Lab 4: Photodiodes (PDs) and Visible Light Communication (VLC) Links
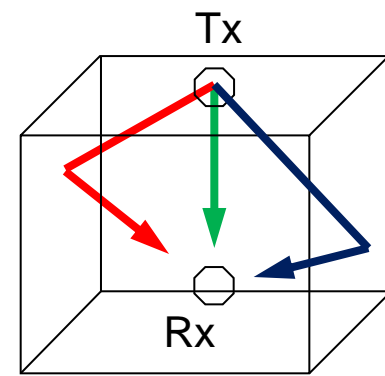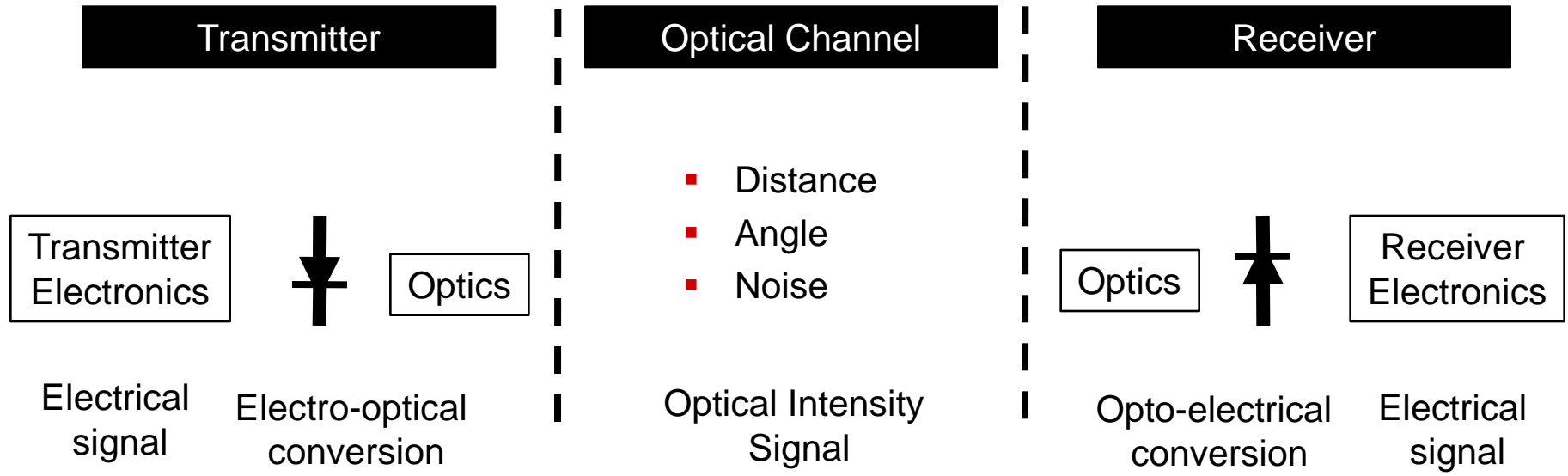
SUMMER CHALLENGE COURSE
SMART LIGHTING

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Optical Modulation:

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

Transmitter	Optical Channel	Receiver

Transmitter Electronics	Optics	▪ Distance ▪ Angle ▪ Noise	Optics	Receiver Electronics

Electrical signal | Electro-optical conversion | Optical Intensity Signal | Opto-electrical conversion | Electrical signal

Tx

Rx

Semiconductor device that converts light into current

Current is generated when photons are absorbed

Responsivity is a function of wavelength

Typical Detector Response Curves
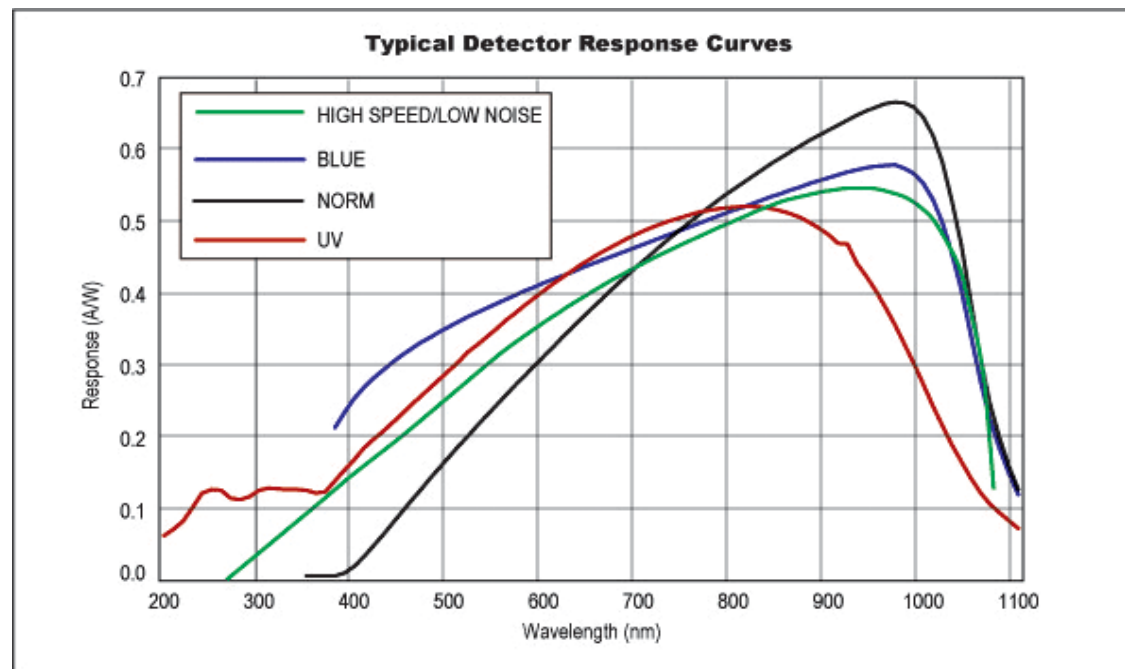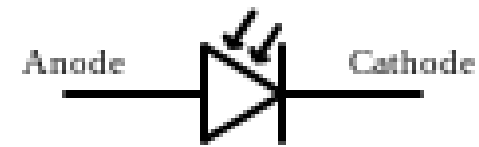
Op-Amp

- Two inputs
- Requires power supply
- Single, amplified output
- Why? Have a relatively small signal and want it to be larger
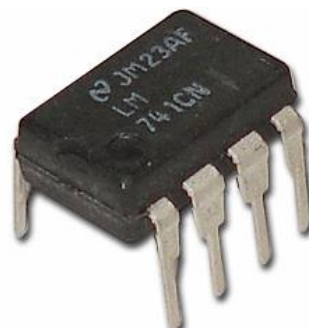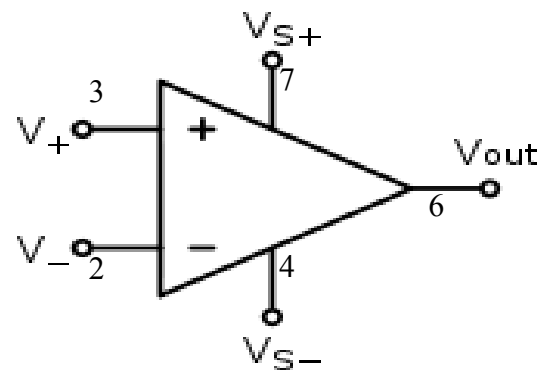
Accomplished with internal circuitry

Built into IC in chip

LM741 Pinout Diagram

OFFSET NULL — 1   8 — NC

INVERTING INPUT — 2 −   7 — V⁺

NON−INVERTING INPUT — 3 +   6 — OUTPUT

V⁻ — 4   5 — OFFSET NULL

Transient Period | Steady State Period

Vs
0.99Vs

Vc

Capacitor Voltage

Capacitor Charging Voltage

0.63Vs

0.5Vs

0   0.7T 1T   2T   3T   4T   5T   6T   Time, t
Time Constant, (T)

$i = \dfrac{Vs}{R}$

Capacitor Current

0.5i

Capacitor Charging Current

0.37i

Ic

0   0.7T 1T   2T   3T   4T   5T   6T   Time, t
Time Constant, (T)

R C

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