Lab 5: Visible Light Data Communication

SUMMER CHALLENGE COURSE

SMART LIGHTING

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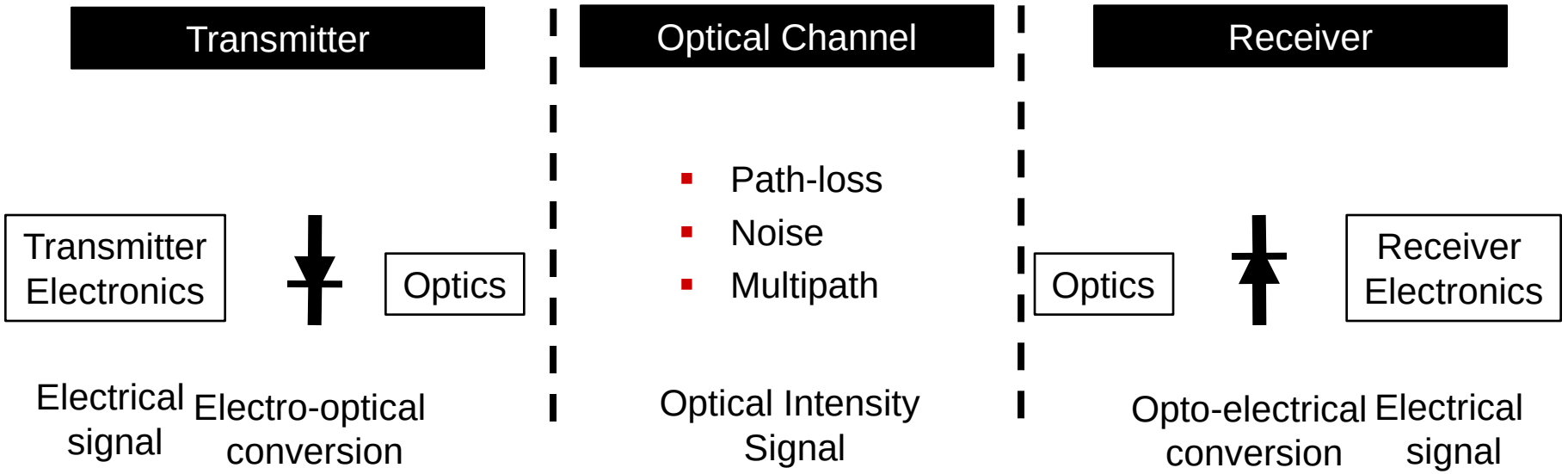
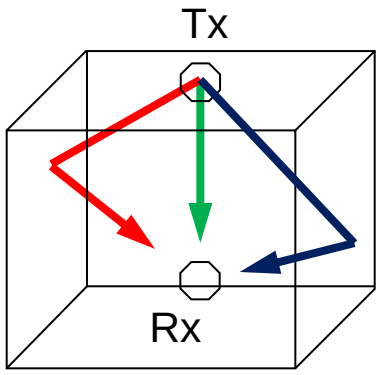
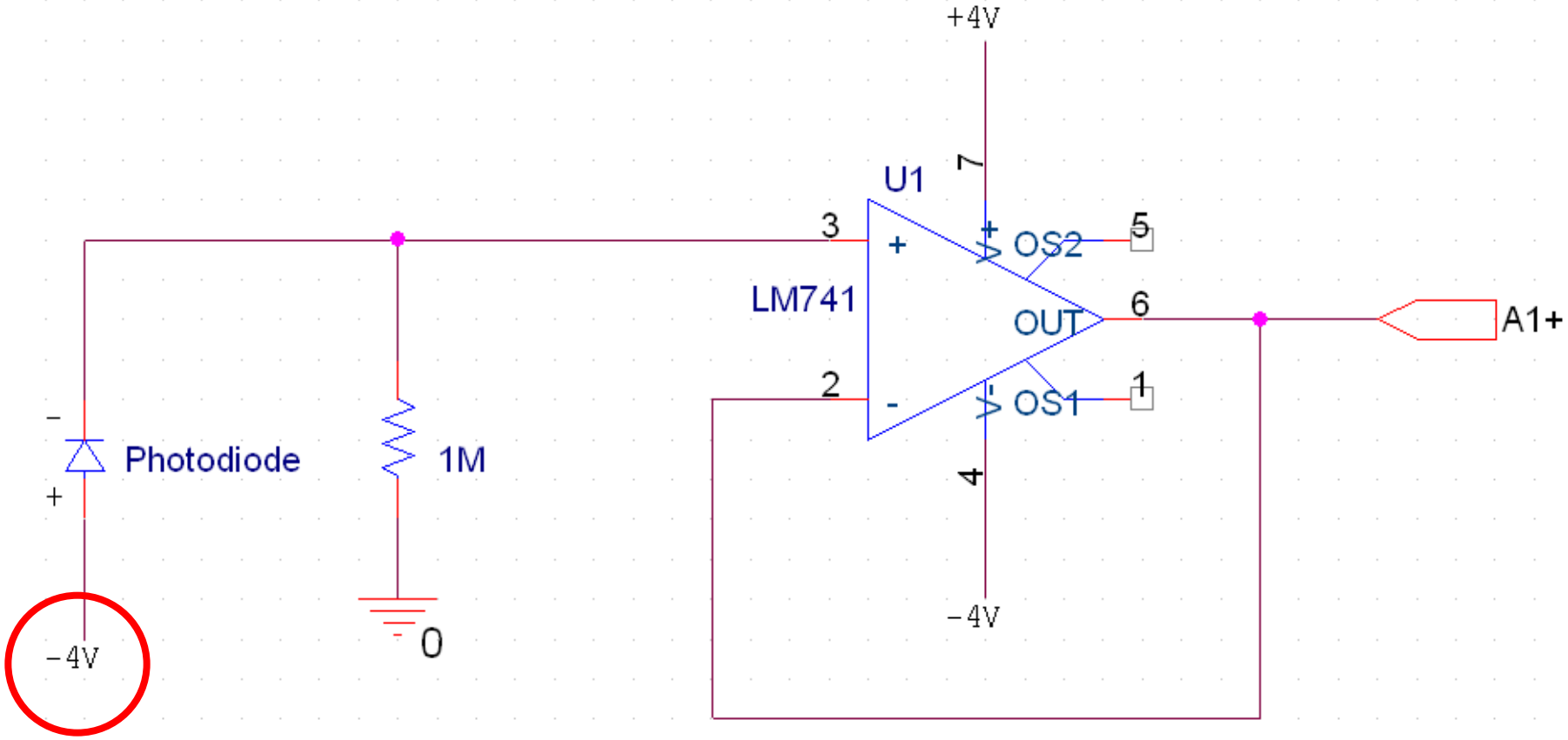
Optical Modulation:

- Intensity-Modulation (IM) and Direct-Detection (DD)



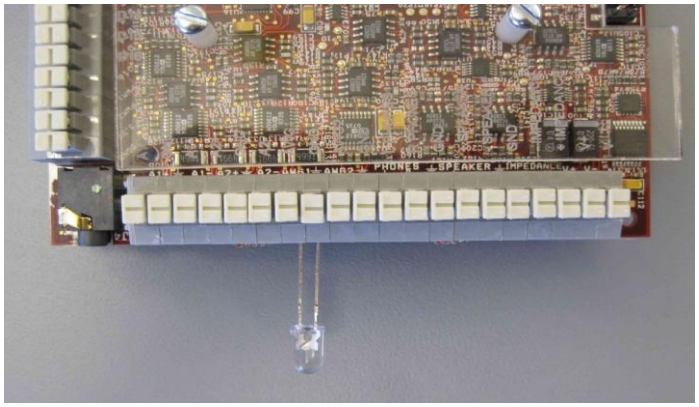




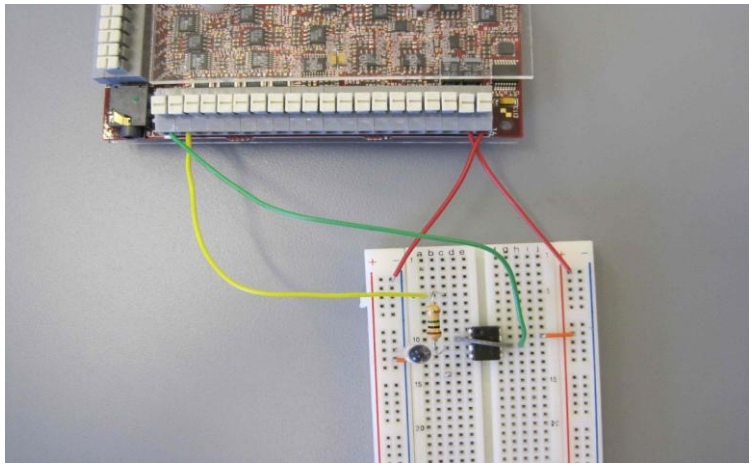
Ambient light: refers to sources of light that are already available naturally (e.g. the sun) or artificial (e.g. to light a room).

Free Space Optical Communication

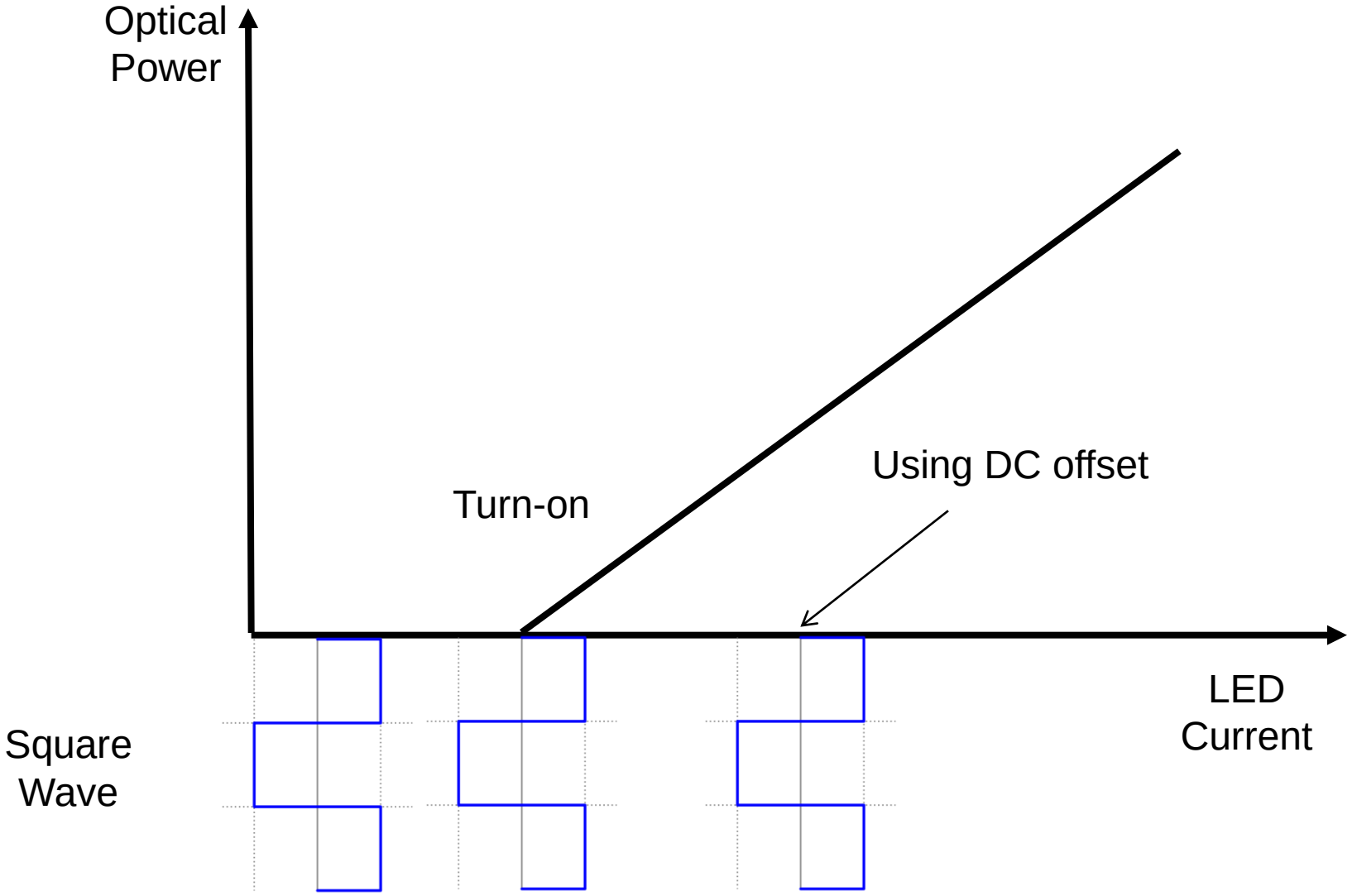
- Air, outer space, vacuum, …

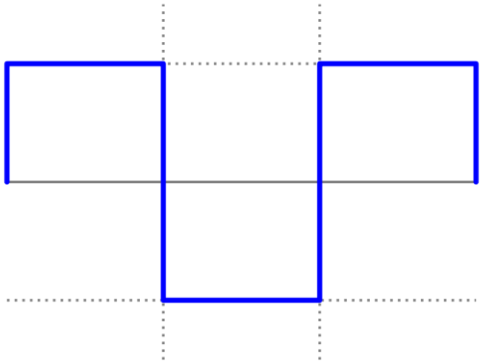


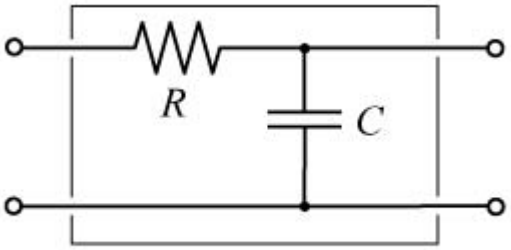
- Alternatives:
  - Optical fiber, transmission line

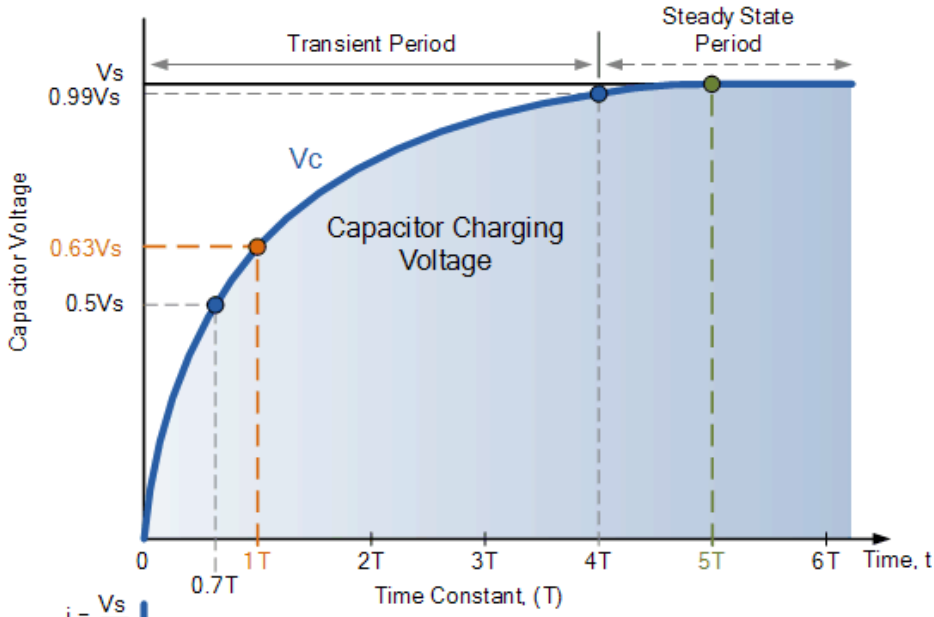


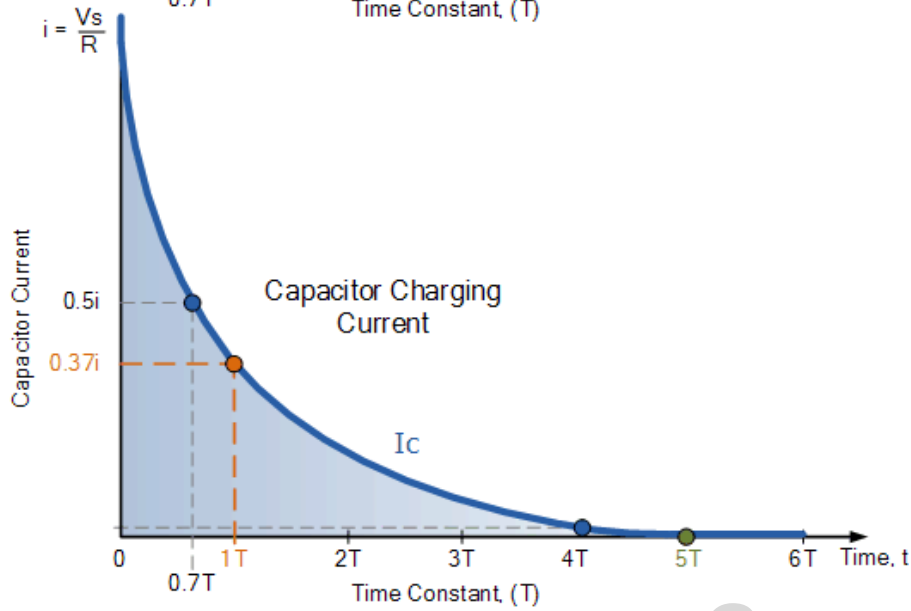
- Check out “heliograph” (wiki)


Optical
Power
Turn-on
Using DC offset
LED
Current
Square
Wave




R
C


Transient Period
Steady State Period
Vs
0.99Vs
Vc
Capacitor Charging Voltage
0.63Vs
0.5Vs
Capacitor Voltage
0
0.7T
1T
2T
3T
4T
5T
6T
Time, t
Time Constant, (T)


i = Vs/R
0.5i
0.37i
Capacitor Charging Current
Ic
Capacitor Current
0
0.7T
1T
2T
3T
4T
5T
6T
Time, t
Time Constant, (T)

Visible Light Spectrum, Spectrum Analyzer

- Simple spectrometer:
  - Using a CD
- Spectrum analyzer:
  - Magnitude vs. frequency
  - What frequencies can you transmit well in your VLC setup?
    - Power, gain?

Gain = 10 log (Pout/Pin) dB