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ATMS 360

April 9, 2007
Dr. Arnott

Homework 4: Sun Photometry Laboratory

Introduction:
For this laboratory exercise we were to take measurements of the sunlight using a sun photometer. Every student that was enrolled in ATMS 360 – Atmospheric Instrumentation, taught by Dr. Pat Arnott, was assigned a different sun photometer along with a digital voltage meter. It was suggested that students take many measurements every ½ hour. Also, it was suggested that measurements be taken on days with minimal cloud cover.

Materials:
1. Sun photometer
2. Digital voltage meter

Procedure:
1. Pickup an assigned sun photometer along with a digital voltage meter from your instructor for ATMS 360. Also, it is essential that you examine your sun photometer to help you become acquainted with your equipment. Also, make sure that you sun photometer is not damage and make sure that your sun photometer has a 9v battery installed. (See Figure 1).

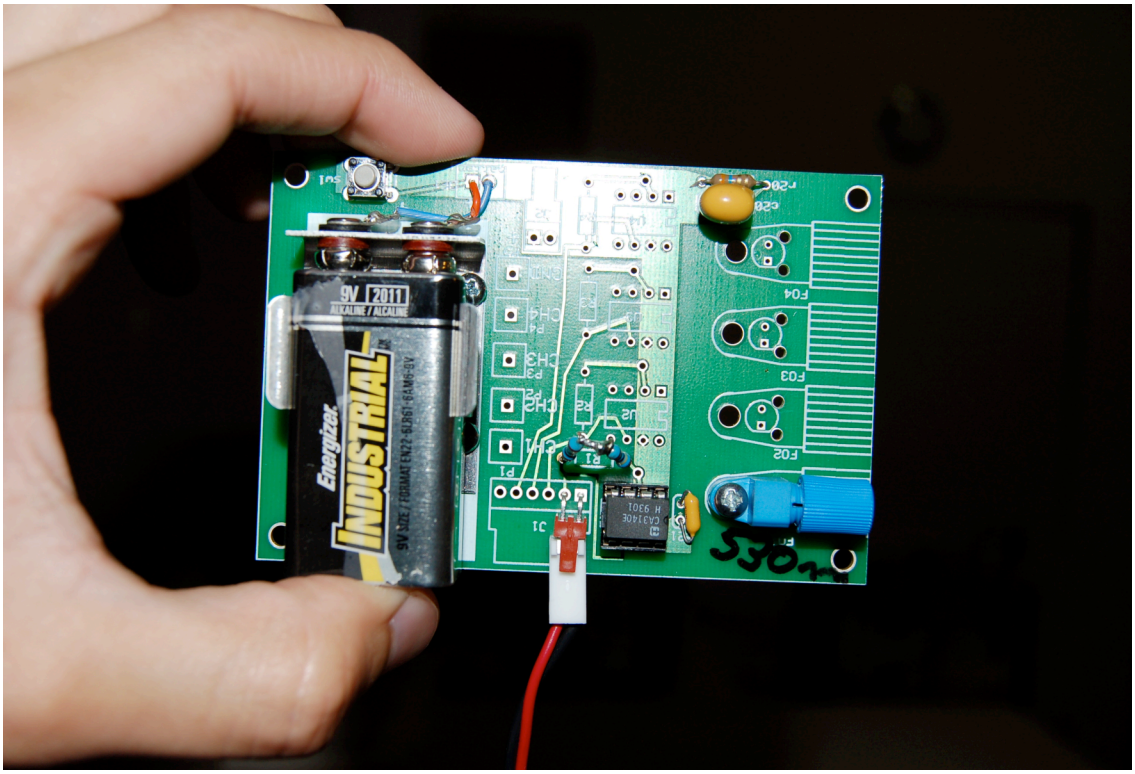


Figure 1: Photo of 530 nm sun photometer components board.

2. Next, make sure that your digital voltage meter is working. There are many different models of voltage meters and any can be used for this laboratory exercise. The voltage meter that was used for this lab was a RadioShack Digital Multi-meter model number 22-813. (See Figure 2).

Figure 2: Photo of RadioShack Digital Multimeter

3. Now connect the wire leads from the sun photometer to the digital voltage meter. Make sure to insert the positive lead (red wire) into the positive terminal on the meter and the negative lead (black wire) into the negative terminal, which is labeled (-com). (See Figure 3).

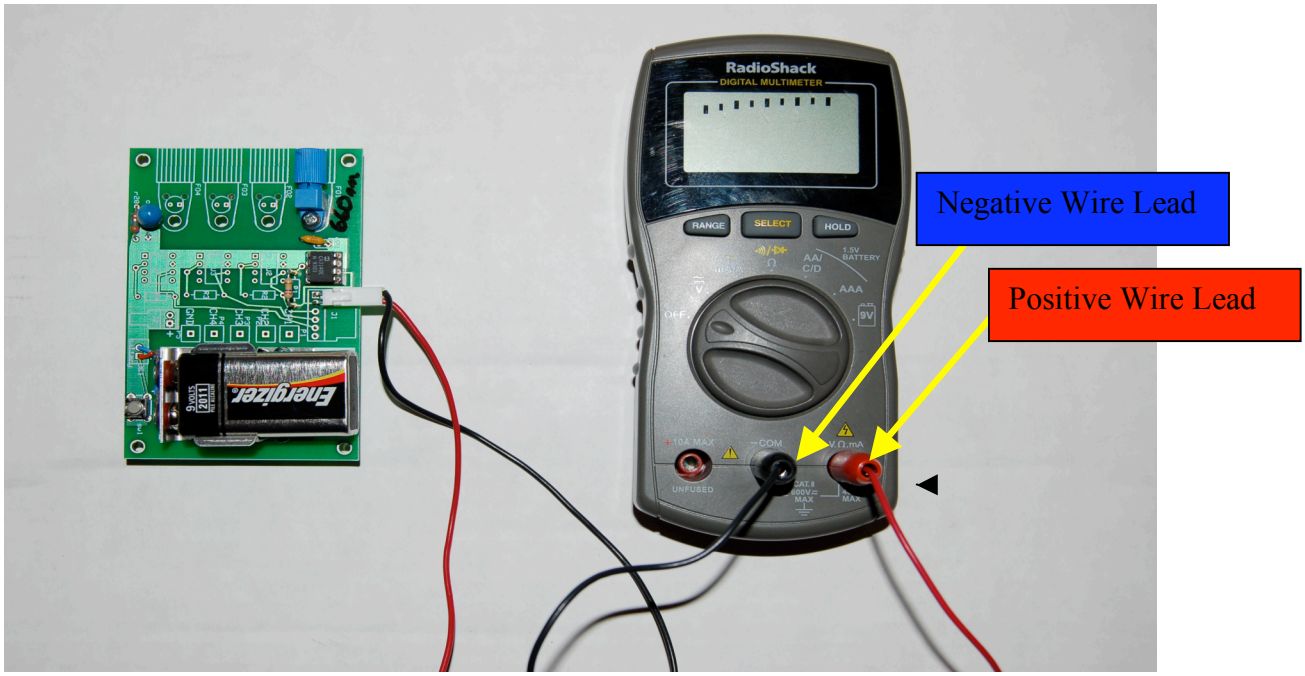


Figure 3: Photo of wire leads connected to meter.

4. Turn on your digital multi-meter and set the meter to the (mvolts) setting. Allow time to have the meter zero out. Once you have let the meter zero out its time to take some measurements of sunlight.

5. You will to go outside with you equipment and notepad so that you can write down the readings from the meter. Find a safe area where you can work without being disturbed. Take you sun photometer and line up the inlet of the LED so that it faces the sun. (Note: Please don't look directly into the sun!) It would help if you used the shadow from the components board for a guide on alignment. (See Figure 4).

Figure 4: Photo of Mark Rincon using the sun photometer to take measurements.

6. To have the sun photometer take a measurement of the sun light you need to depress the switch on the components board and hold it until the readings on the meter increase to the maximum signal. Record the maximum signal at the angle you are holding the sun photometer. Make sure to write down the time of day and date you are working. Continue to take measurements continuously until you have about five to six different entries. Also, take a record of the darkness measurement. To complete this you will need to place your finger over the inlet for the LED and depress the switch on the sun photometer. (See Figure 5).

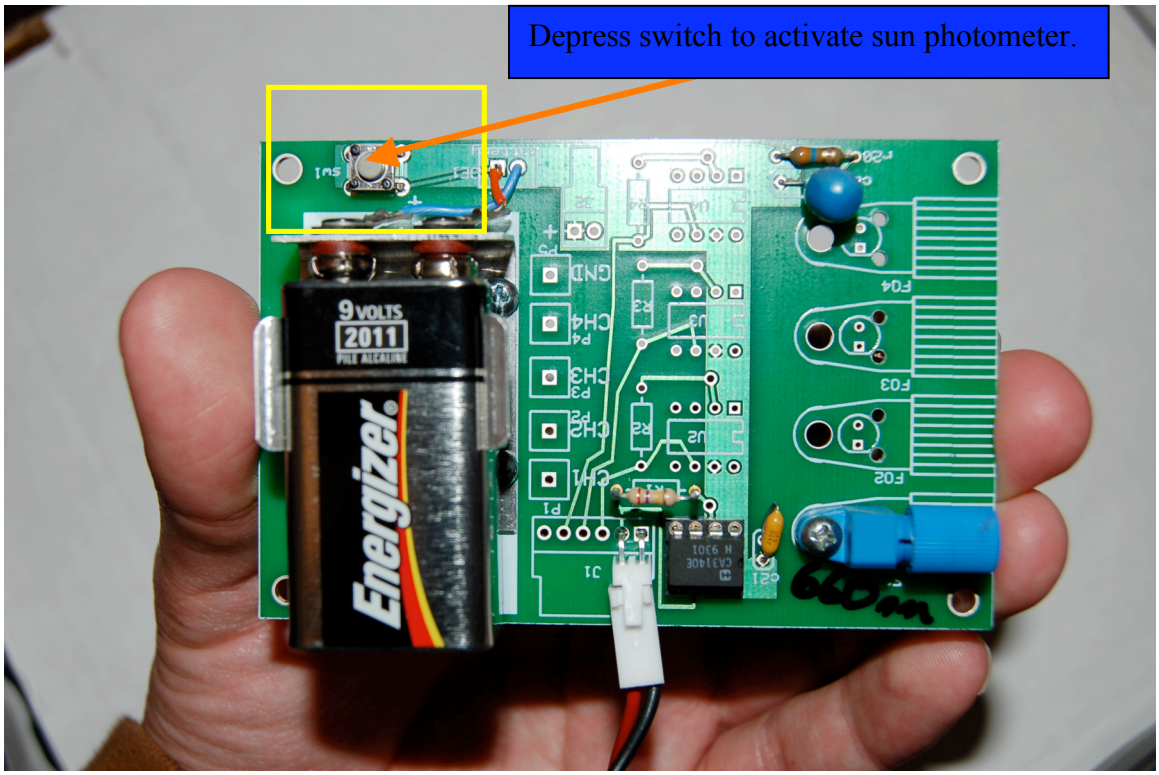


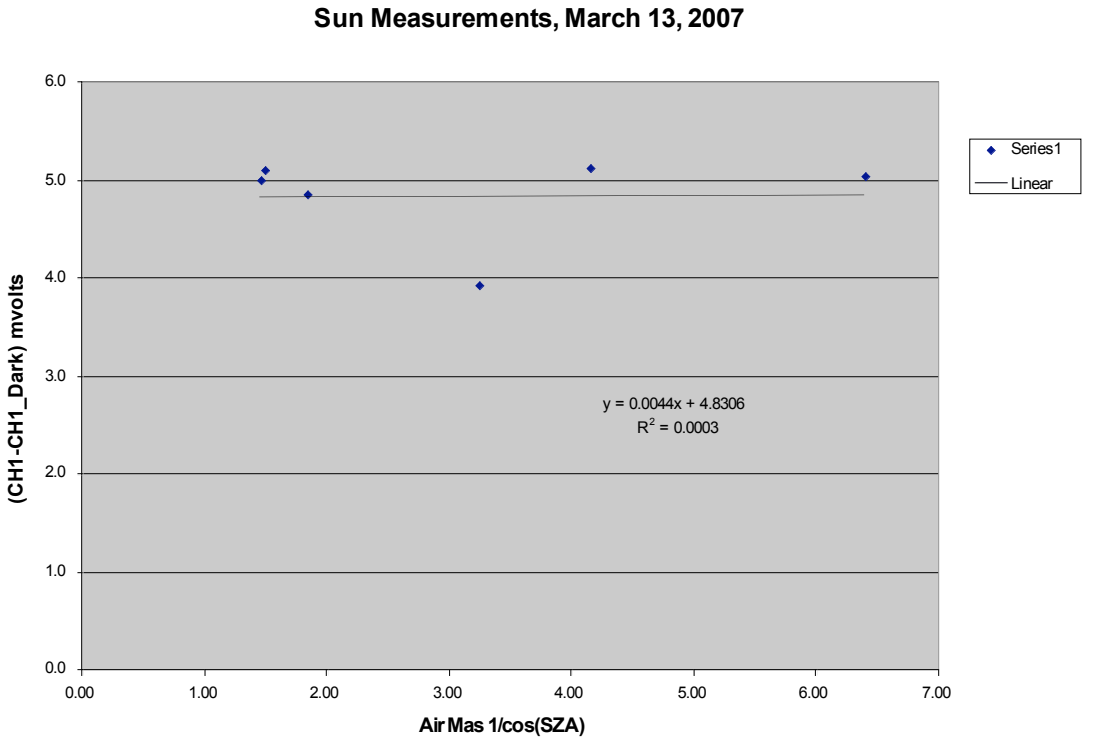
Figure 5: Photo of sun photometer.

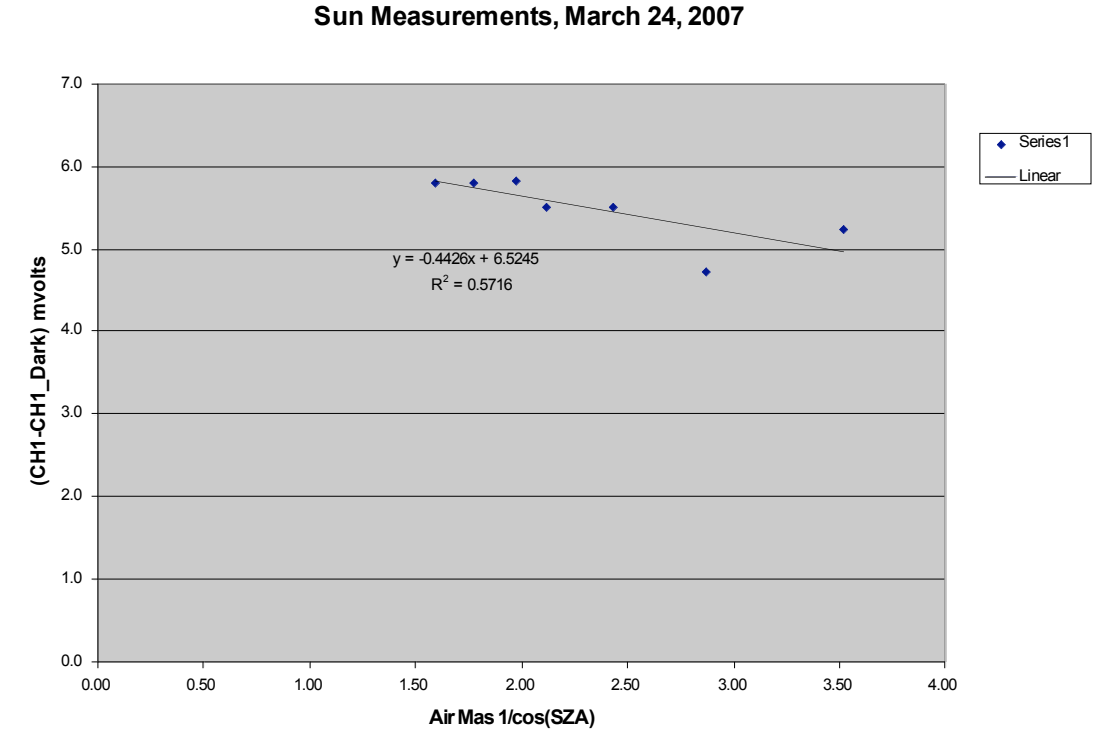
Results:
There were two different sun photometers that utilized for this assignment. A 530nm sun photometer which recorded measurements on March 13th, 2007 and a 660nm sun photometer that recorded measurements on March 24th, and March 25th, 2007. After taking sun light measurements using two different sun photometers the next step was to generate a graph. Using Microsoft Excel we plotted the (CH1-CH1_Dark) mvolts on the y-axis, and the (Air mass) on the horizontal x-axis.

While taking measurements with the sun photometer at different time intervals it was noted that the record of (mvolts) were scattered. From the measurements that were taken on March 13th, 2007 it should be noted that the slope equaled ($y = 0.0044x + 4.8306$) which was very different from the slopes that were generated on other days. The measurements from March 24th, 2007 the slope was ($y = -0.4426x + 6.5245$) and on March 25th, 2007 the slope was ($y = -0.1603x + 5.9988$). More importantly, it should be pointed out that our slopes were negative on these two days. Now, possible reasons for this outcome could have resulted in the difference of sun photometers (530nm and 660nm) scales. For the measurements from March 24th and 25th a 660nm level sun photometer was used. Also, the range of values for air mass was different on each day and this is probably a result of the cloudiness. Cloudiness or hazy sun conditions could be a resulting factor in the negative slope values compared with the non-negative slope value.

While completing the sun photometer data collection some notes for improve can be noted. It would be convenient if the sun photometer was attached to a camera tripod

where someone can then adjust the angle of tripod to meet sun levels at different time periods throughout the day. In addition, the continuous depression of the switch on the sun photometer made it difficult for users to hold the device, digital voltage meter, and record measurements at the same time. If the switch was changed to a single-pole, single-throw switch then it would allow for the activation of the sun photometer to take continuous measurements. Finally, resulting in a more precise measurement taken by the user of the equipment.





Sun Measurements, March 25, 2007