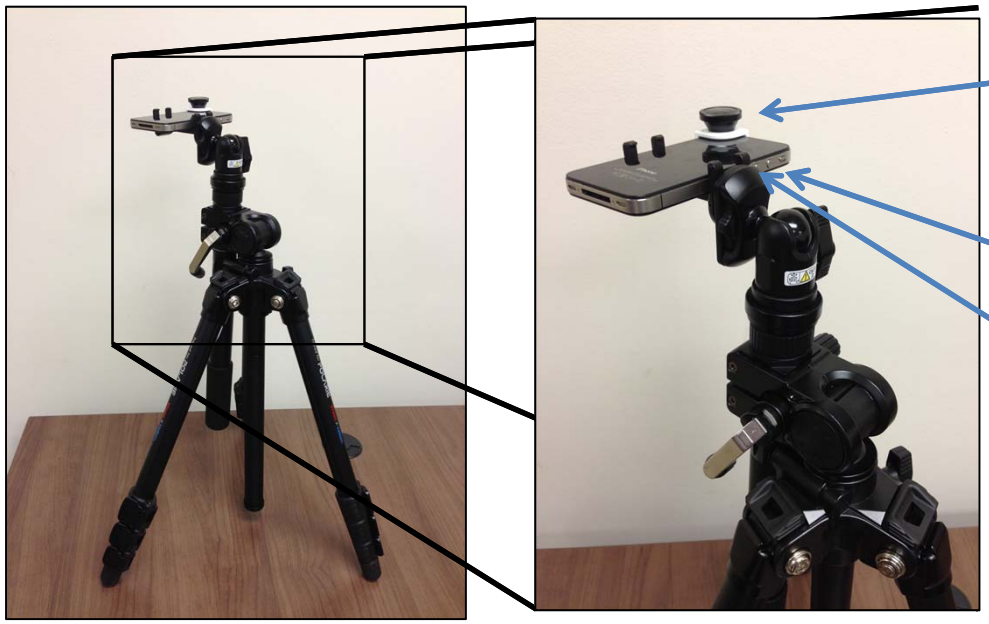


$I=I_0 \exp(-\tau m) \quad m=1/\cos(A)$

Once the exo-atmosphere value is known then subsequent measurements can be made.

The aerosol optical depth can be used to normalize the size distribution

iPhone as an all sky camera



The iPhotometer can double as a sky camera or the phone and mount itself can be use to observe the sky using TimeLapse. The CCD array in the iPhone is not sensitive to sun exposure.

Student Projects

- How does aerosol concentration vary during the day
- Make a Langley plot to calibrate the blocker – how do the plot lines vary if you use R, G or B.
- How do the color filters affect the retrieval
- How does polarization affect the retrieval
- Use TimeLapse to automate the picture taking – how often do I have to adjust the pointing?
- How do aerosol measurements in my area compare with other measurements?
- How do they compare with AirNow measurements?