

## Physics 37100 Advanced Physics Laboratory I

### Lab #4

(PART II: Simple oscilloscope)

- 1) Using the code and circuit from part I and lab 3-II, create a sketch to:
  - a. establish communication with matlab using '?' and 'K';
  - b. **wait** to receive the character 'g' (for go);
  - c. make one loop to take 512 points of time series data from photoresistor on A0 measuring the PWM pin 9 LED set to 128;
  - d. make a second loop to send the data to matlab using `Serial.println()`;
  - e. at the end of the second loop send the total acquisition time;
  - f. loop back to part b.
- 2) Modify (part I) matlab script to:
  - a. establish communication with arduino using '?' and 'K';
  - b. **send** the character 'g' (for go);
  - c. loop over the serial data using `fgetl()` and `str2double()` to store the data in an array;

```
V=zeros(1,N);
t=(0:N-1)/N;
for m=1:N
    str=fgetl(s);
    V(m)=str2double(str);
end
```

- d. read the acquisition time using `fgetl()` and `str2double()`;
  - e. plot the data using a time axis in  $\mu\text{s}$ ;
  - f. `drawnow`;
  - g. Loop back to part b.
- 3) Move the wire connected to A0 to other points in the circuit while the script is running to see the data update.
- 4) Change the plotting to display the FFT of the data.
  - a. The horizontal axis should be in Hz. Include a nice plot of the FFT with x and y axis labels in the report.
  - b. What is the frequency of the PWM light?
  - c. Is it consistent with the value in the description of `analogWrite` on the arduino site: <https://www.arduino.cc/en/Reference/AnalogWrite>.
  - d. Measure the frequency directly using the time series data to measure the time from one peak to the next. Is it consistent?
- 5) (Extra credit) modify to allow matlab to set the value of the LED output on each loop.