Solar PV Lab #1 for PHY 576

(adapted from lab made by Brice Smith)

Data Collection:

1. Starting with the light source roughly 50 cm away from a single panel, measure I_{sc} and four surrounding intensity measurements (one on each side top, bottom, left, and right). Repeat these measurements moving the light source roughly 10 cm further away each time until the end of the table is reached.
2. Starting with the light source roughly 50 cm away from a single panel, measure V_{oc}, and four surrounding intensity measurements. Repeat these measurements moving the light source roughly 10 cm further away each time until the end of the table is reached. (Note: this step can most easily be done in combination with part 1.)
3. For a single panel and a single intensity with the light source roughly 60 cm from the panel, measure I and V along with the load resistance and four surrounding intensity measurements for at least 35 different load resistances between a short circuit (I_{sc}) and an open circuit (V_{oc}) being sure to get around 10 data points near each of the following: I_{sc}, V_{oc}, and the knee. While you are measuring current, voltage, and resistance you only have to periodically measure intensity as it should not change substantively during the experiment.
4. For a single intensity with the light source roughly 60 cm from the panel measure I_{sc}, V_{oc}, and six surrounding intensity measurements (one on each side top of each panel, bottom of each panel, left, and right) for two panels in series and parallel.

Analysis:

1. Plot the short circuit current (I_{sc}) versus the average intensity for your data. Fit a straight line to this data and comment on the results.
2. Plot the open circuit voltage (V_{oc}) versus the average intensity for your data. Fit a logarithmic curve to this data based on the equation we derived in class and comment on the results.
3. Plot the current versus voltage for the various load resistances from your data. From this plot, would you say your solar panel is described well or poorly by the ideal solar cell model?
4. Use your data for current and voltage to estimate the maximum power point for your panel and from that result estimate the fill factor for your system. From this result, would you say your solar panel is described well or poorly by the ideal solar cell model?
5. Using your results from parts 1 and 2, estimate I_{sc} and V_{oc} for the individual panels under the average illumination you measured for the two panels together in part 4. From these results do your measurements for the panels in series and parallel agree with what you would expect from circuit theory?