LED Strips for Everyone Everywhere

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Pioneer of **VR** (in the mid-1980s)
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flickr: **maltman23**
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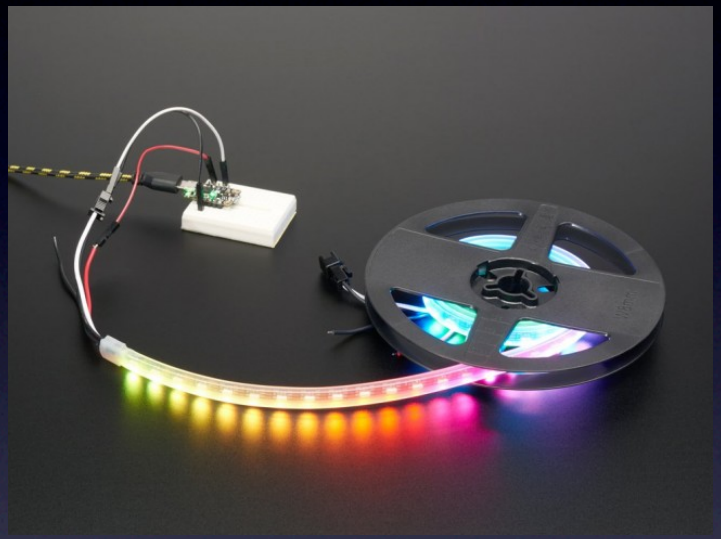
Patreon: mitchaltman

LED Strips for Everyone Everywhere

Syllabus

- Brief intro to LEDs and electronics
- RGB color theory
- A bit about Arduino
- PWM basics
- Programming RGB LED strips
- Ordering RGB LED strips

LED Strips for Everyone Everywhere



These slides are available at:

https://CornfieldElectronics.com/cfe/projects.php#ledstrips

Brief Intro to LEDs and Electronics

A Green LED

Brief Intro to LEDs and Electronics

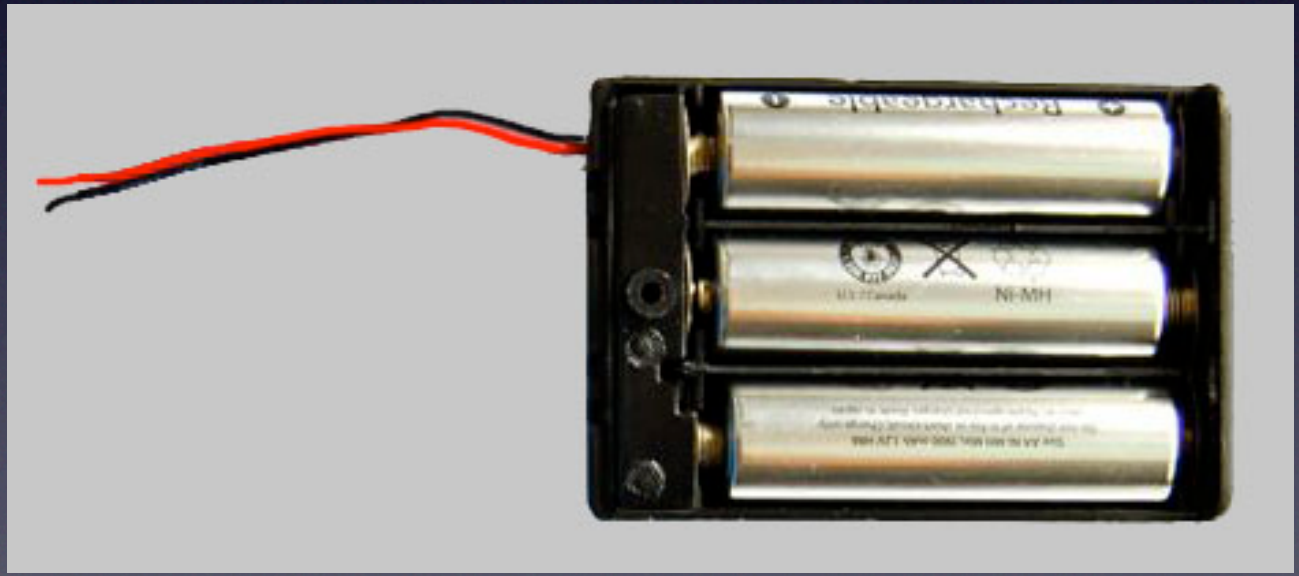
Lots of different colored LEDs!

Brief Intro to LEDs and Electronics

How to make them light up?

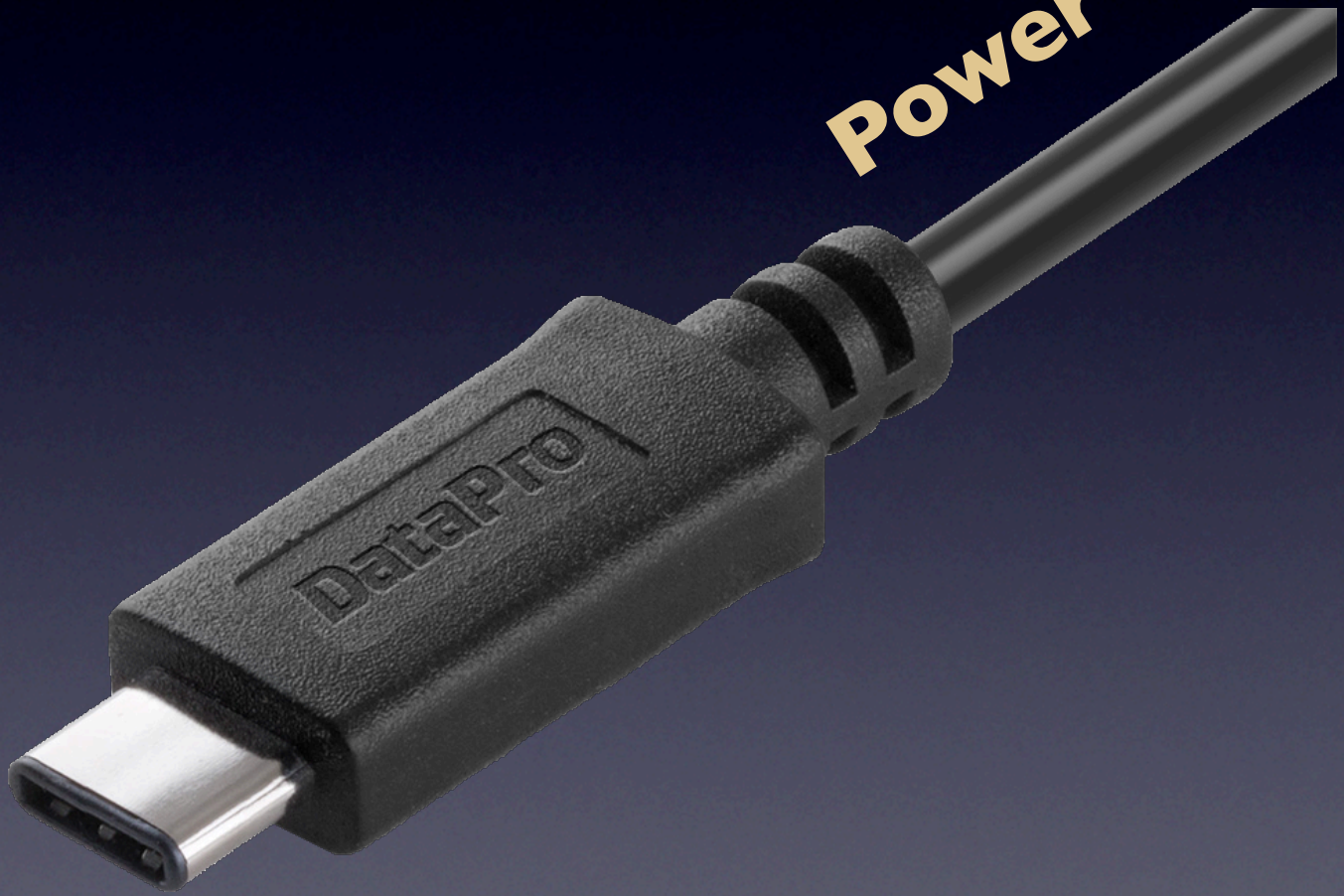
Brief Intro to LEDs and Electronics

Power Supply



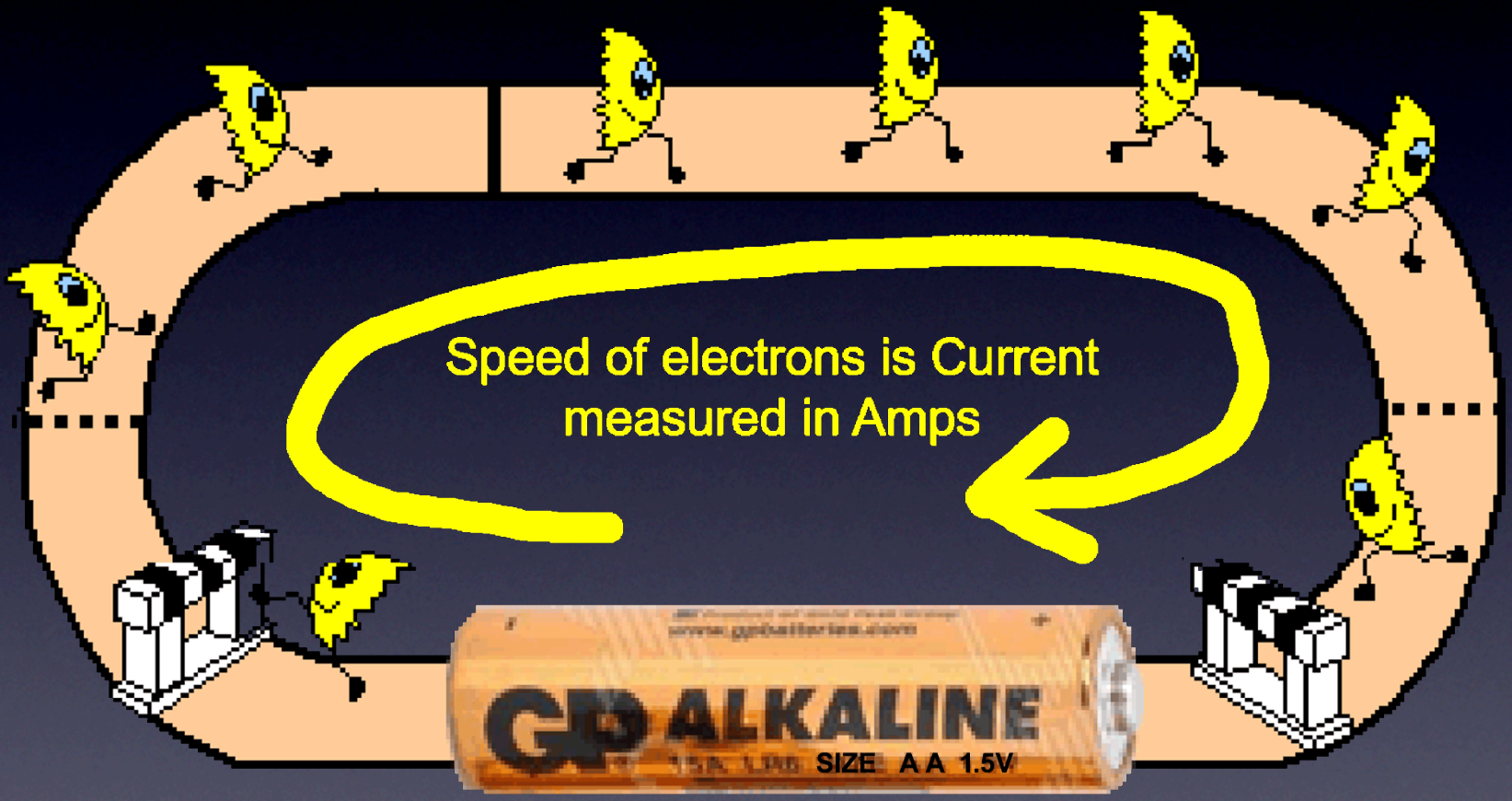
Voltage / **Volts**

Brief Intro to LEDs and Electronics



Voltage / **Volts**

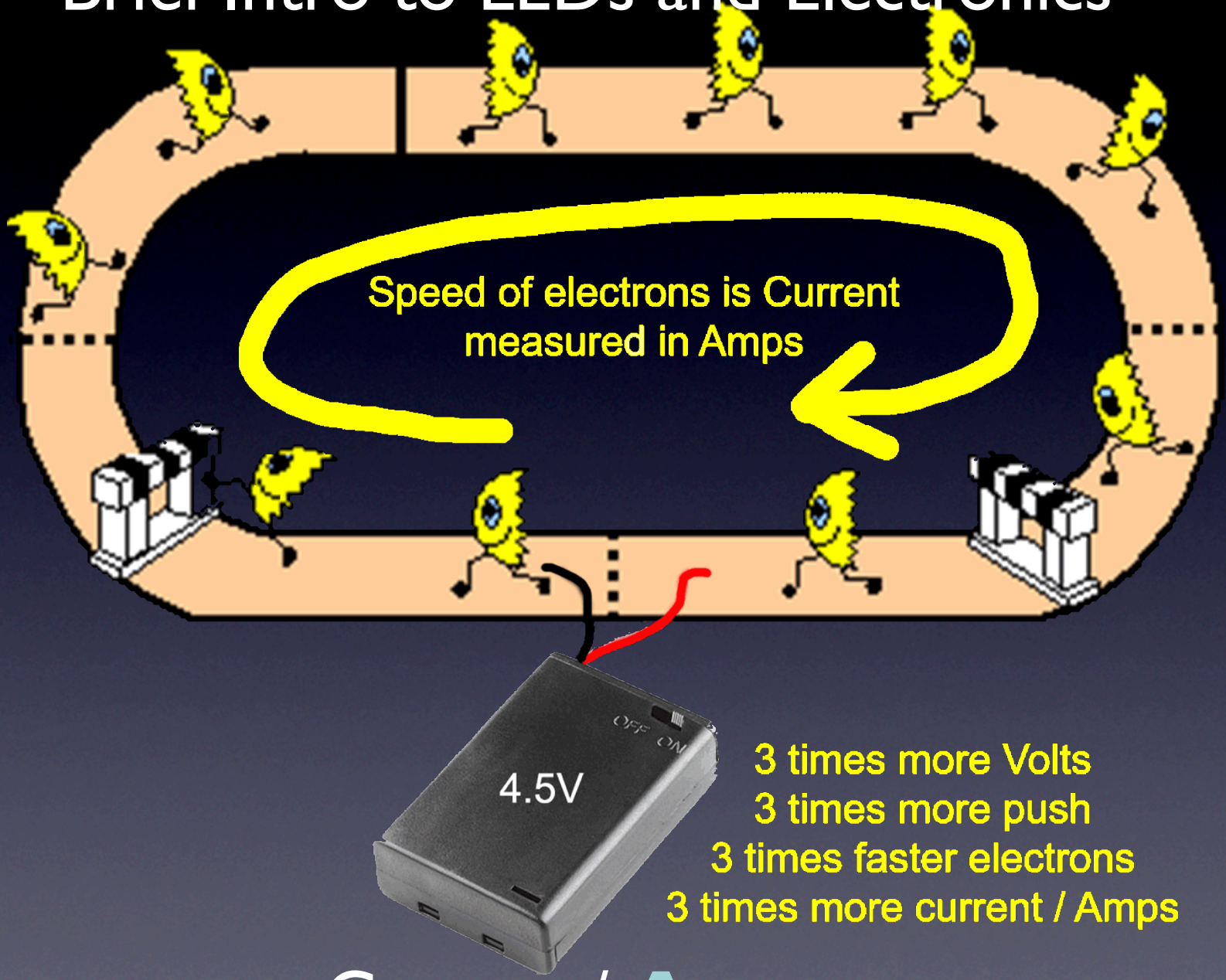
Brief Intro to LEDs and Electronics



Electrons pushed with 1.5V.
So, they move!

Current / **Amps**

Brief Intro to LEDs and Electronics



3 times more Volts
3 times more push
3 times faster electrons
3 times more current / Amps

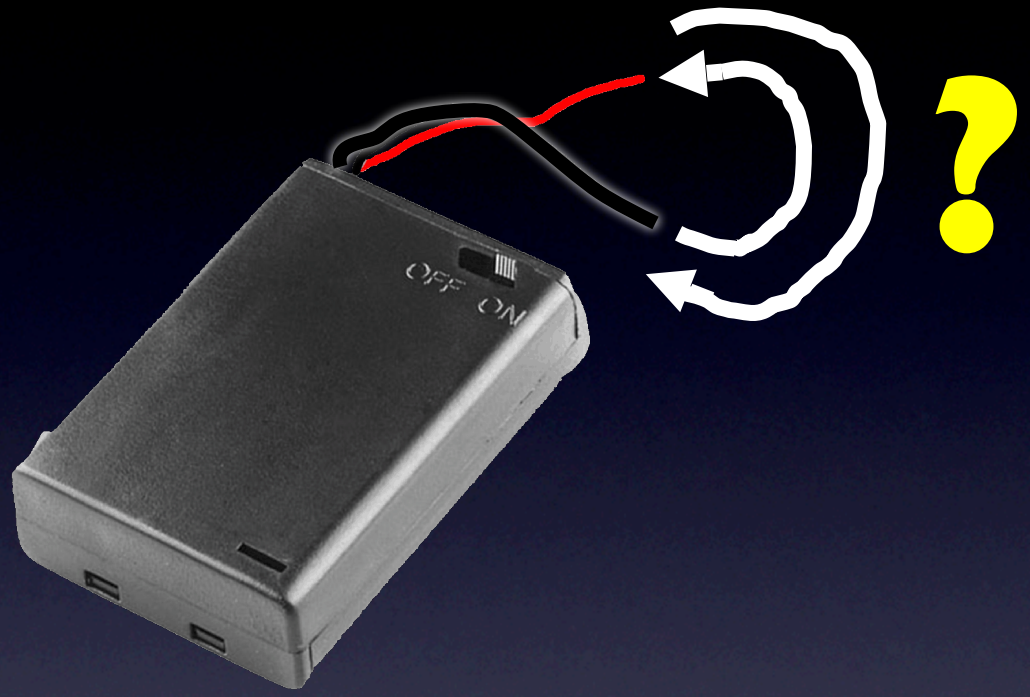
Current / **Amps**

Brief Intro to LEDs and Electronics

Too much energy?

Magic smoke goes away…

Brief Intro to LEDs and Electronics

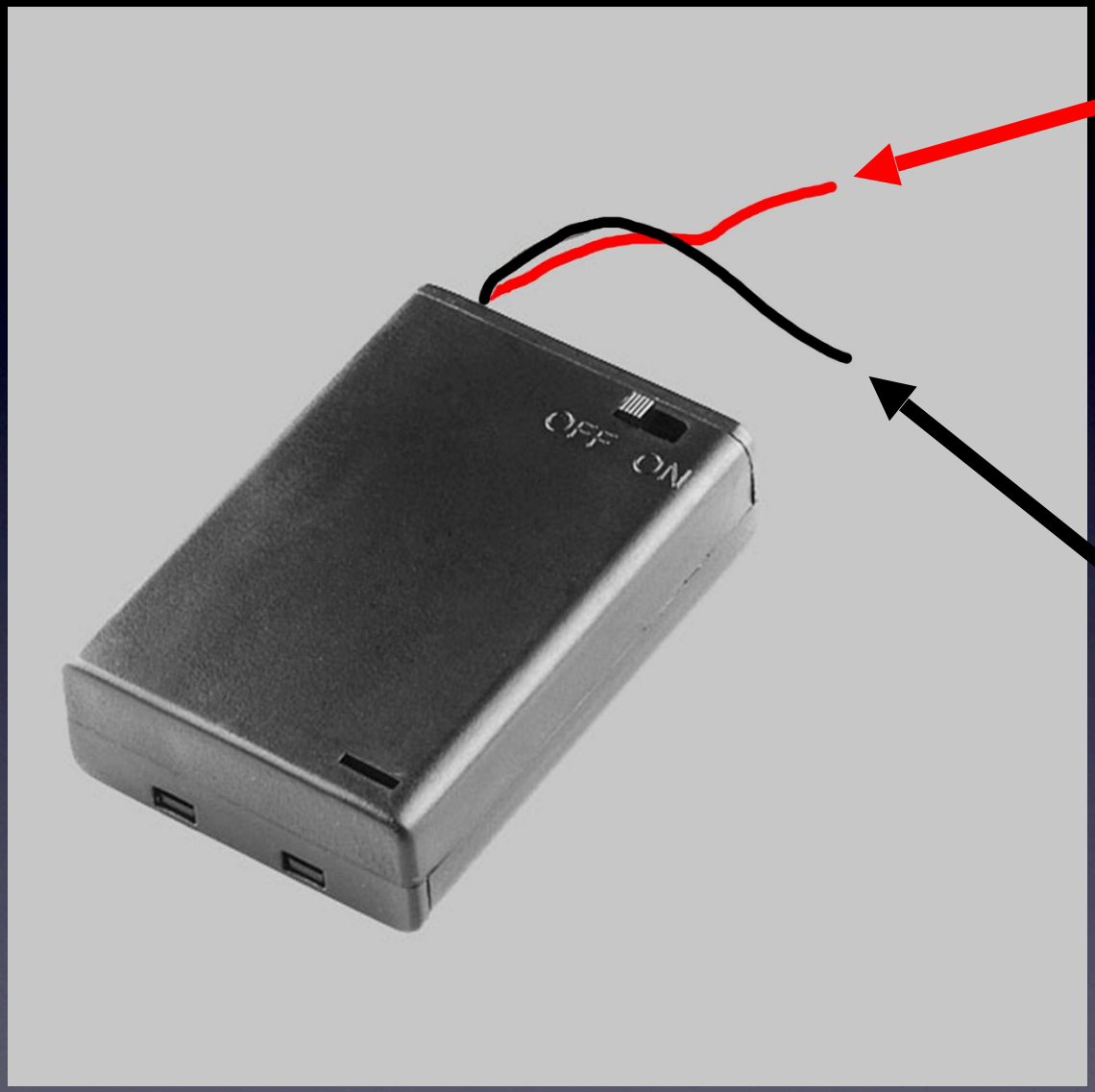


What happens?

Polarity

Power Supply – it matters how you connect it!

Brief Intro to LEDs and Electronics



Red wire:
Power,
Plus, Positive,
4.5V,
Vcc

Black wire:
Minus,
Negative,
0V,
Ground (GND)

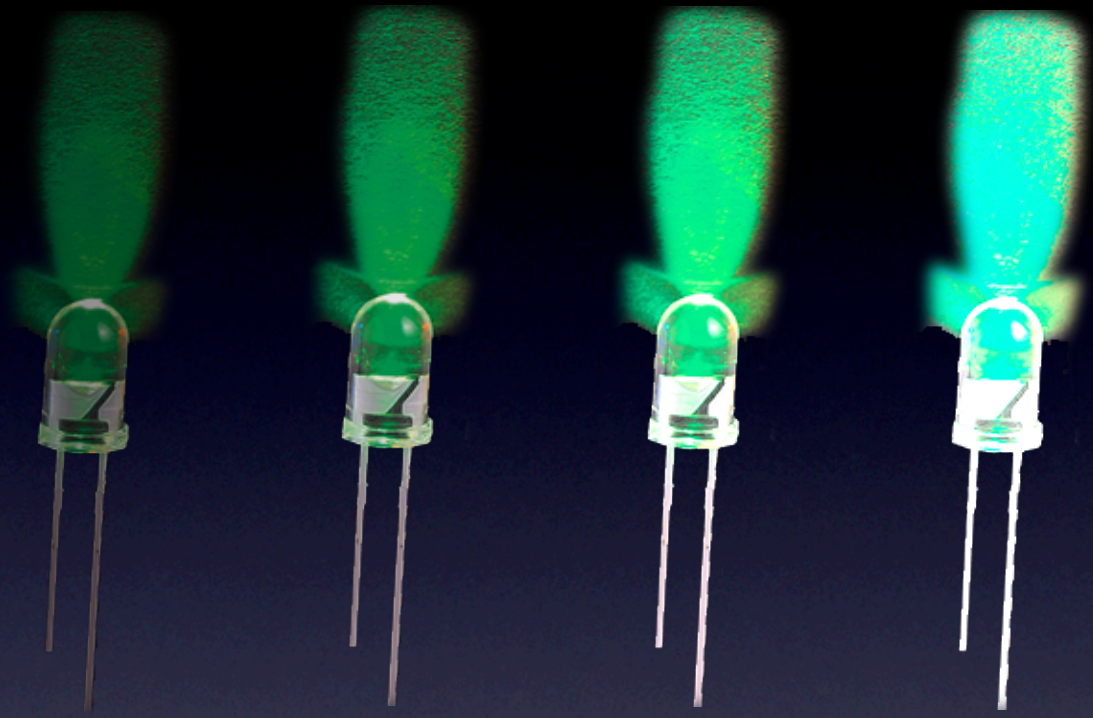
Power Supply – it matters how you connect it!

Brief Intro to LEDs and Electronics

Plus / Positive (+)

Minus / Negative (-)

LED Brightness



More current → More brightness!

LED

LED Brightness

But, we will use a trick:

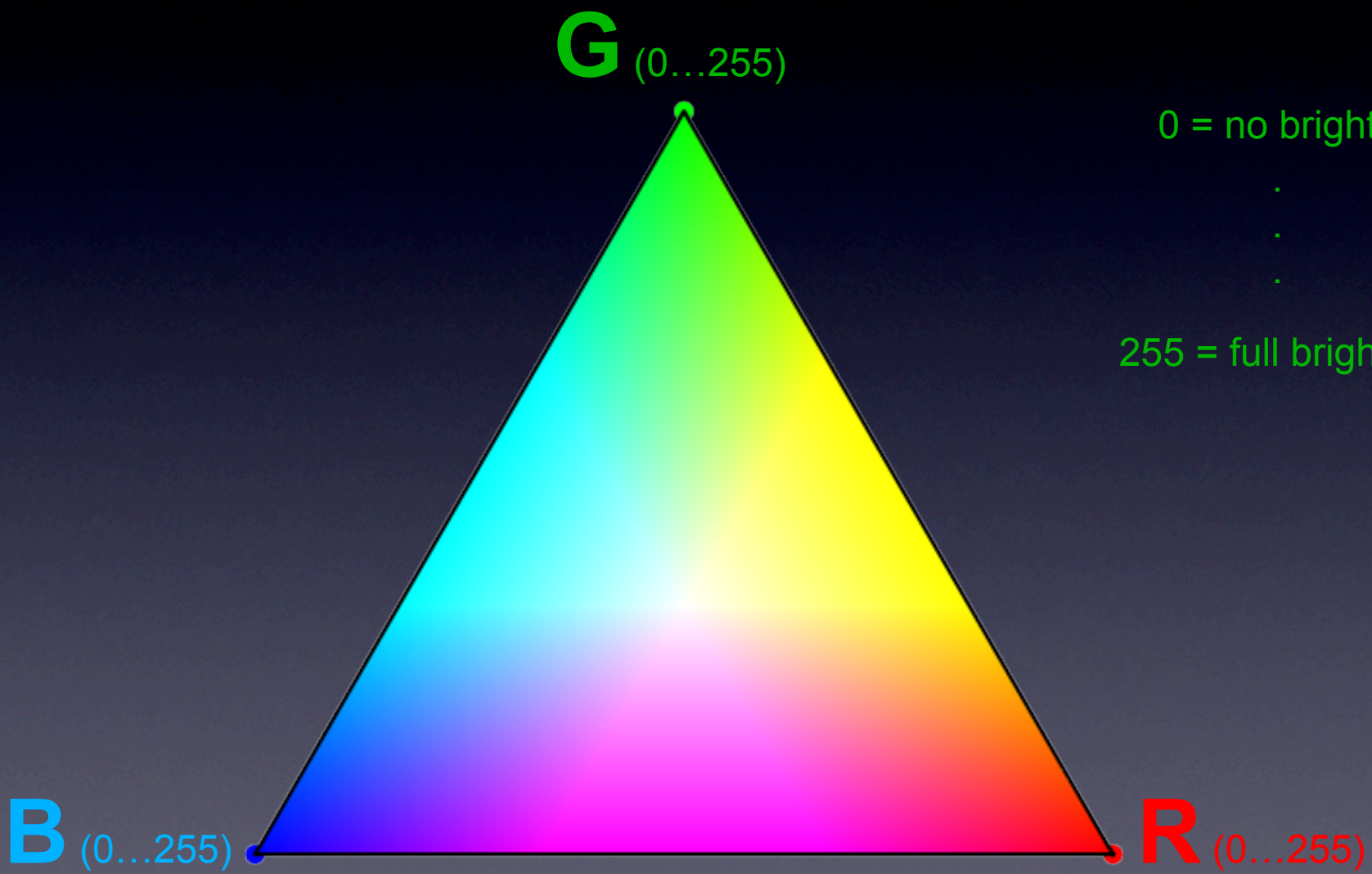
PWM

(coming soon…)

Light Color Mixing

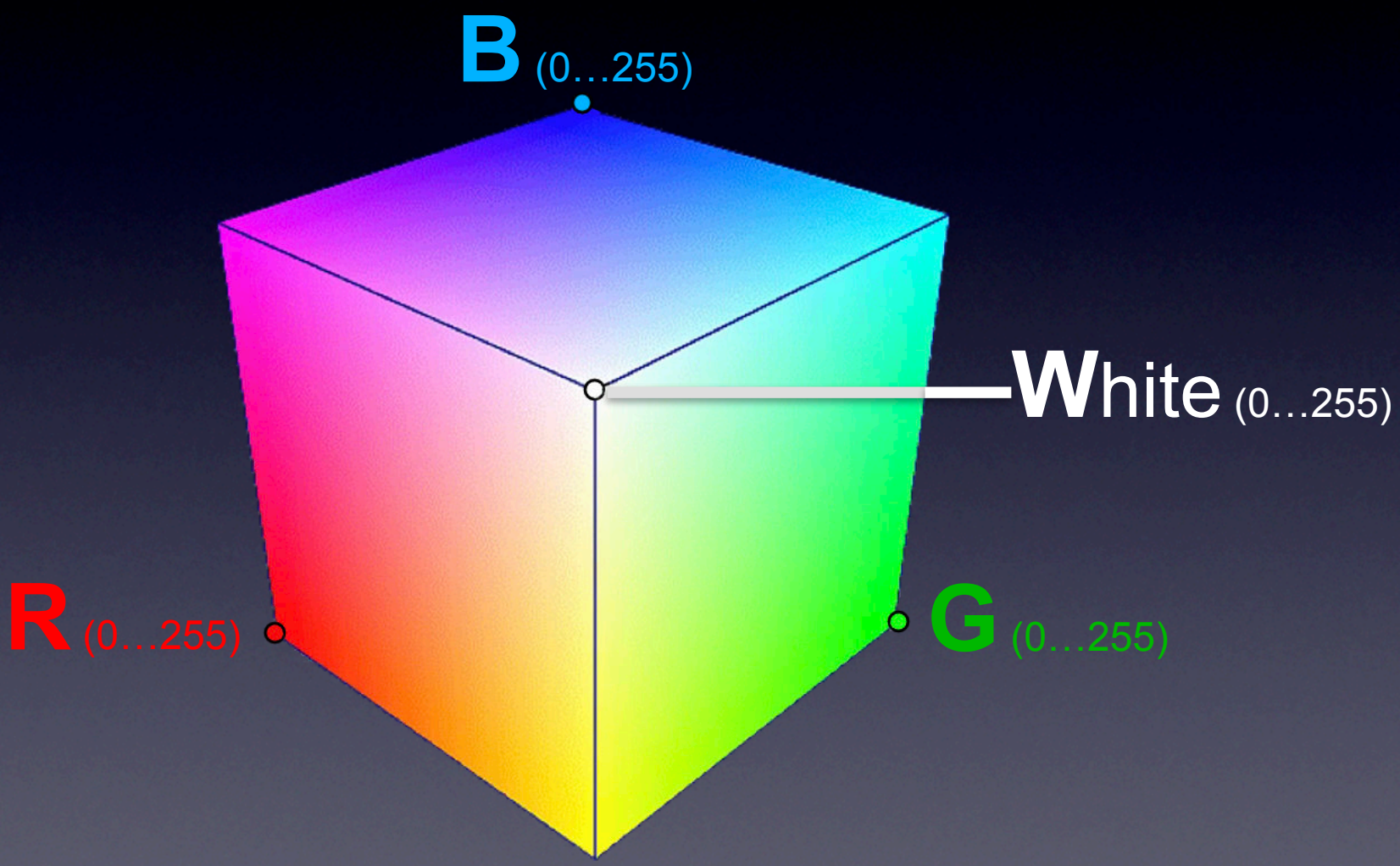
Light Color Mixing

RGB Color Triangle



Light Color Mixing

RGBW Color Cube



LED Brightness

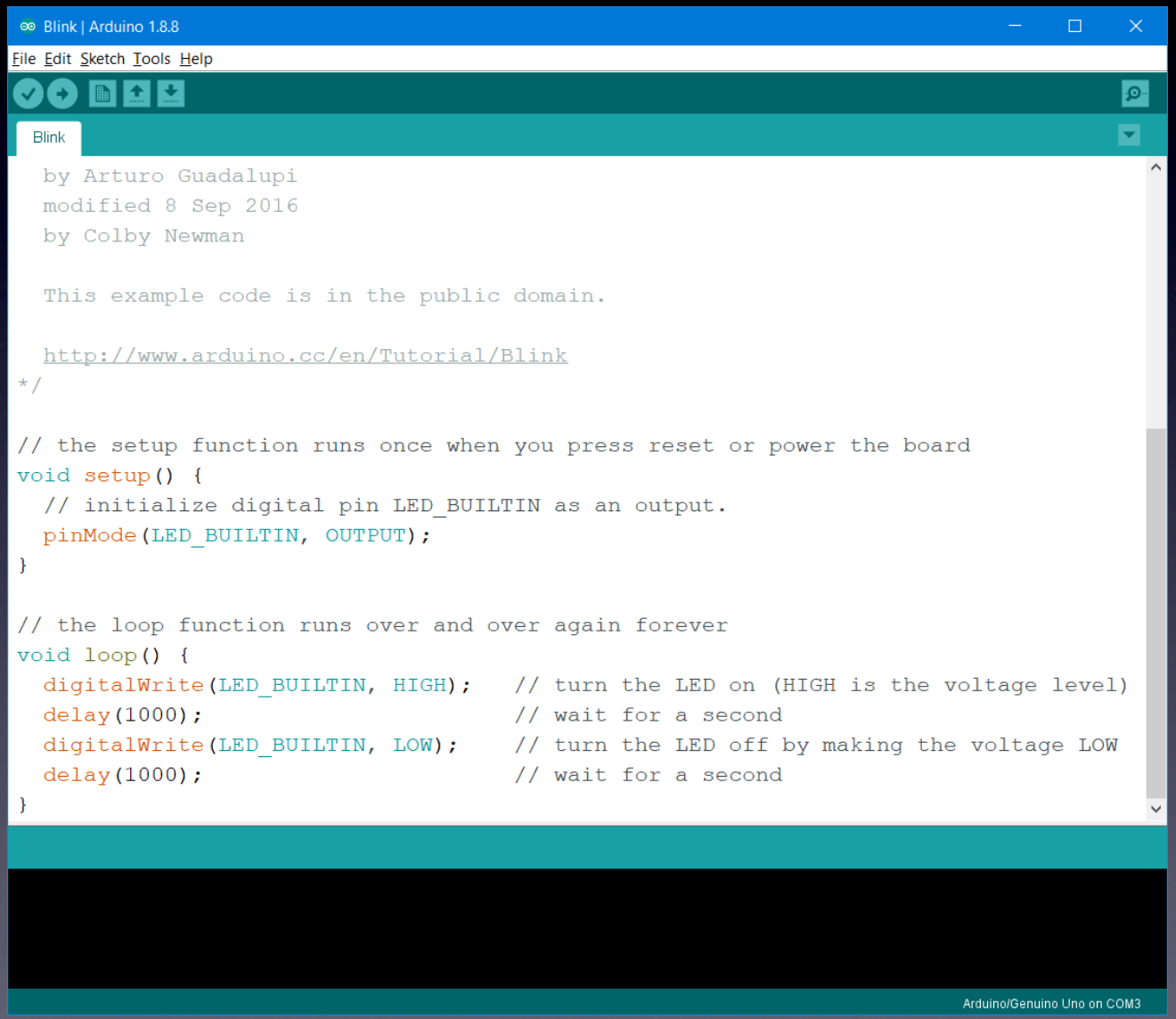
We will use a trick:

PWM

(to control "brightness" with a computer chip)

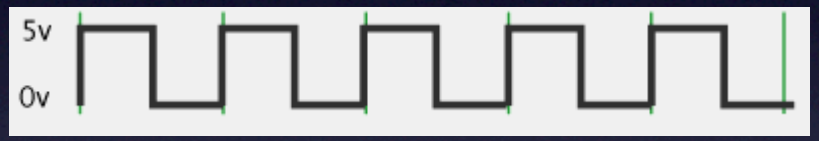
Arduino

Hacking the Blink sketch



LED Brightness

PWM

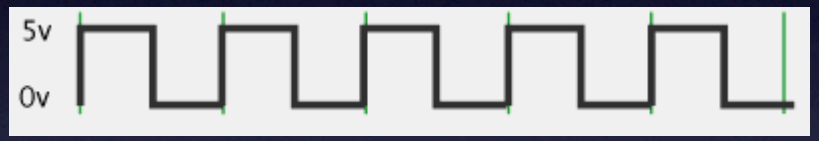


Square Wave:

ON half the time / OFF half of the time

LED Brightness

PWM



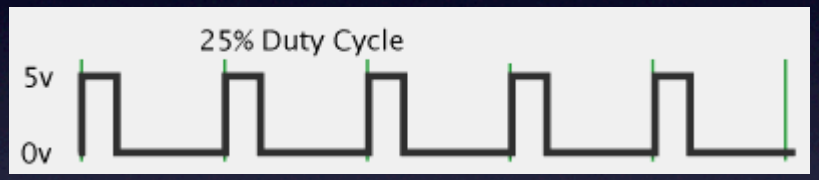
Square Wave:

ON half the time / OFF half of the time

(half the energy of ON all the time)

Digital Signal Processing

PWM



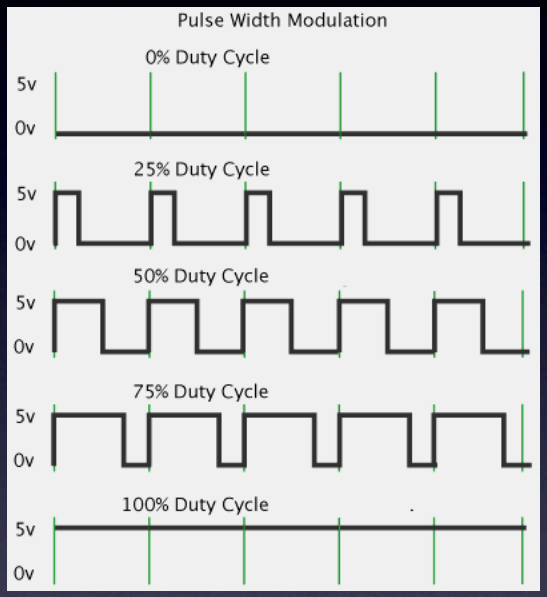
Pulse Wave (different Pulse Widths):

ON and OFF at any ratio you like

This waveform: ON for 25% of the time / OFF for 75% of the time

LED Brightness

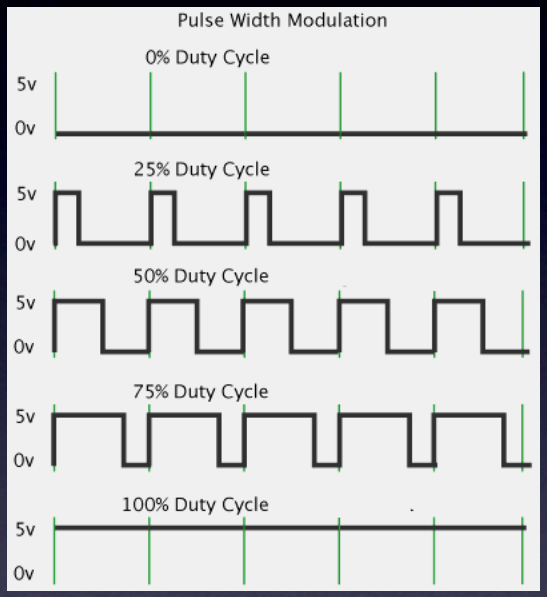
PWM



Pulse Wave (different Pulse Widths):

ON and OFF at any ratio you like

LED Brightness



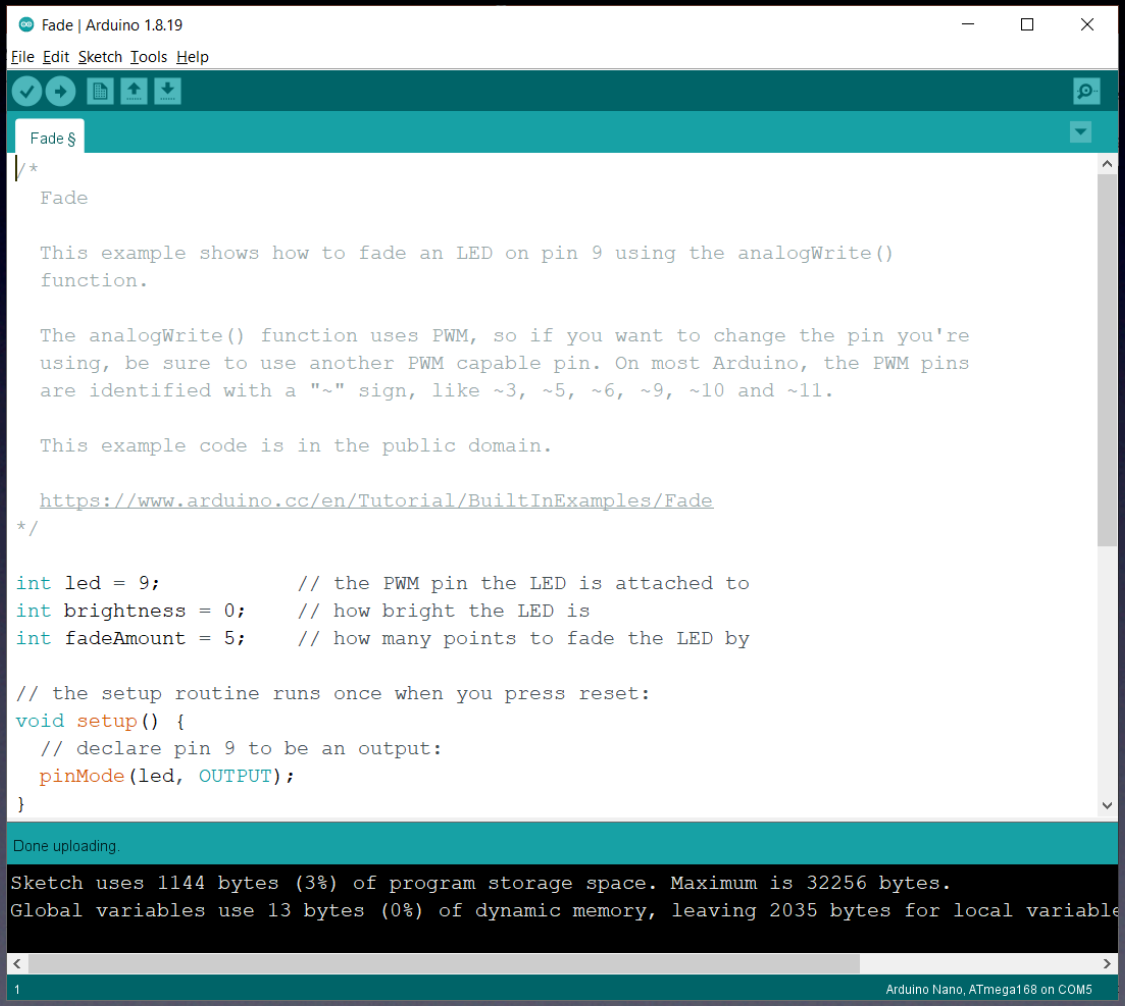
PWM

Pulse Width Modulation

"Modulation" — anything that changes over time

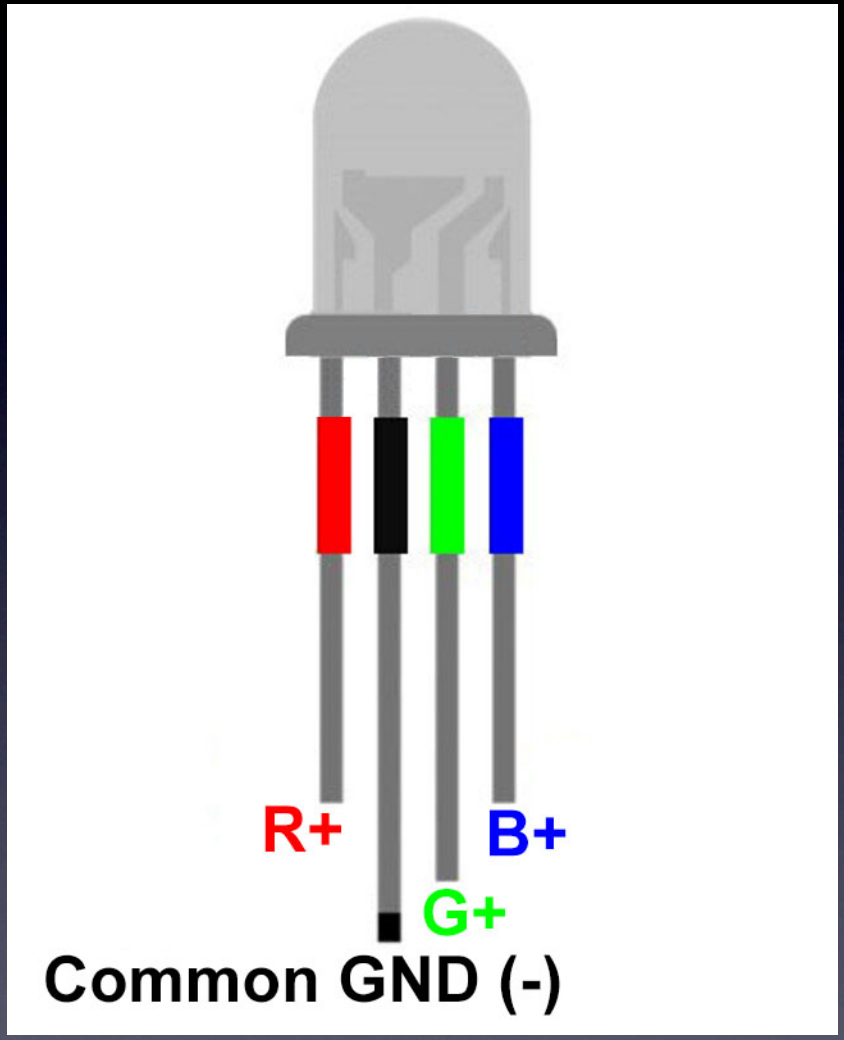
Arduino

Example “sketch”: Fade

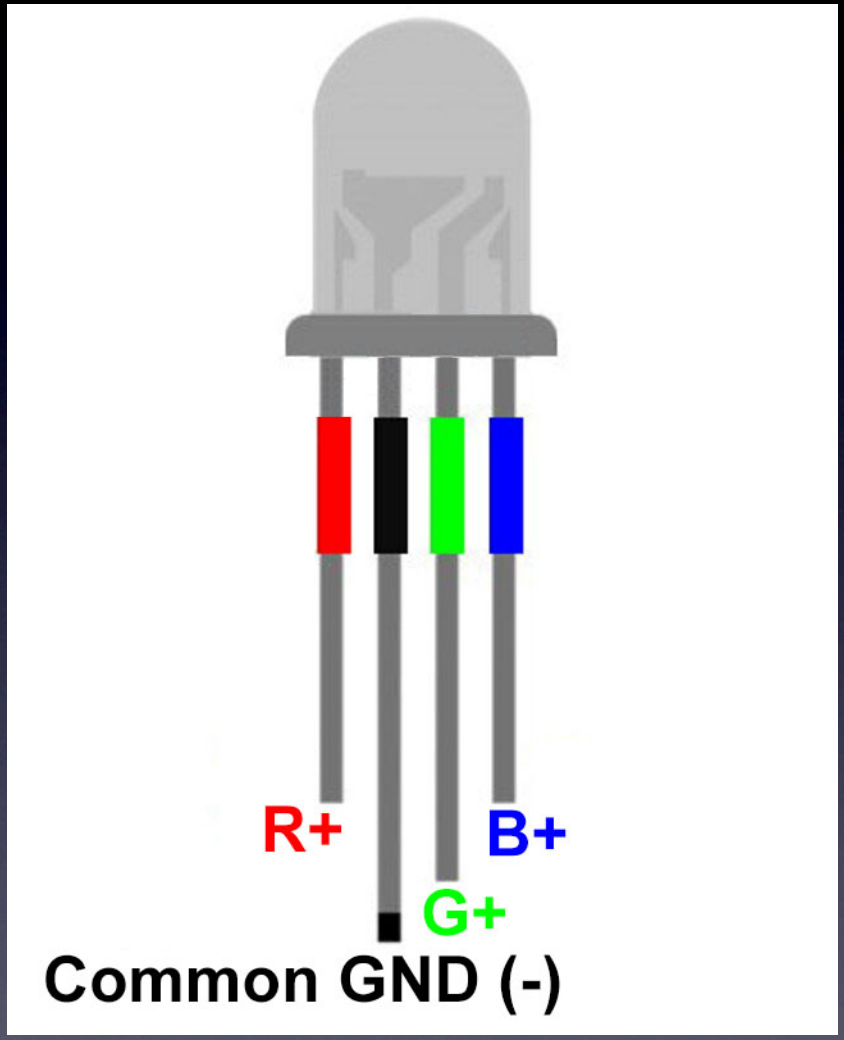


Uses PWM to fade an LED on and off

RGB LED

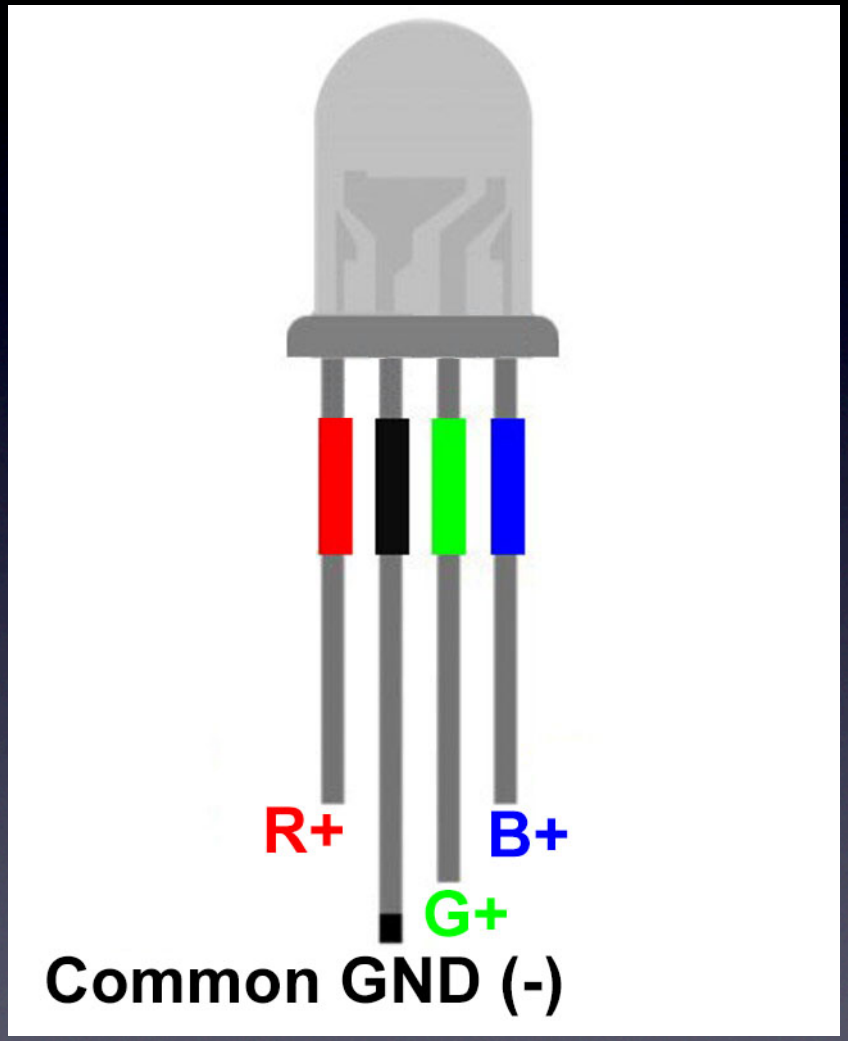


RGB LED



Can use PWM with a microcontroller
to control brightness of **R** *and* **G** *and* **B**

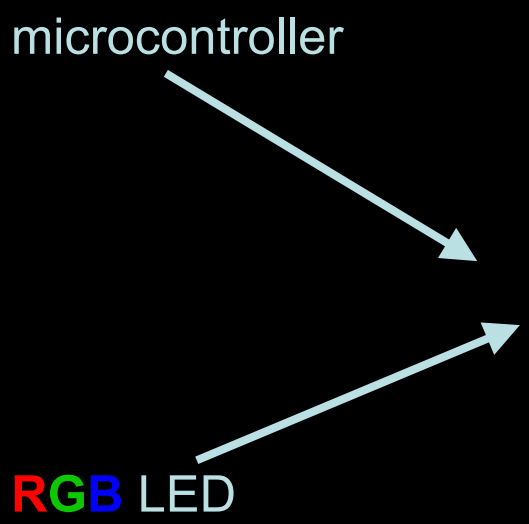
RGB LED



We can create any color in the RGB triangle!

Can use PWM with a microcontroller to control brightness of R and G and B

RGB LED with microcontroller (Example)



RGB LED

Contains:

** microcontroller*

** RGB LED*

WS2812B

RGB LED

Contains:

** microcontroller*

** RGB LED*

WS2812B

“Neopixel”

RGB LED Strips

Each pixel contains:

** microcontroller*

** RGB LED*

WS2812B strip

“Neopixel” RGB LED strip

RGB LED Strips

Each pixel contains:

** microcontroller*

** RGB LED*

To control all pixels, we only need:

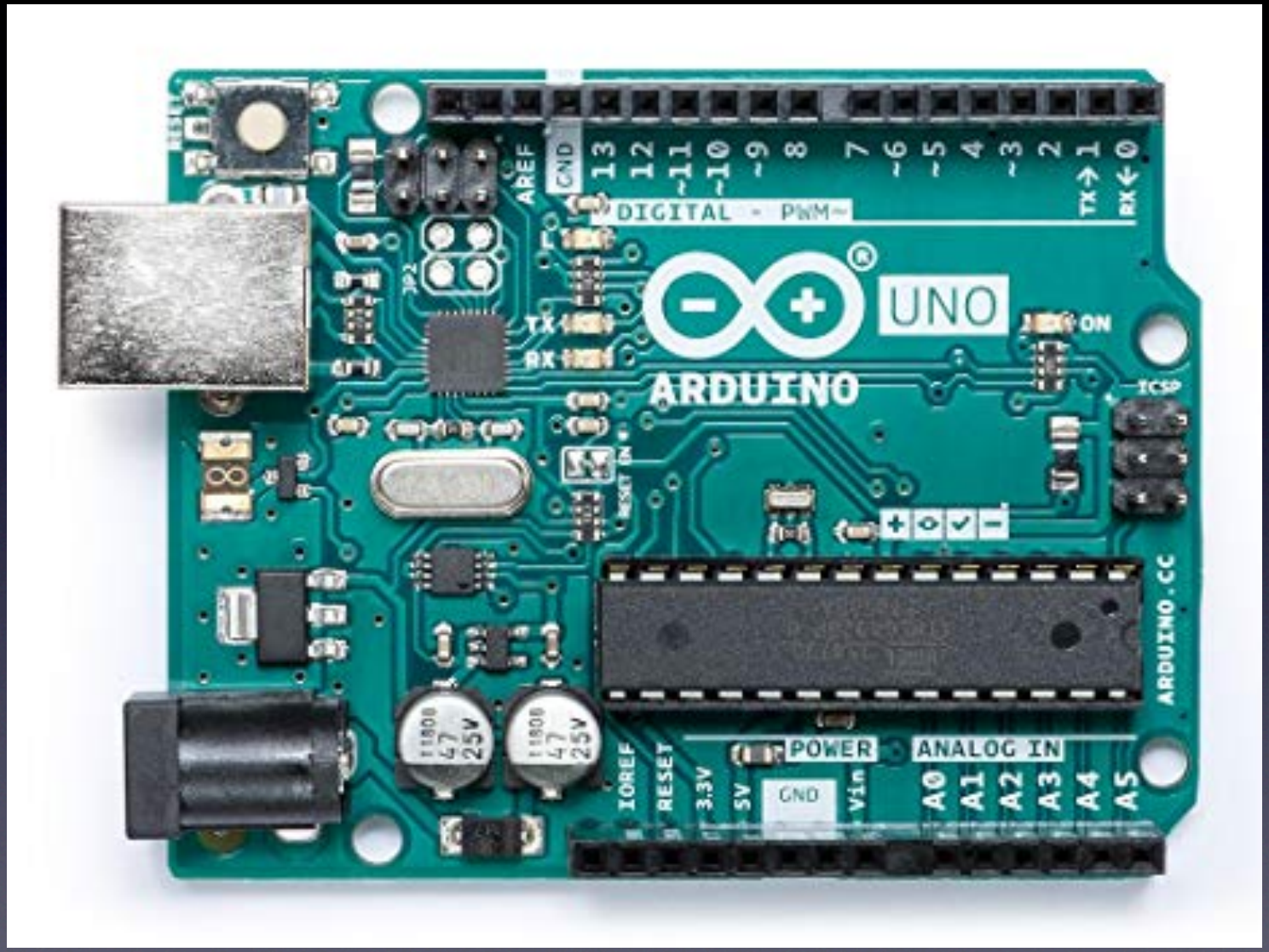
* +5V and GND

* control data from a microcontroller data

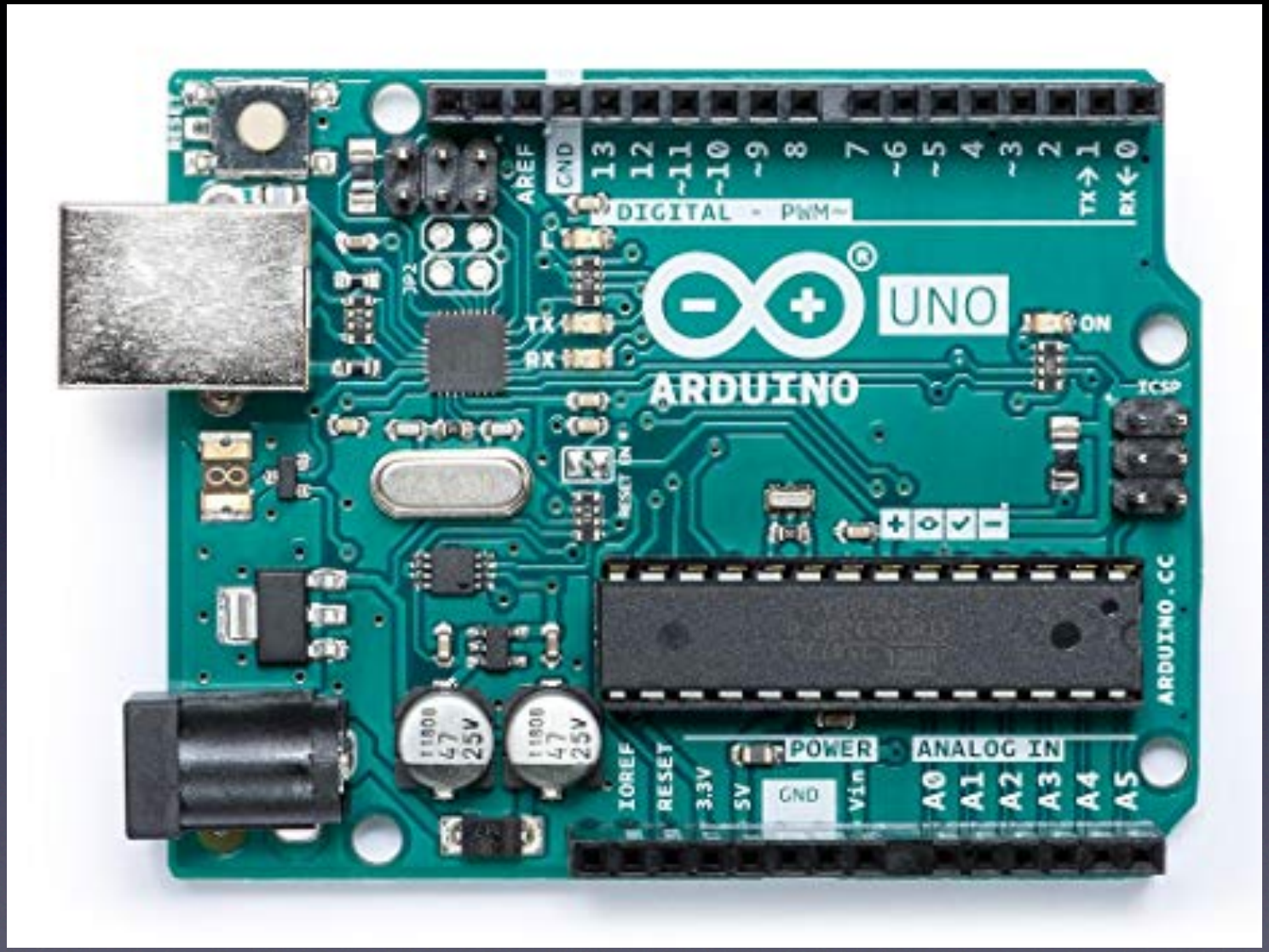
WS2812B strip

“Neopixel” RGB LED strip

Intro to Arduino

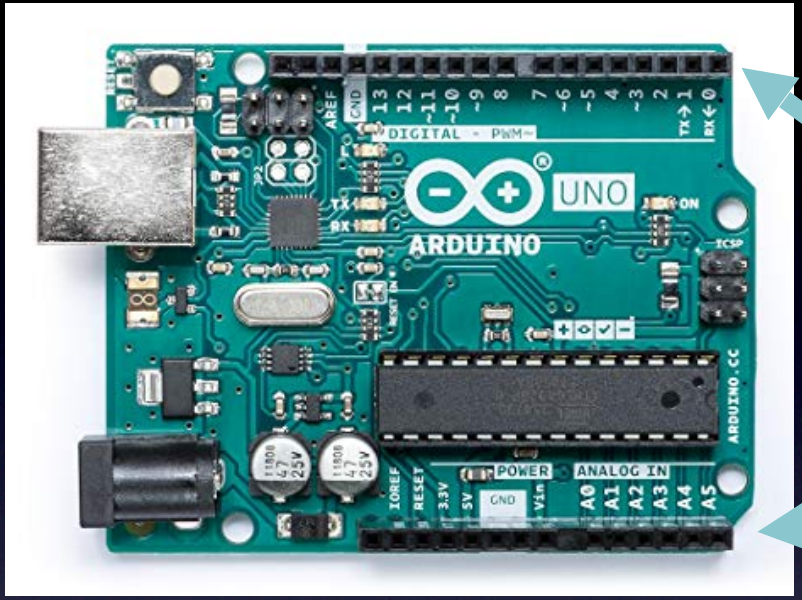


Intro to Arduino



Created for non-geeky artists

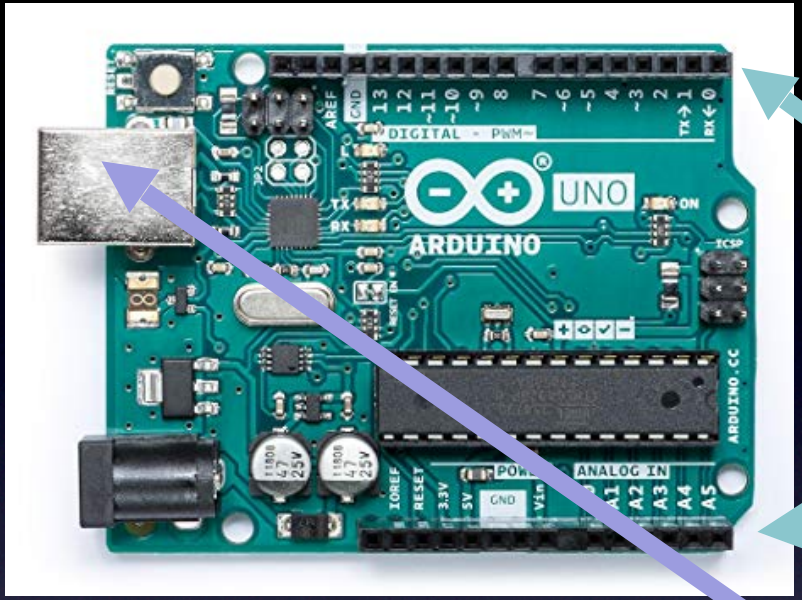
Intro to Arduino



Super easy to
connect parts
to its microcontroller's pins

Use an Arduino board

Intro to Arduino

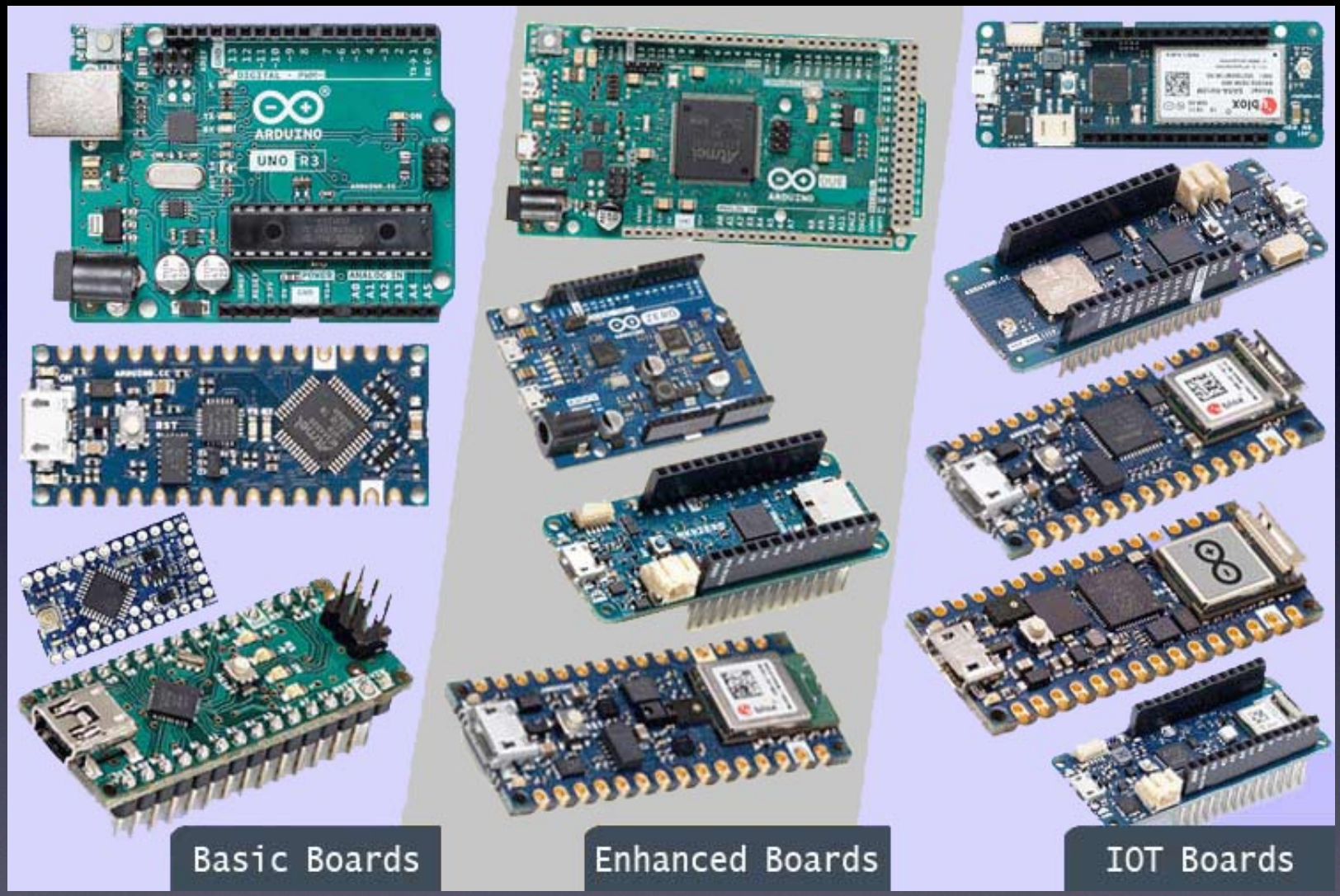


Use an Arduino board

Super easy to
connect parts
to its microcontroller's pins

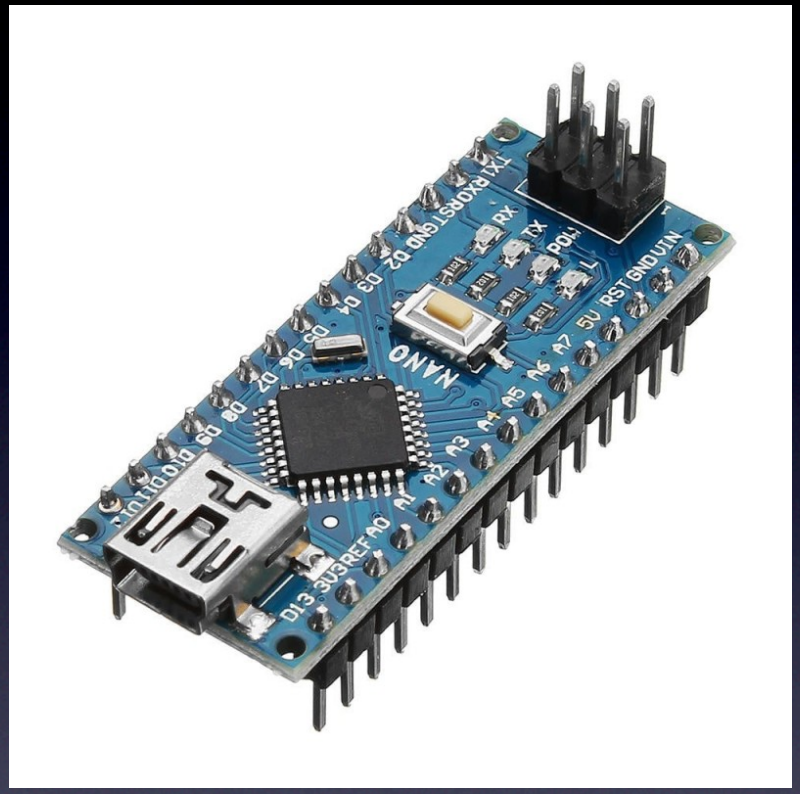
Super easy to
create and upload a program
to control the parts

Intro to Arduino



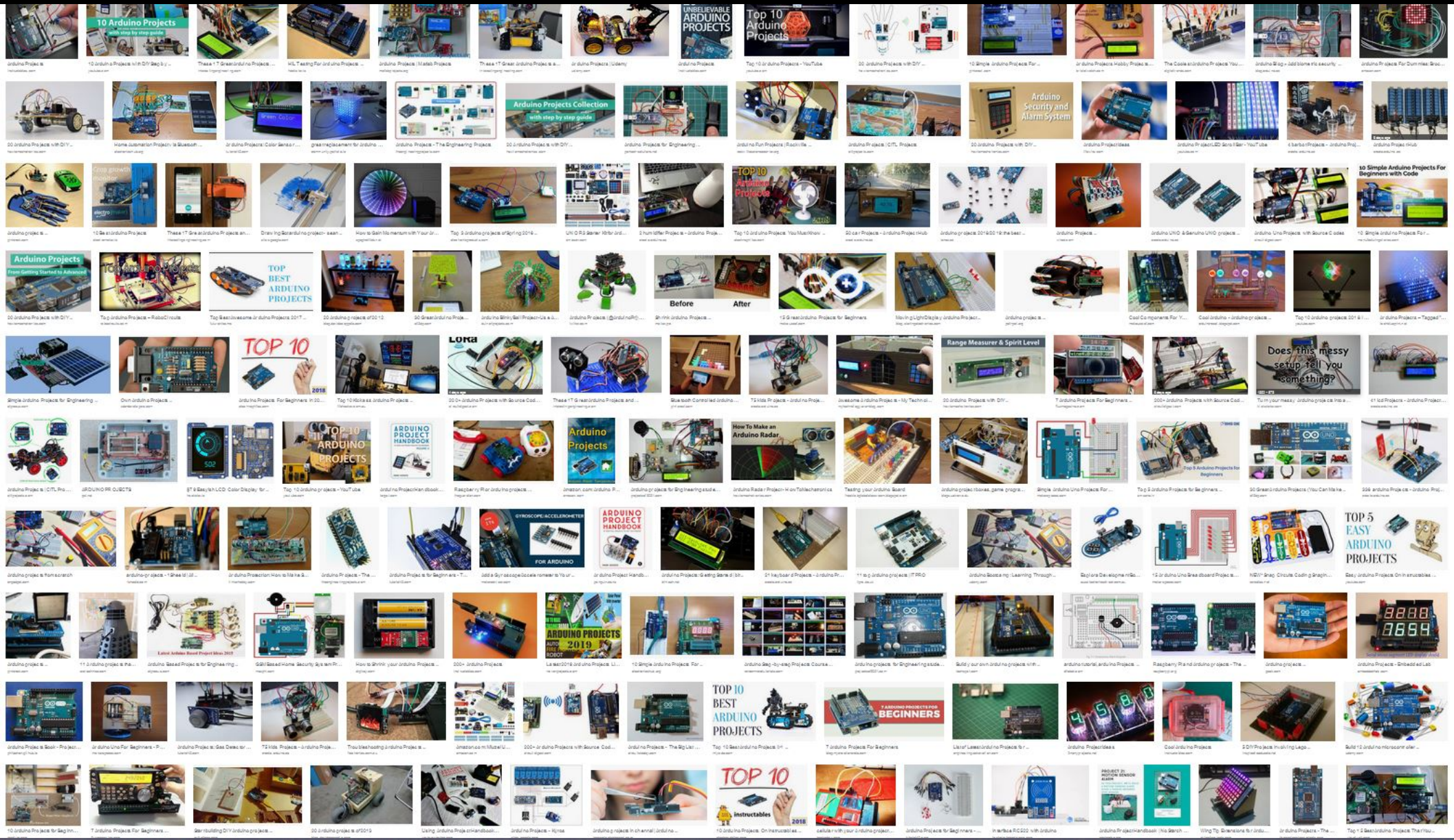
Open Source

Intro to Arduino



Arduino Nano “clone”

Intro to Arduino



hundreds of thousands of projects online!

Intro to Arduino

Arduino For Total Newbies workshop

Day 3 Tuesday 29-December, 13:00 to 16:30

→ → ***Right-click on this link, and open in a new windo***
Arduino For Total Newbies workshop room on Big Blue

NOTE: You do NOT need to register to take this works
Just show up before the start time at the Big Blue Button room, given above.

Learn Arduino
using TV-B-Gone
as an example project
(no materials required)

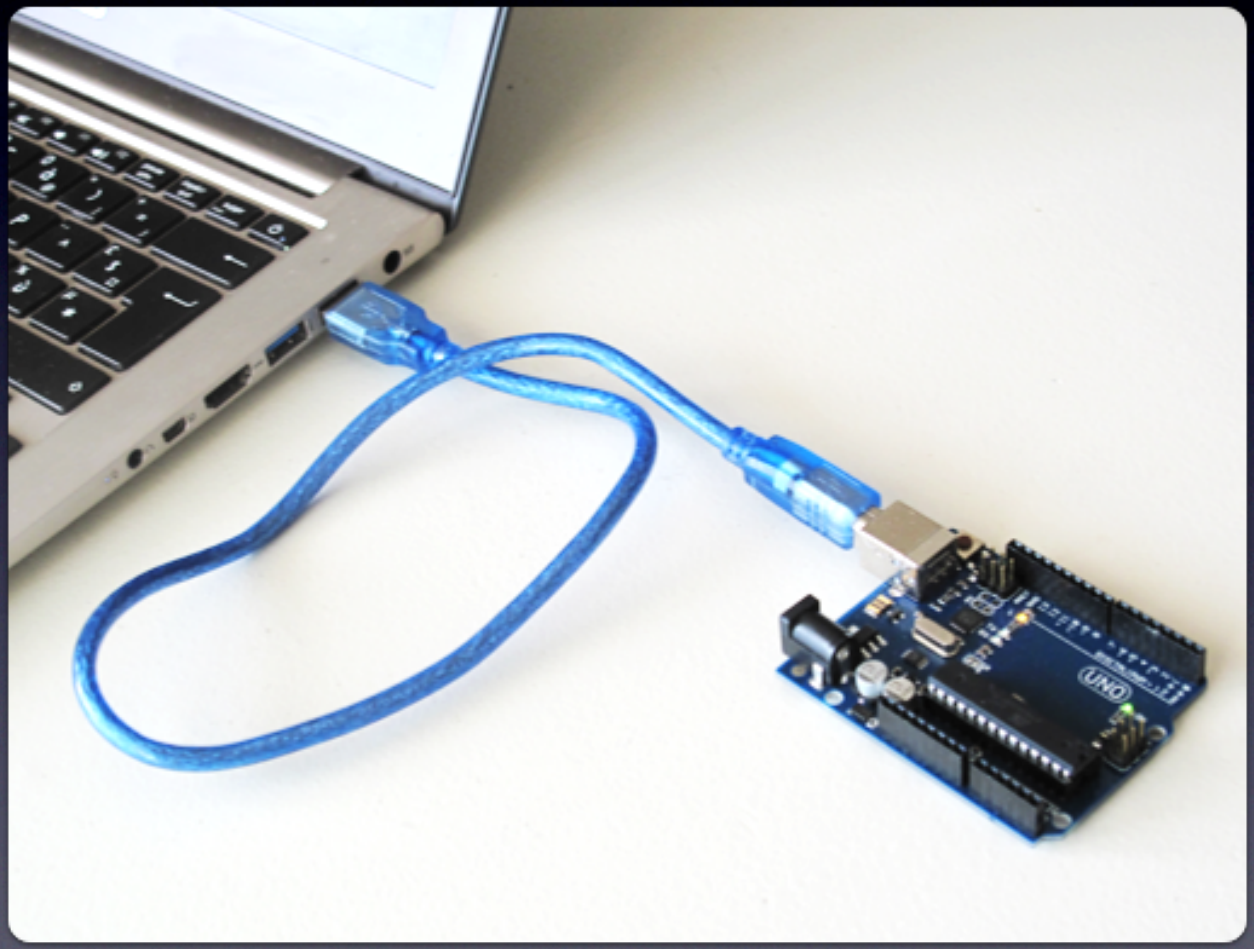
Arduino For Total Newbies workshops

Arduino

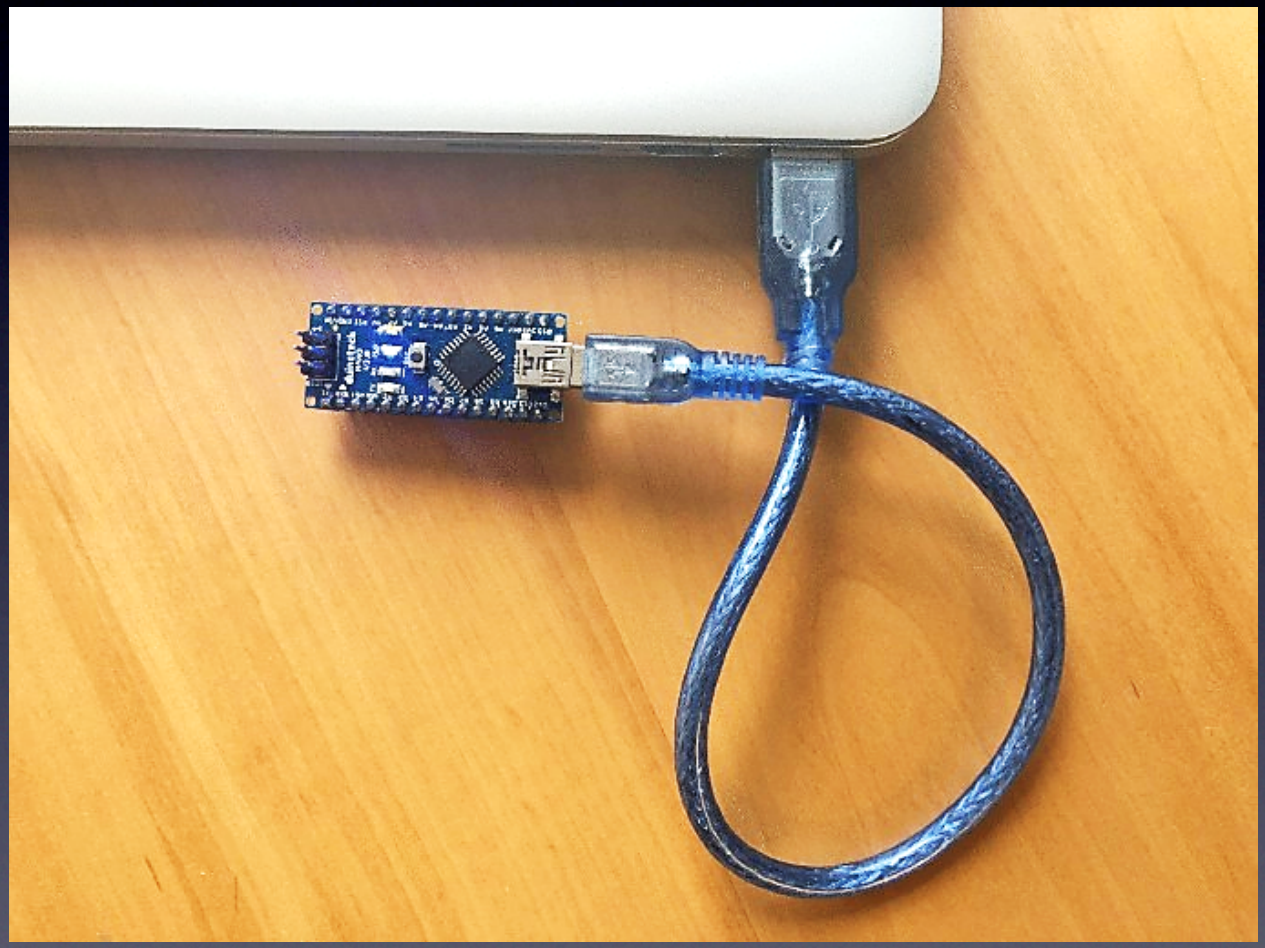
For more info, there are many good Arduino tutorials online.
A good place to start is:
<https://www.arduino.cc/en/Tutorial/HomePage>

Windows, MacOS, or Linux

Connect your Arduino to your computer



Connect your Arduino to your computer



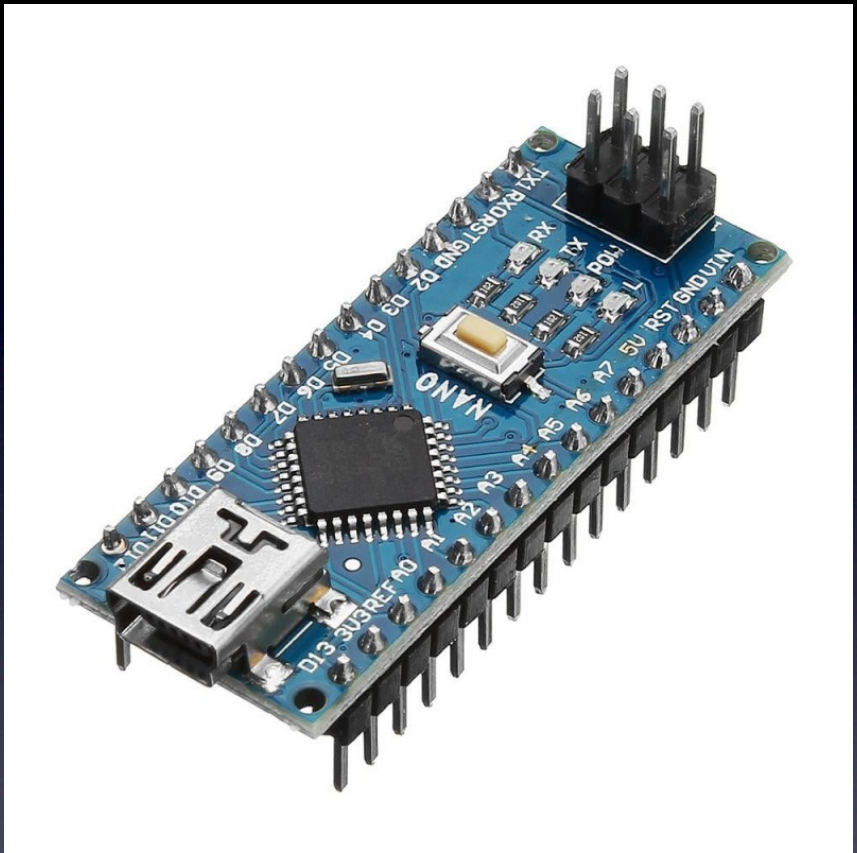
Arduino

Download and install the Arduino software
< http://arduino.cc >

Any version is fine!

Windows, MacOS, or Linux

Serial Port Driver

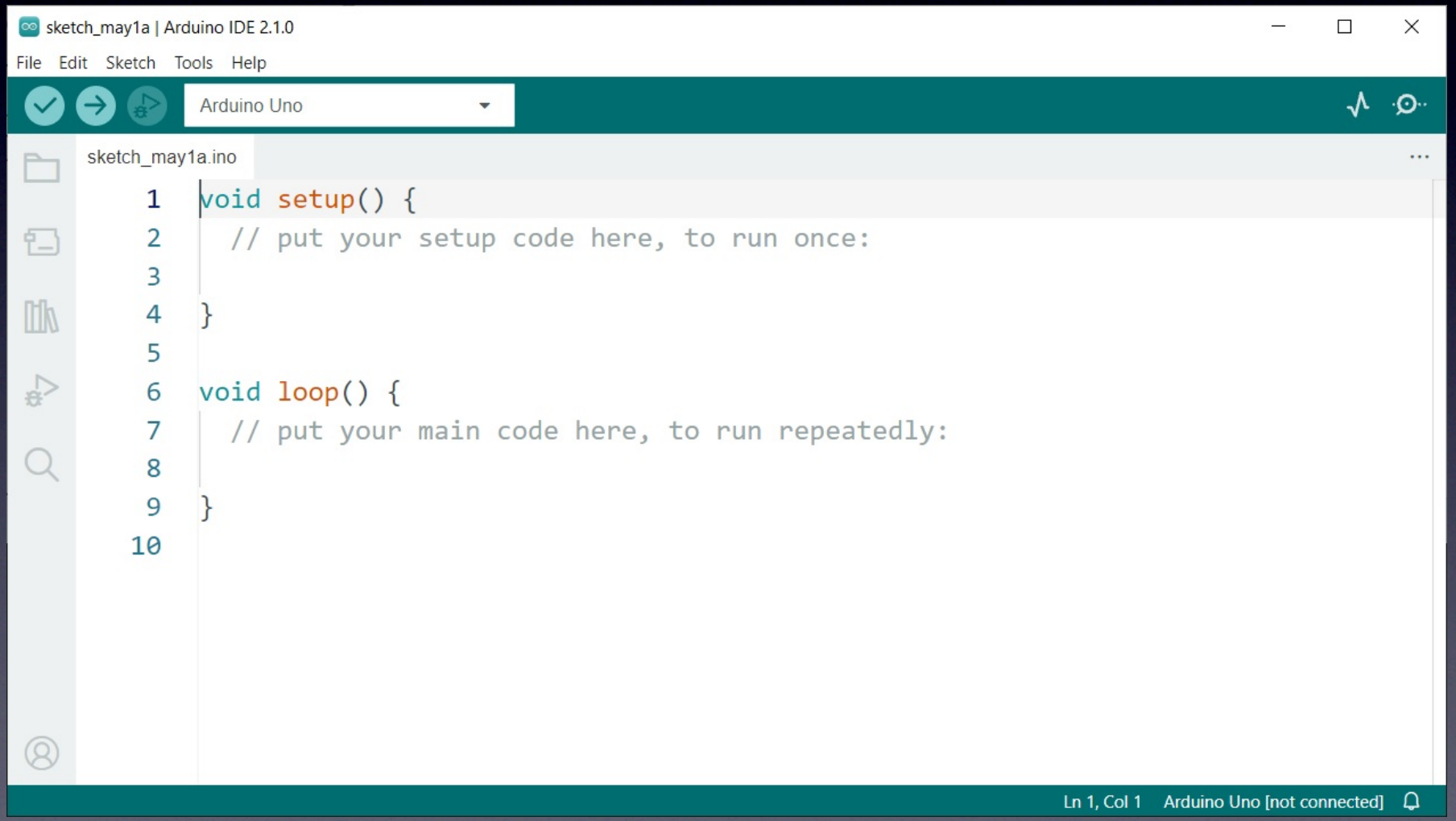


You may need to download and install a ***driver***
for your Operating System (Windows, MacOS, or Linux):

search for: "CH340 Driver"

Arduino

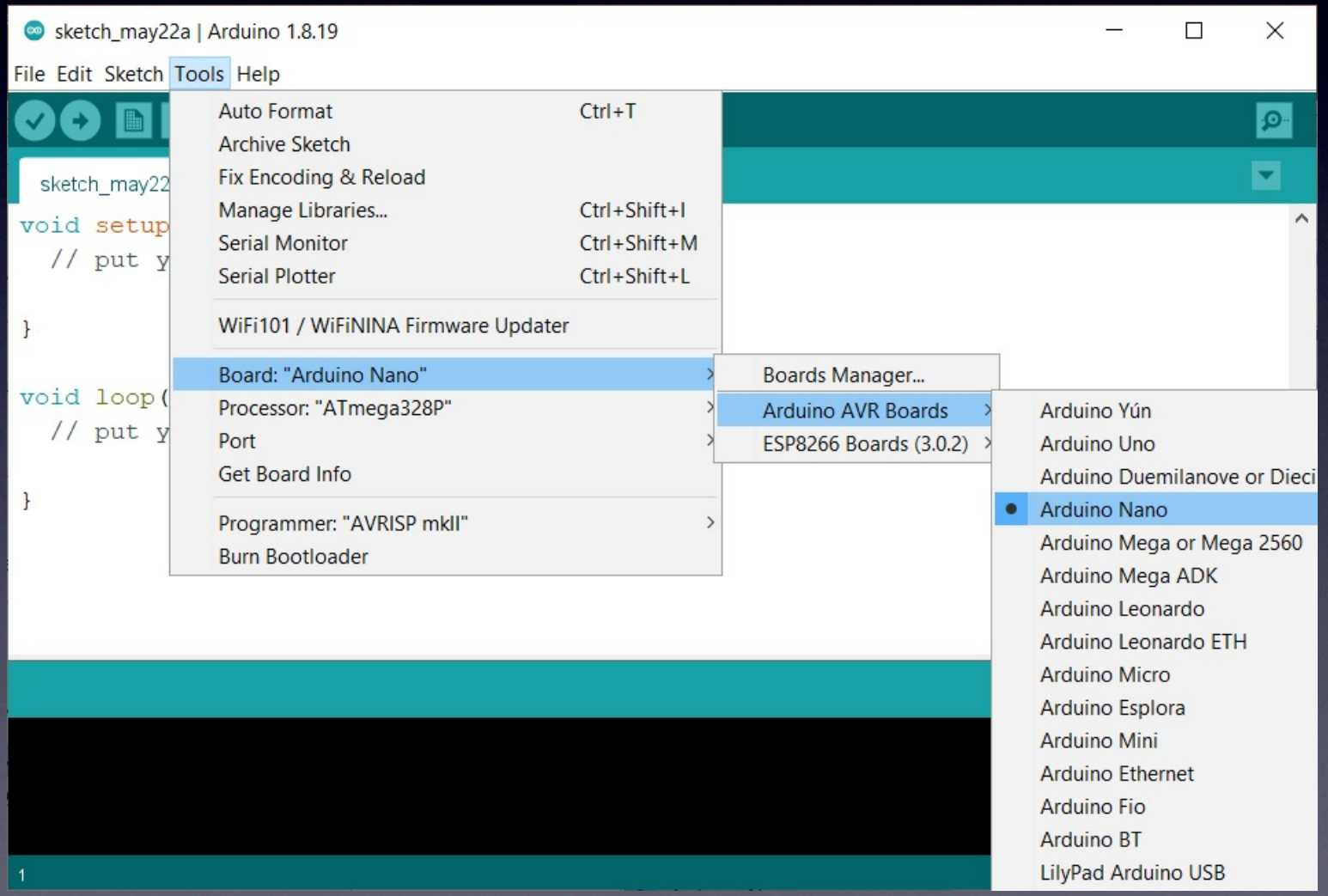
After you download and install the Arduino software start it, and you will see a screen that looks like this:



Arduino

The first time you start your Arduino software you need to set things up

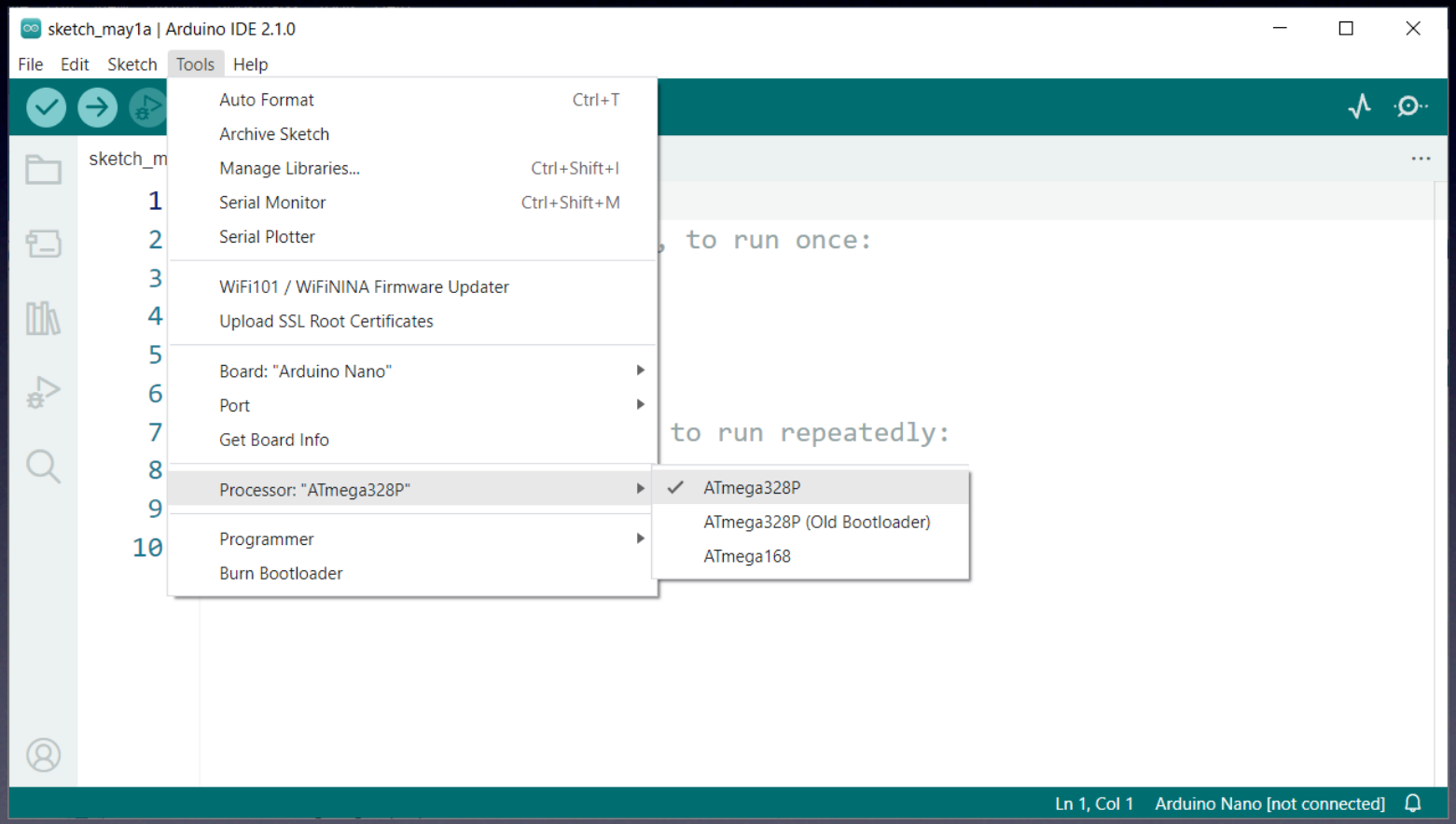
(1) Choose "Arduino Nano" as the Board



Arduino

The first time you start your Arduino software you need to set things up

(2) Choose your Processor as the Board

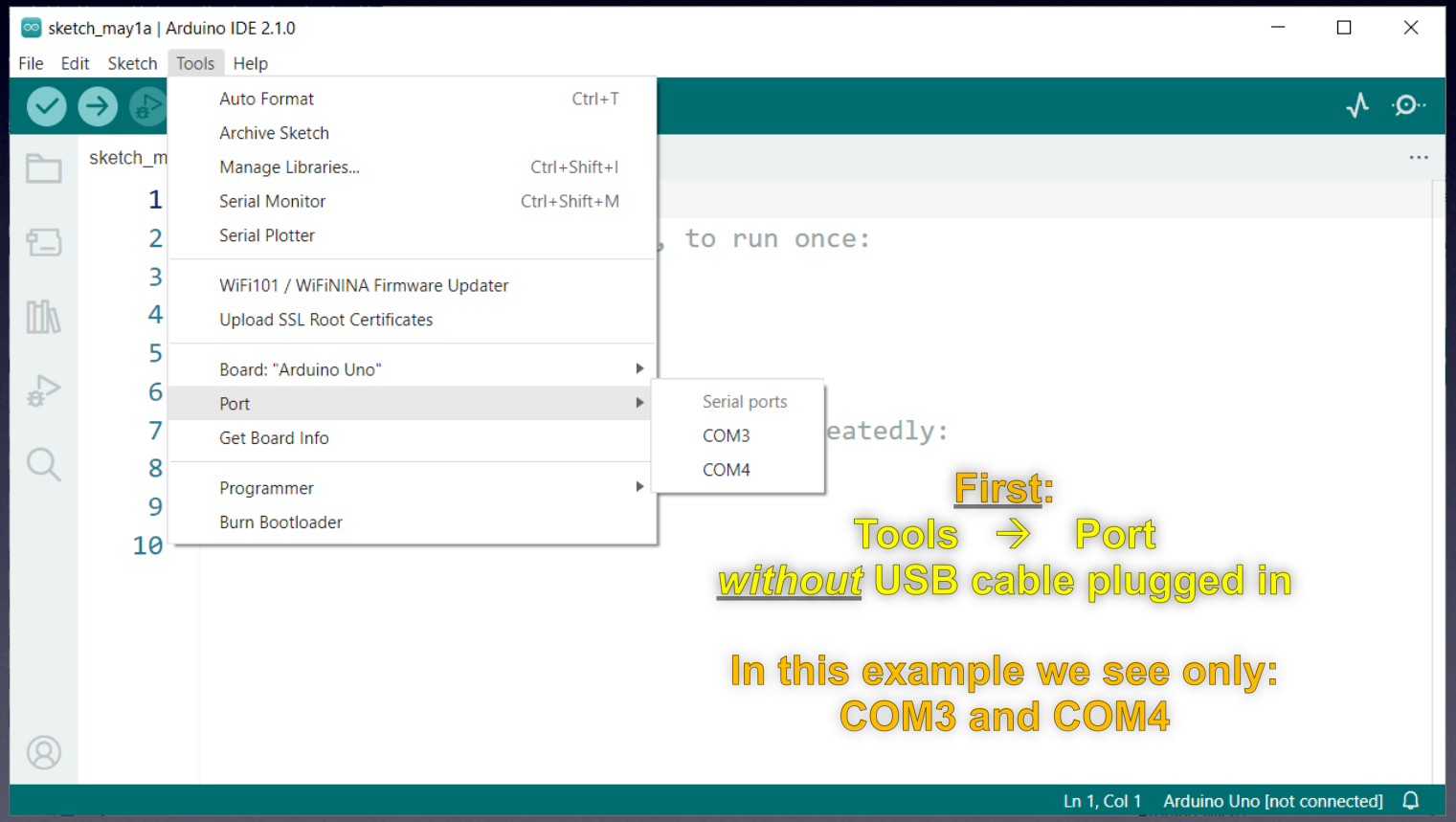


If this one doesn't work,
then
choose
"ATmega328P (Old Bootloader)"

Arduino

The first time you start your Arduino software you need to set things up

(3) Choose the Port (this will be different depending on your Operating System)

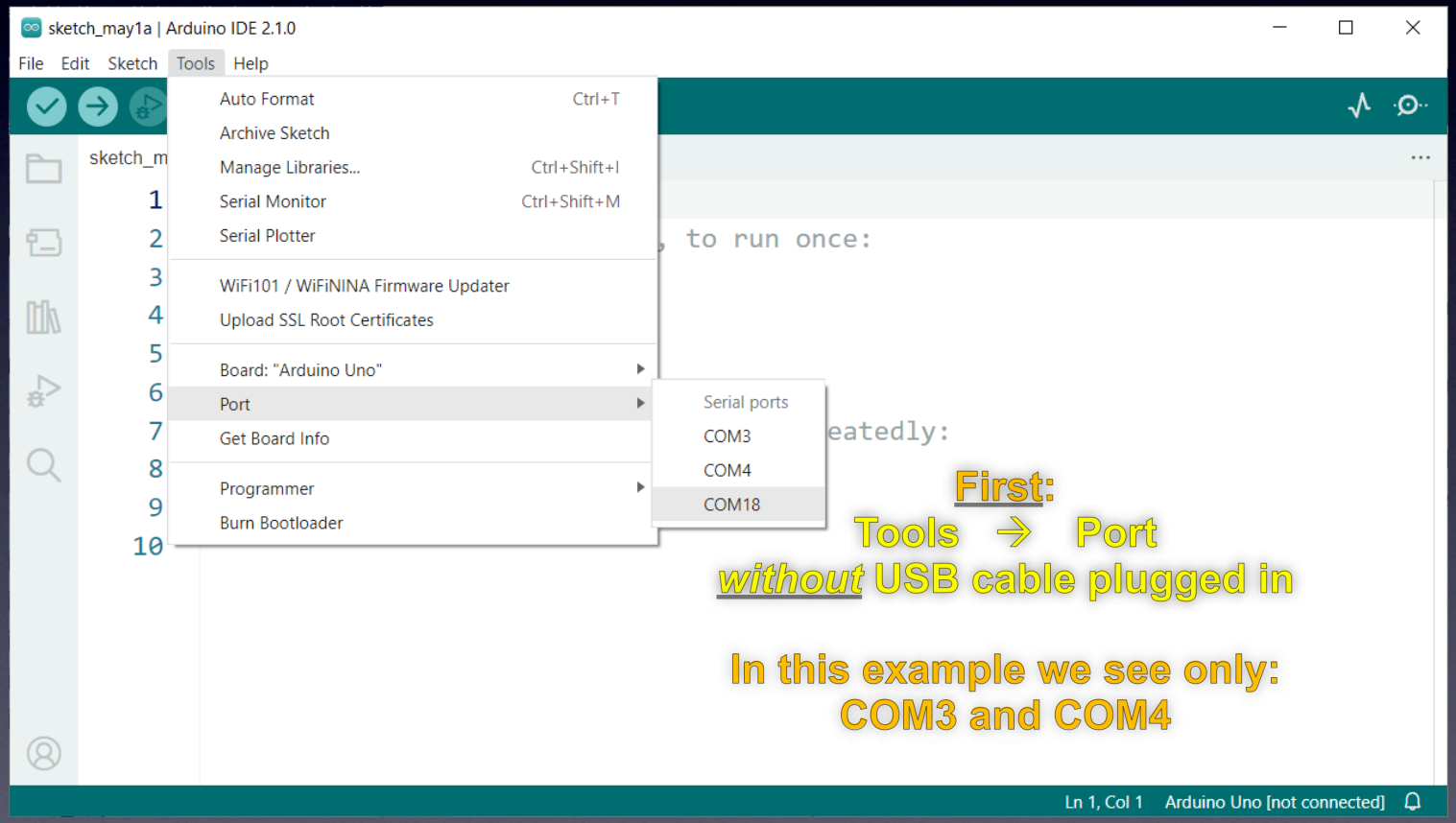


Arduino

The first time you start your Arduino software you need to set things up

(3) Choose the Port (this will be different depending on your Operating System)

(After installing the driver for your Arduino (USB-Serial adapter), with your Arduino plugged in, your operating system will see a serial port and it appears here.)

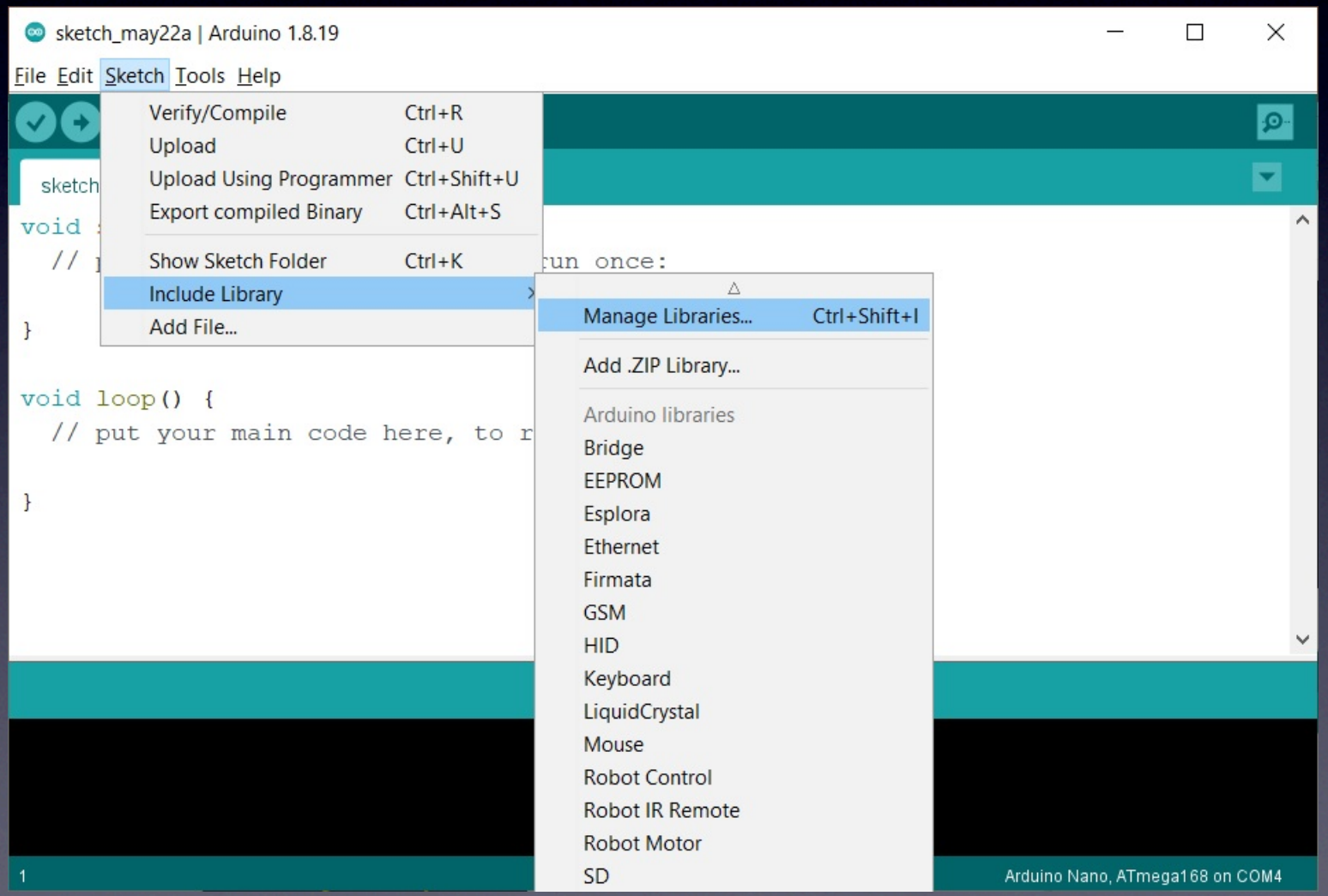


(Driver: search for: "CH340 Driver")

Arduino

The first time you start your Arduino software you need to set things up

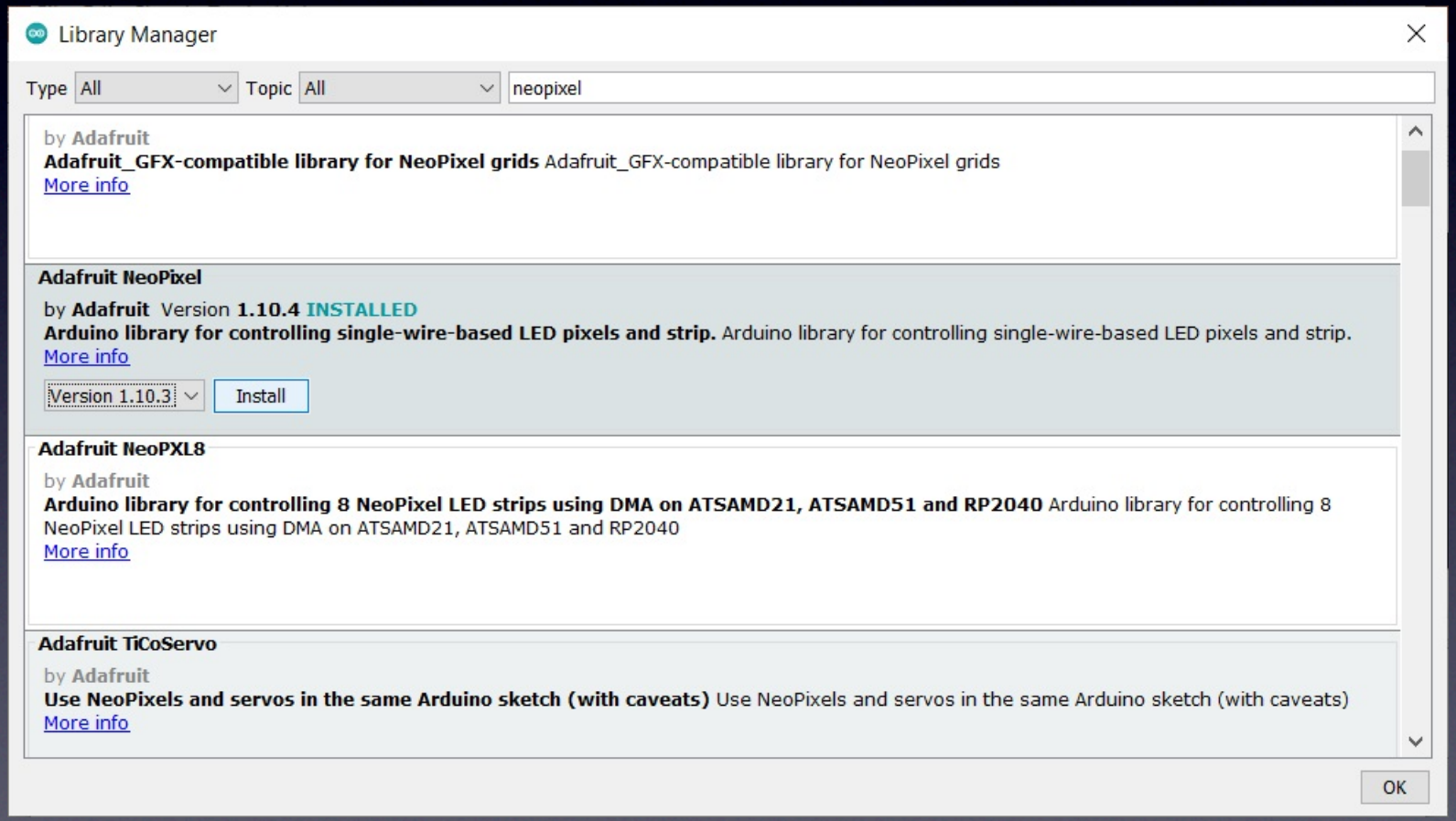
(4a) Install the Neopixel library



Arduino

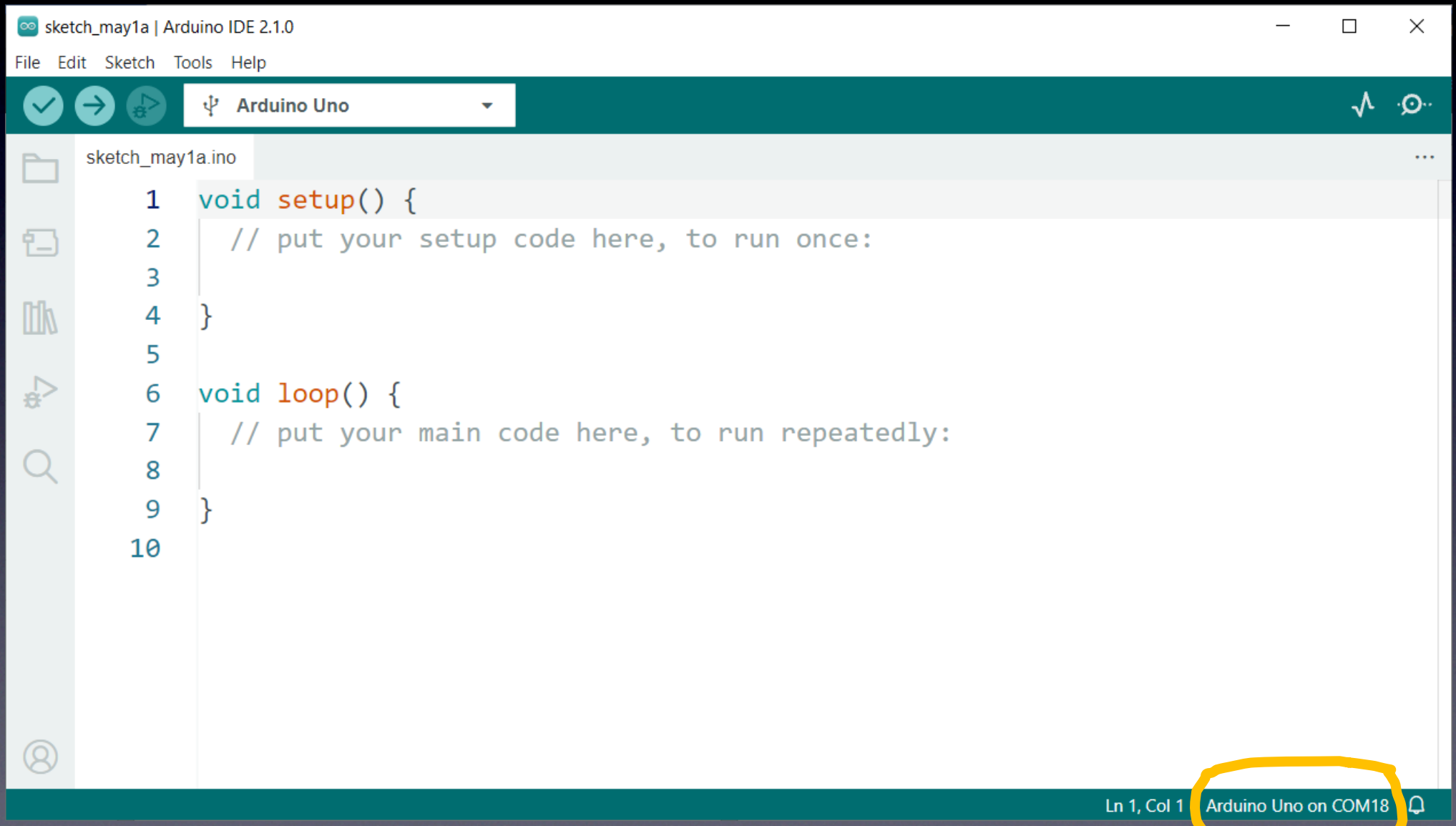
The first time you start your Arduino software you need to set things up

(4b) Install the Neopixel library



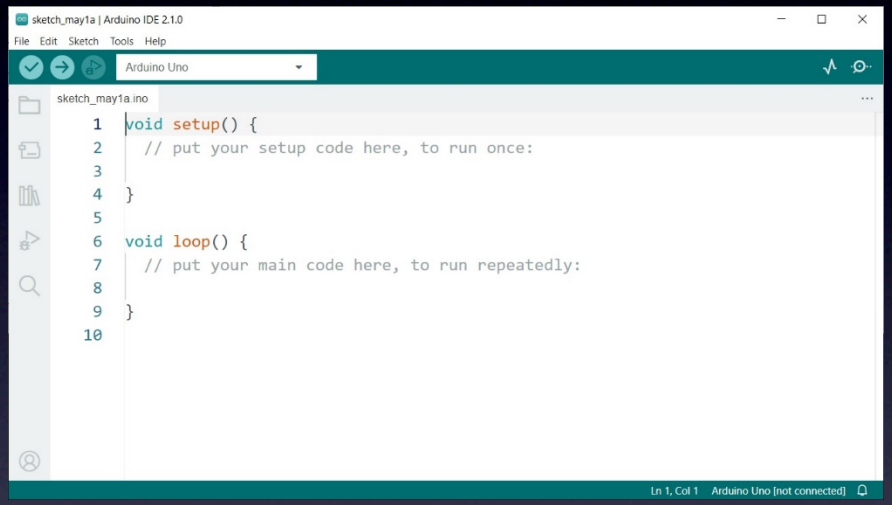
Arduino

Your Arduino software is now ready to program your *Arduino Nano* board!



Arduino

Designed for *non-geeky artists*



Definition of

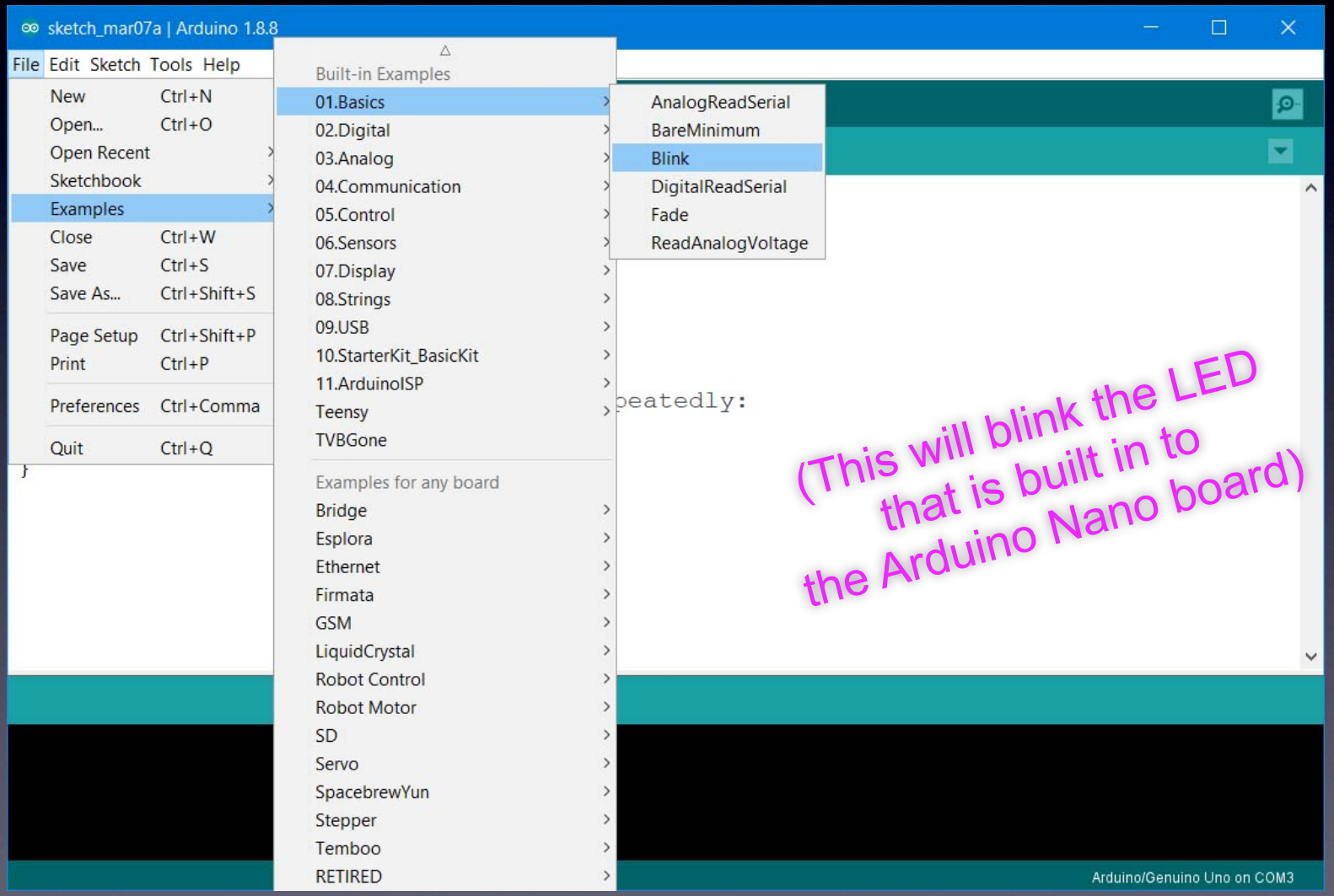
“Sketch” :

an Arduino program

Arduino

Let's start simple!

Let's all make an LED blink!



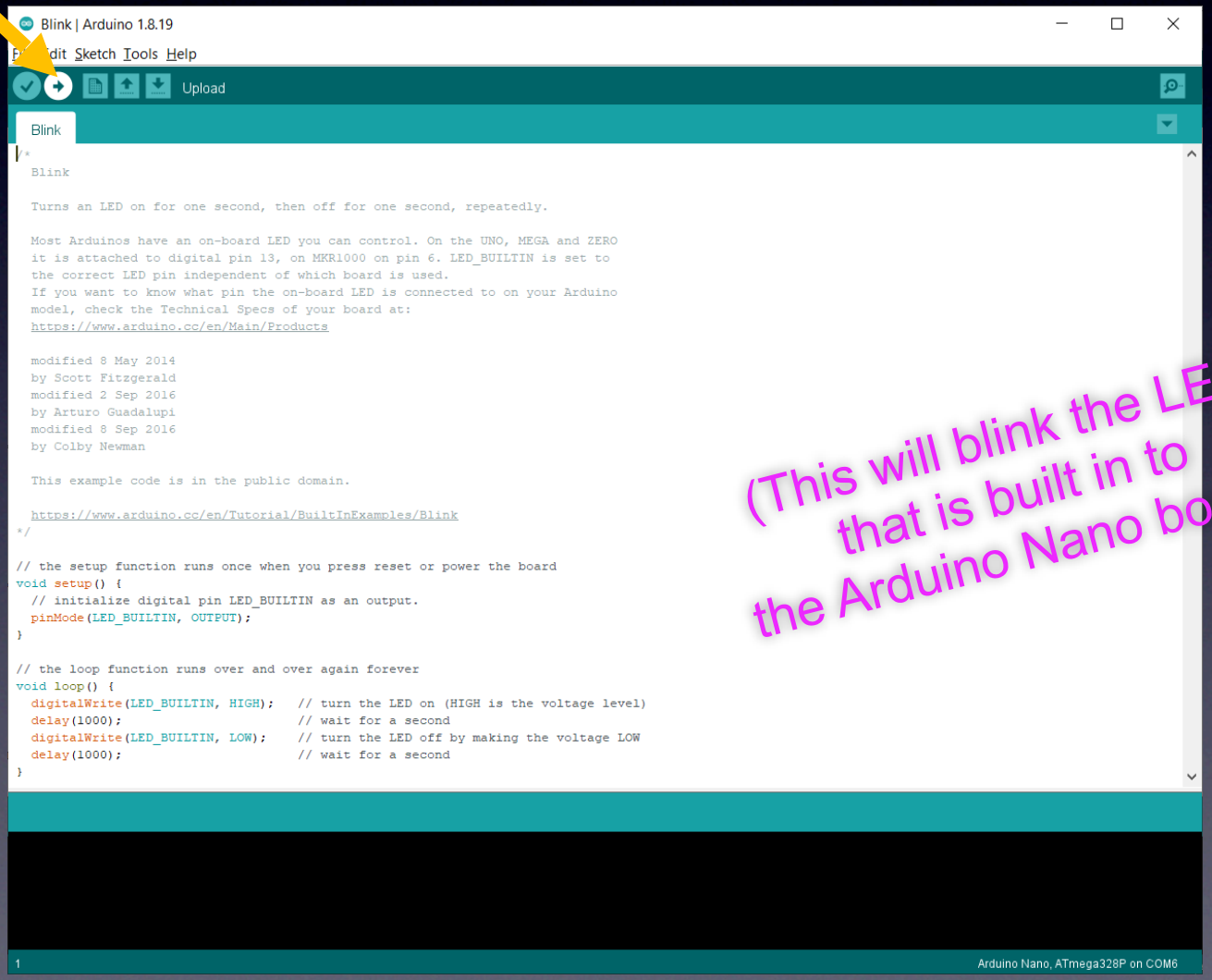
Arduino

Example “sketch”: Blink

(This will blink the LED that is built in to the Arduino Nano board)

Arduino

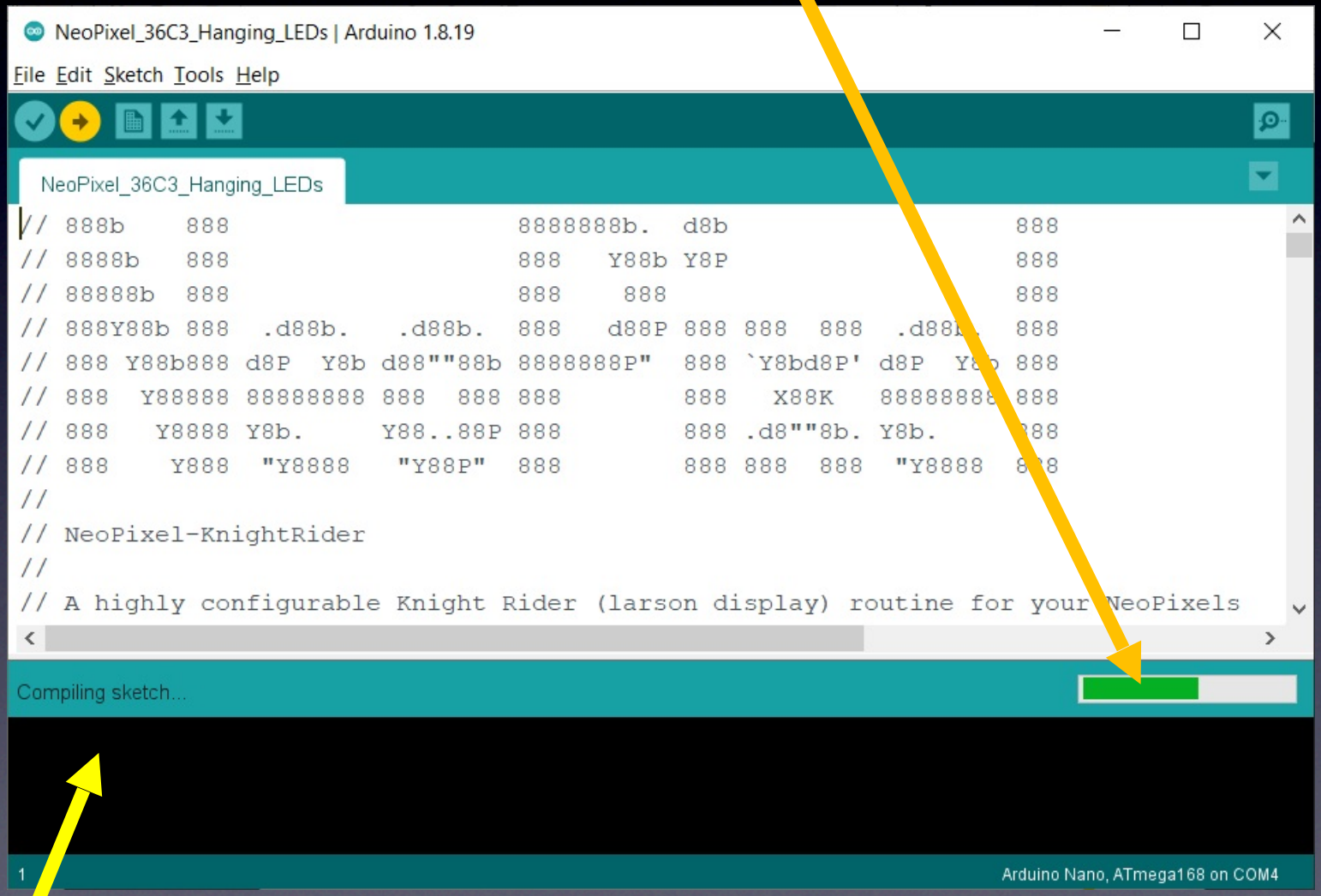
With the USB cable connected to your Arduino board press the Upload button



(This will blink the LED that is built in to the Arduino Nano board)

Arduino

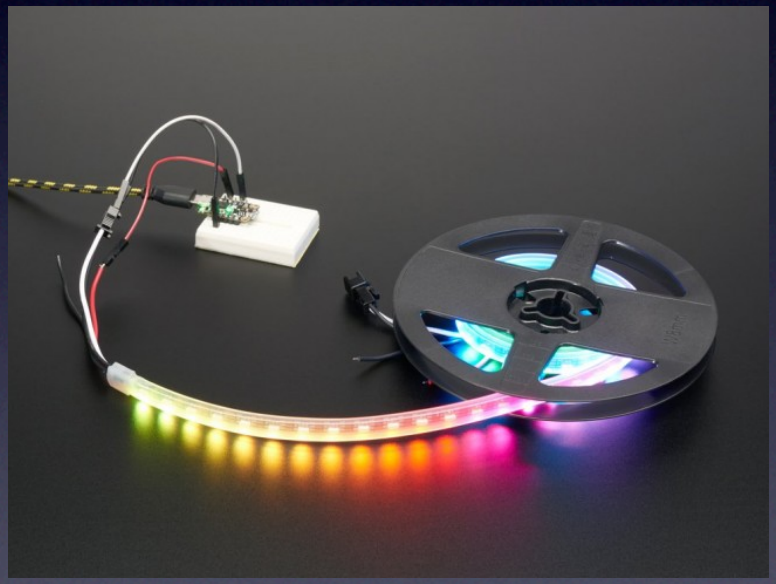
While uploading, you will see a progress bar…



…and when it's completed successfully, it says: "Upload done"

Now,

Let’s Program Some LED Strips!

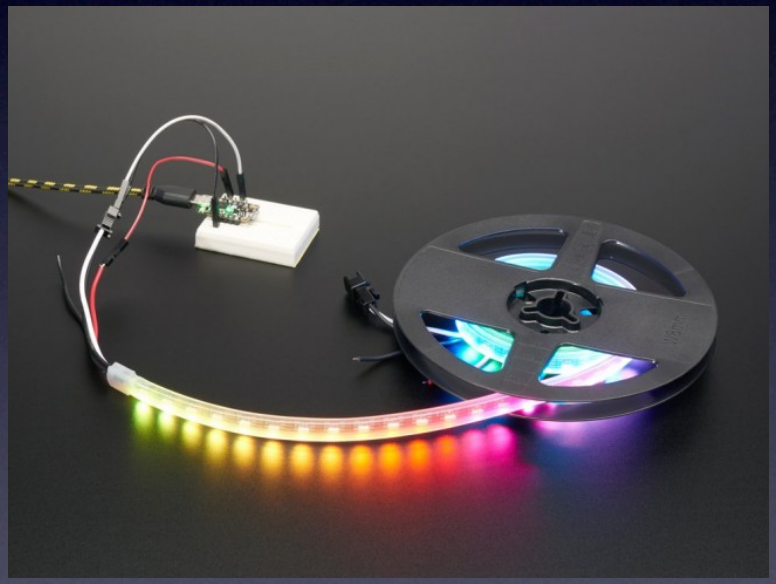


Let’s Program Some LED Strips!

First,

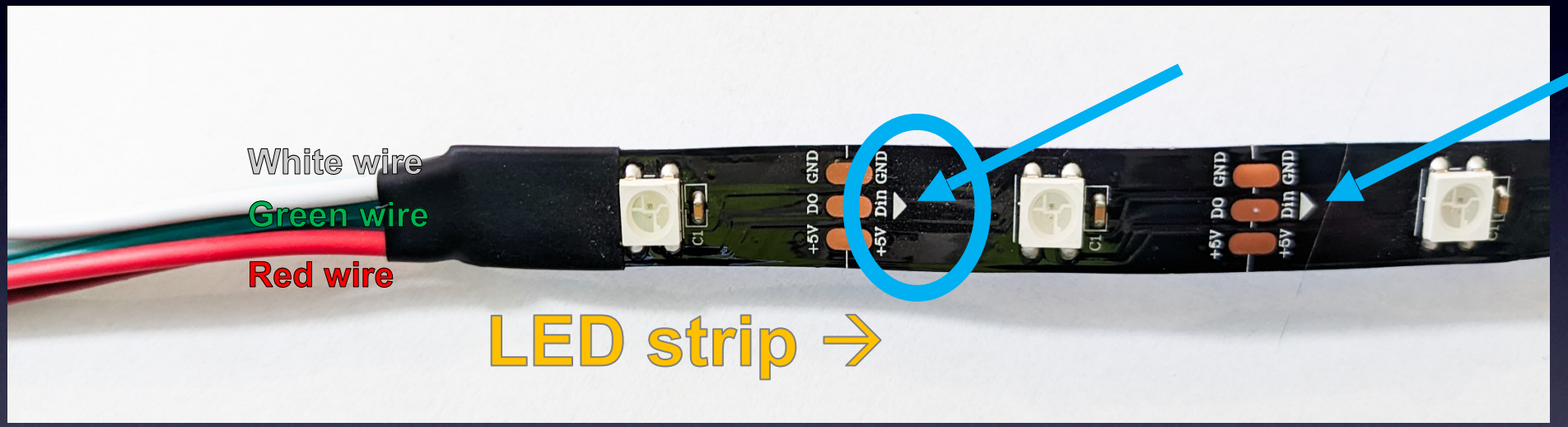
we need to connect the LED strip

to our Arduino Nano board



Let’s Program Some LED Strips!

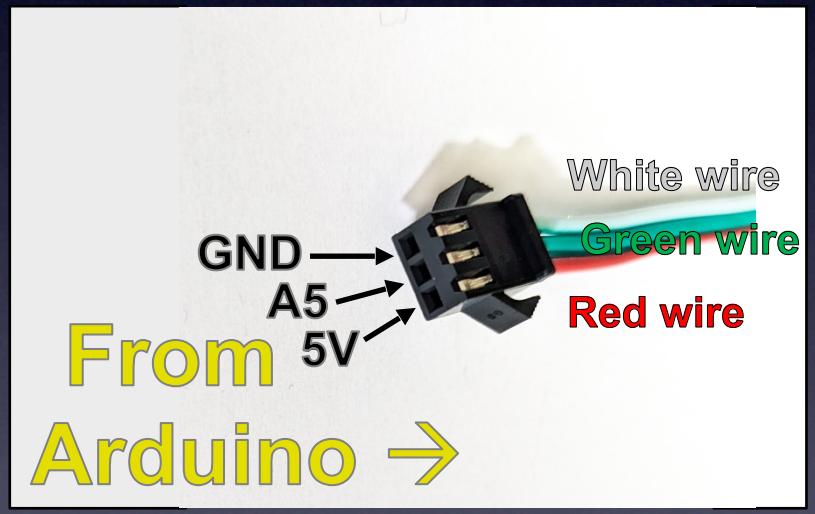
We use the INPUT side of the LED strip



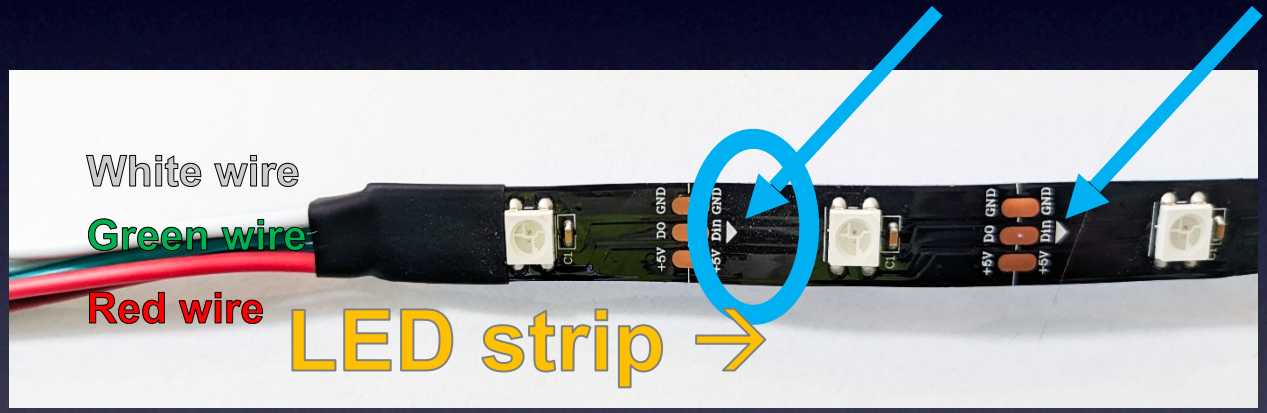
The Input side of the LED Strip
has arrows at each LED pointing into the strip

Let's Program Some LED Strips!

The Input side of the LED Strip:



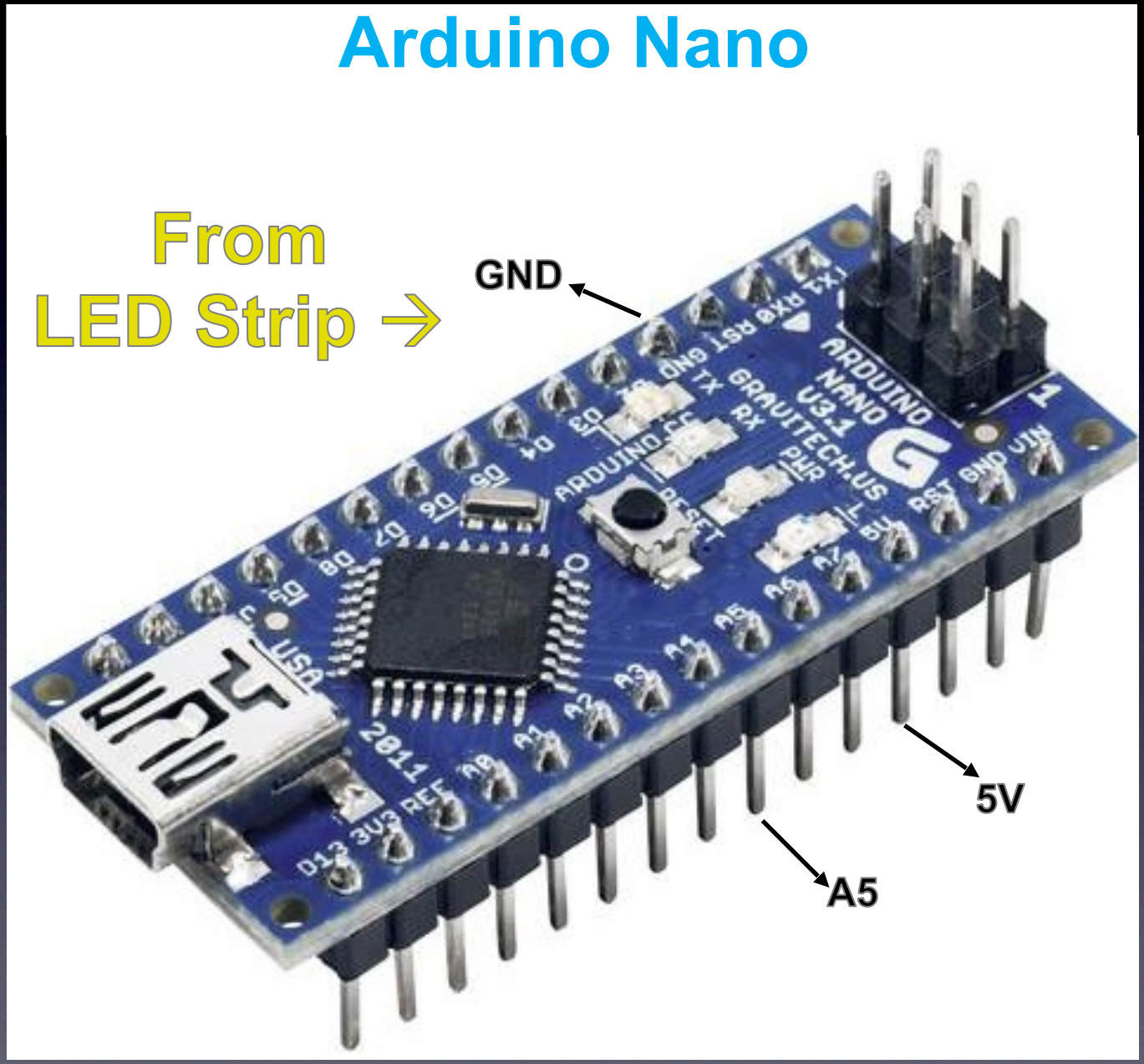
The Input connector of the LED Strip



The Input side of the LED Strip

Let's Program Some LED Strips!

Arduino Nano



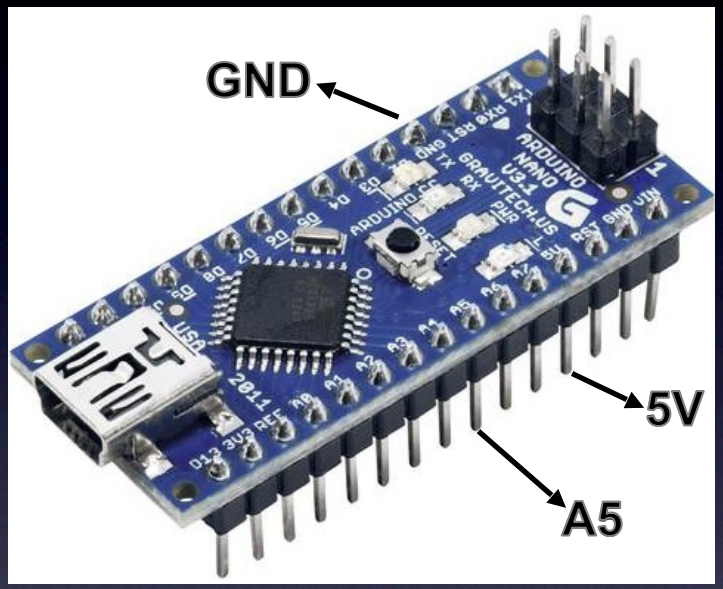
Let’s Program Some LED Strips!

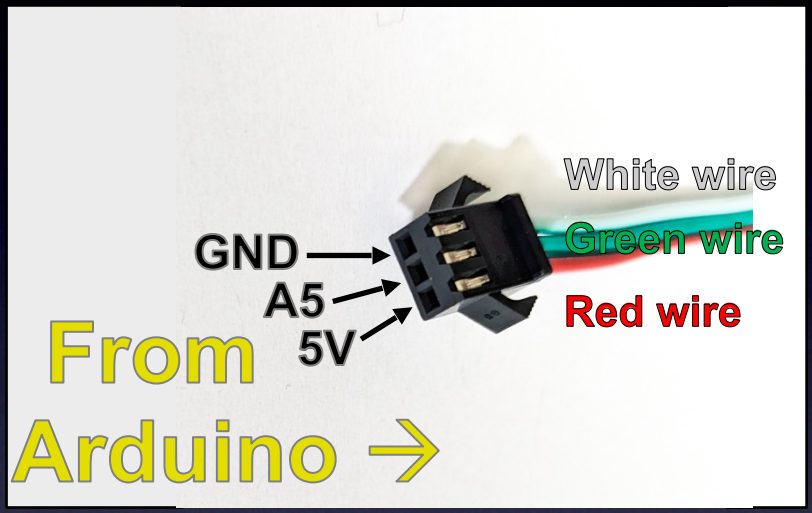
Arduino Uno

From LED Strip → 5V GND A5

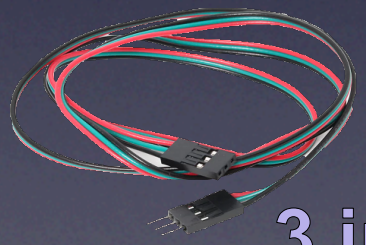
Let's Program Some LED Strips!

Arduino Nano

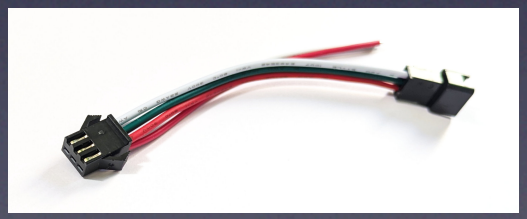




The Input connector of the LED Strip



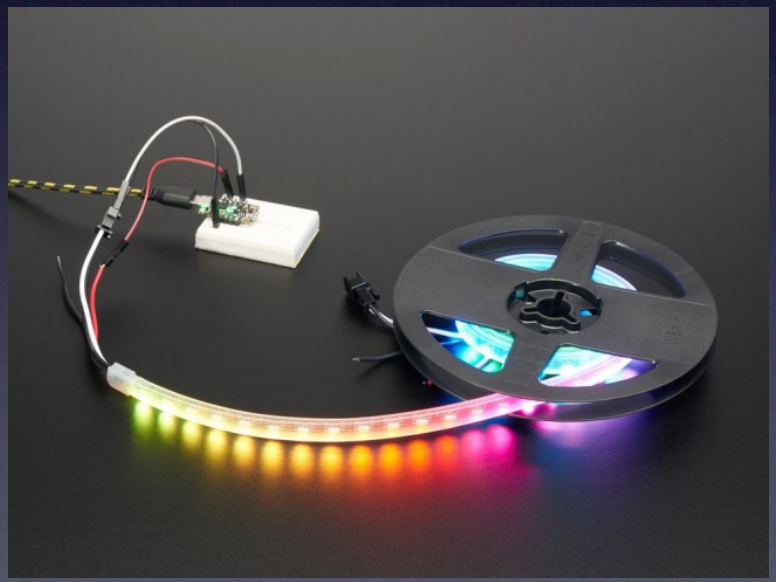
Use your 3 jumper wires



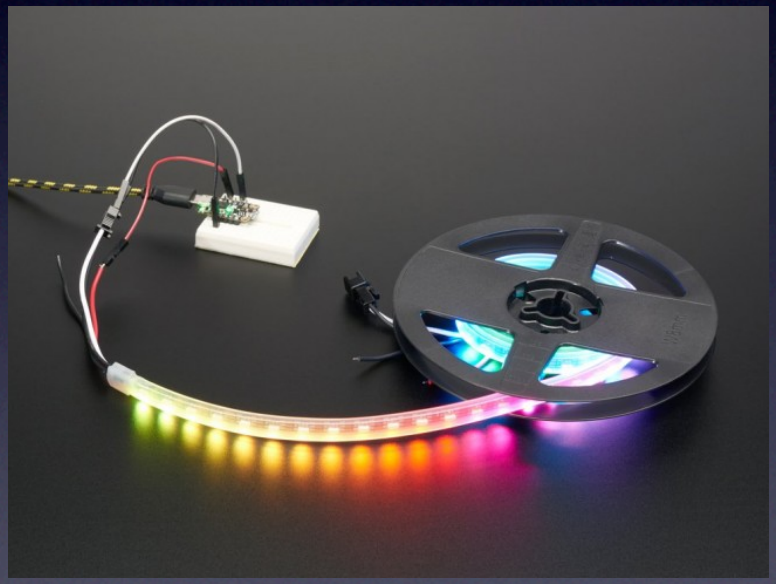
and the cable that came with your LED strip

Let’s Program Some LED Strips!

We are now ready to program our LED Strips!



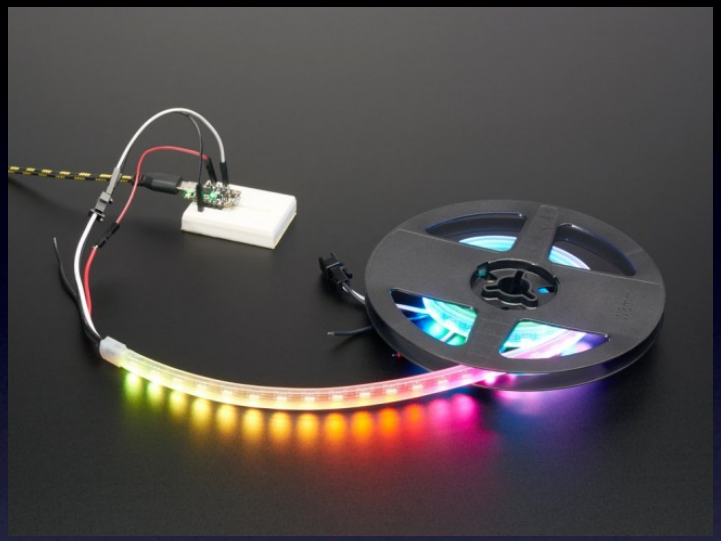
Let’s Program Some LED Strips!



Download some Arduino “sketches”:

https://CornfieldElectronics.com/cfe/projects.php#ledstrips

Let’s Program Some LED Strips!



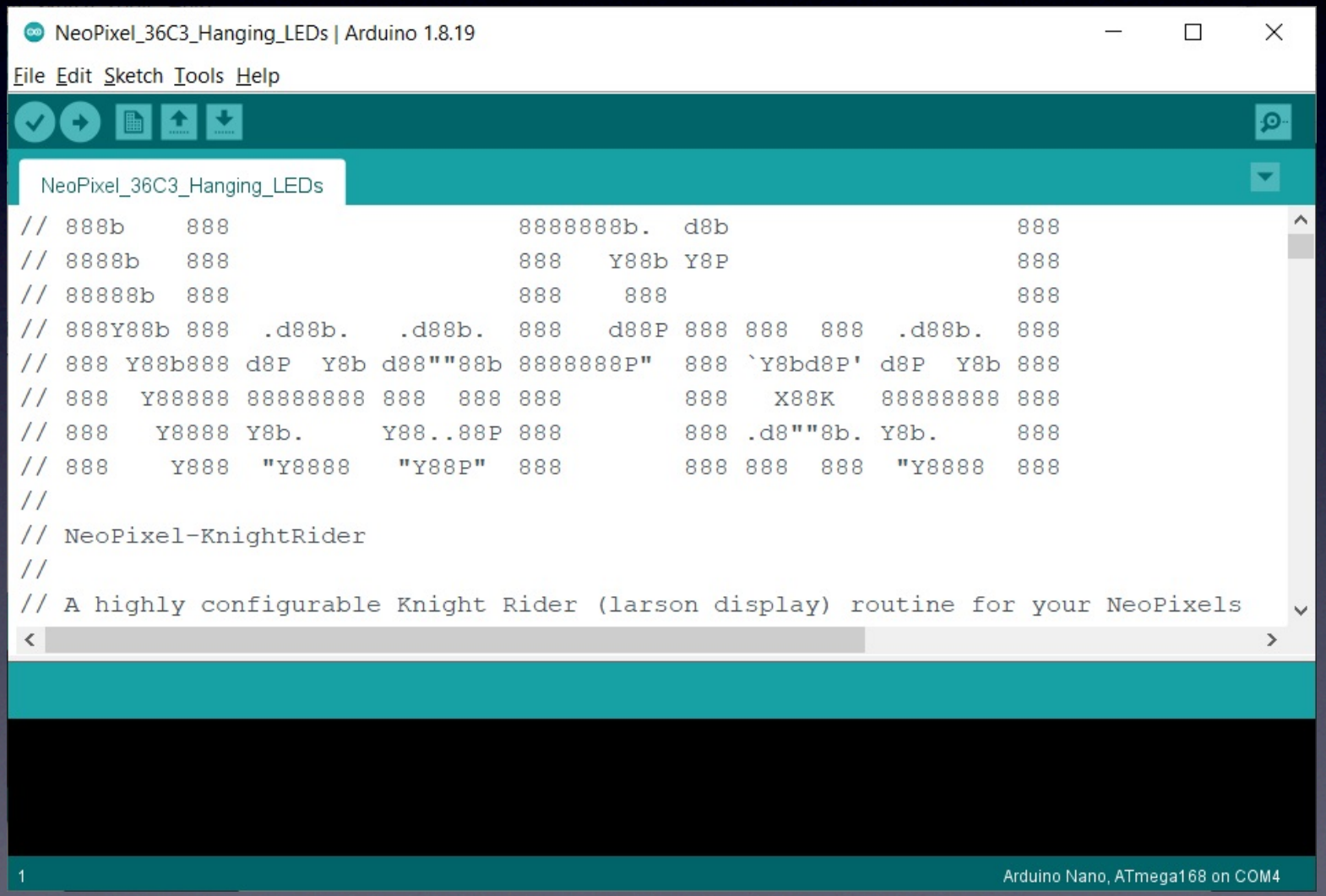
You can also

Search for: *“RGB LED Strip Sketches”*

Store them on your computer anywhere you like.

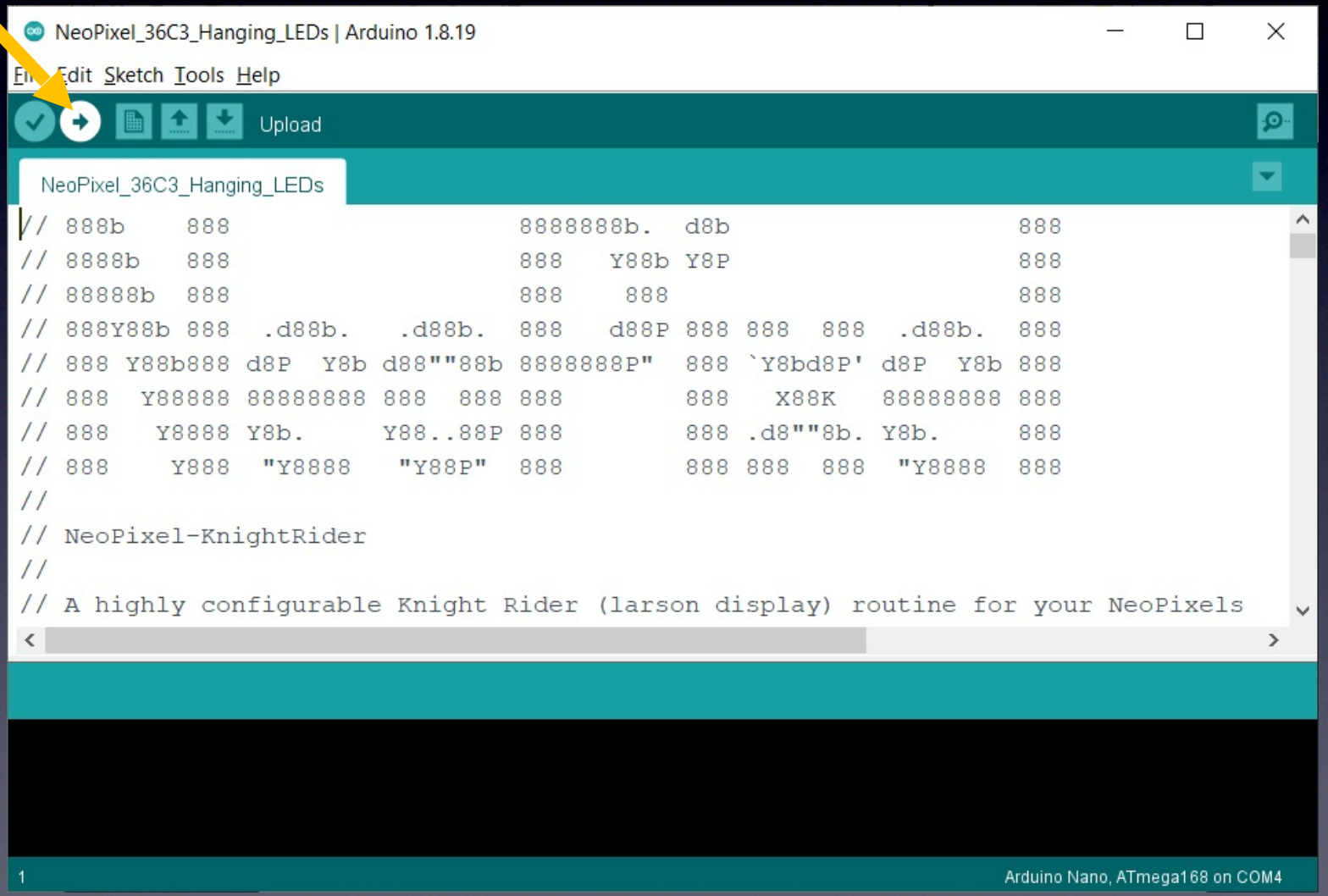
Let’s Program Some LED Strips!

Open the “sketch” you want to program



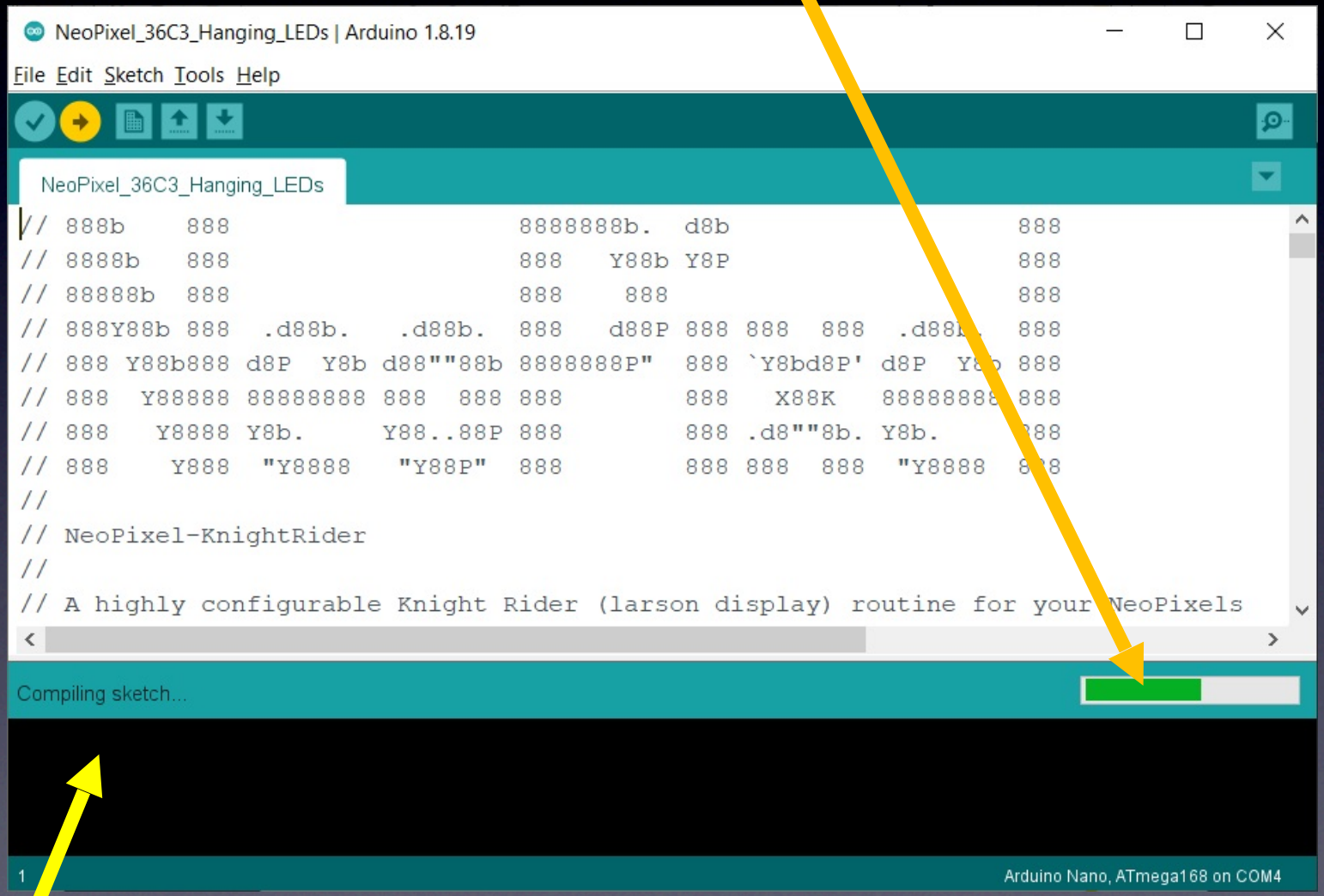
Let’s Program Some LED Strips!

With the USB cable connected to your Arduino board press the Upload button



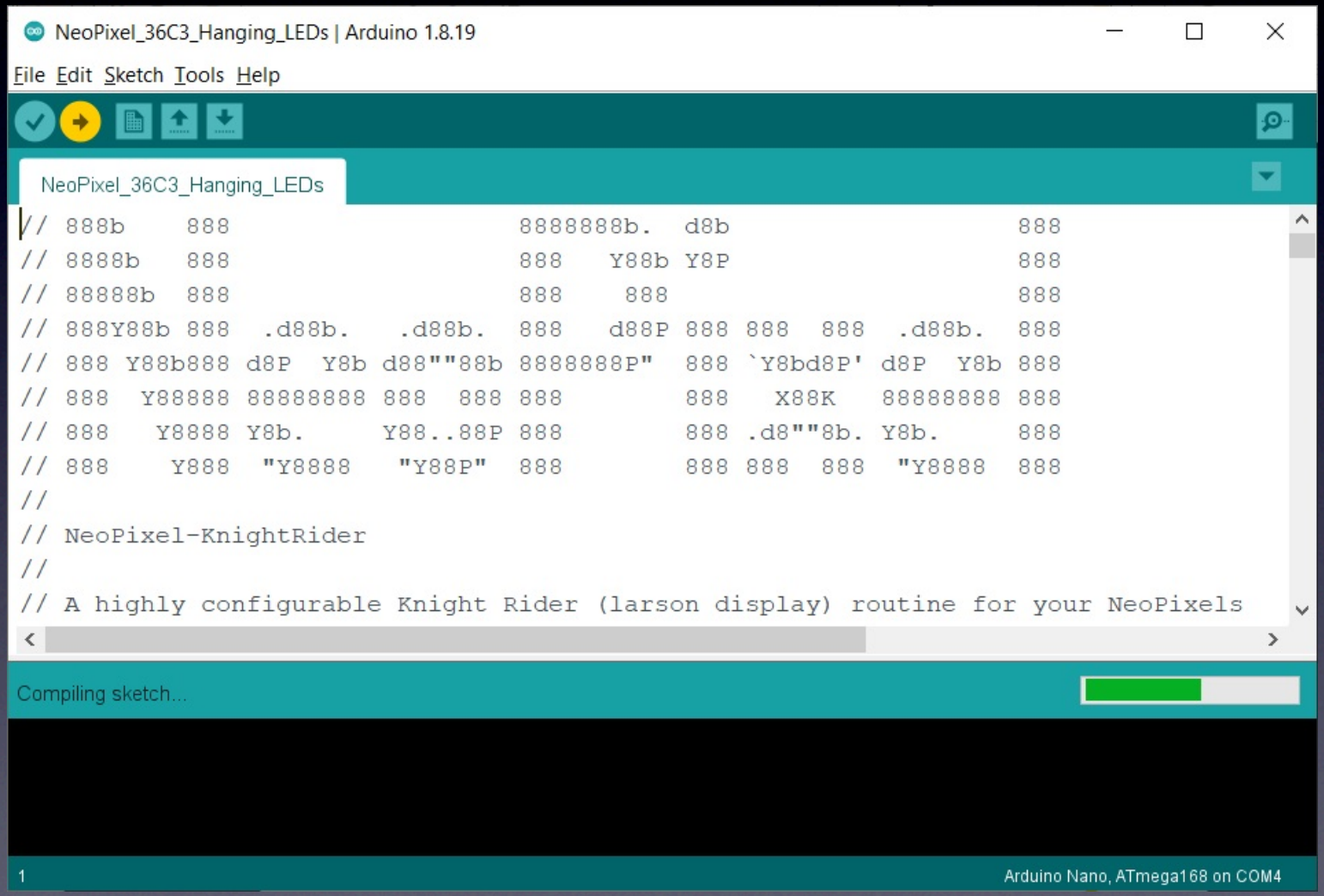
Let's Program Some LED Strips!

While uploading, you will see a progress bar…



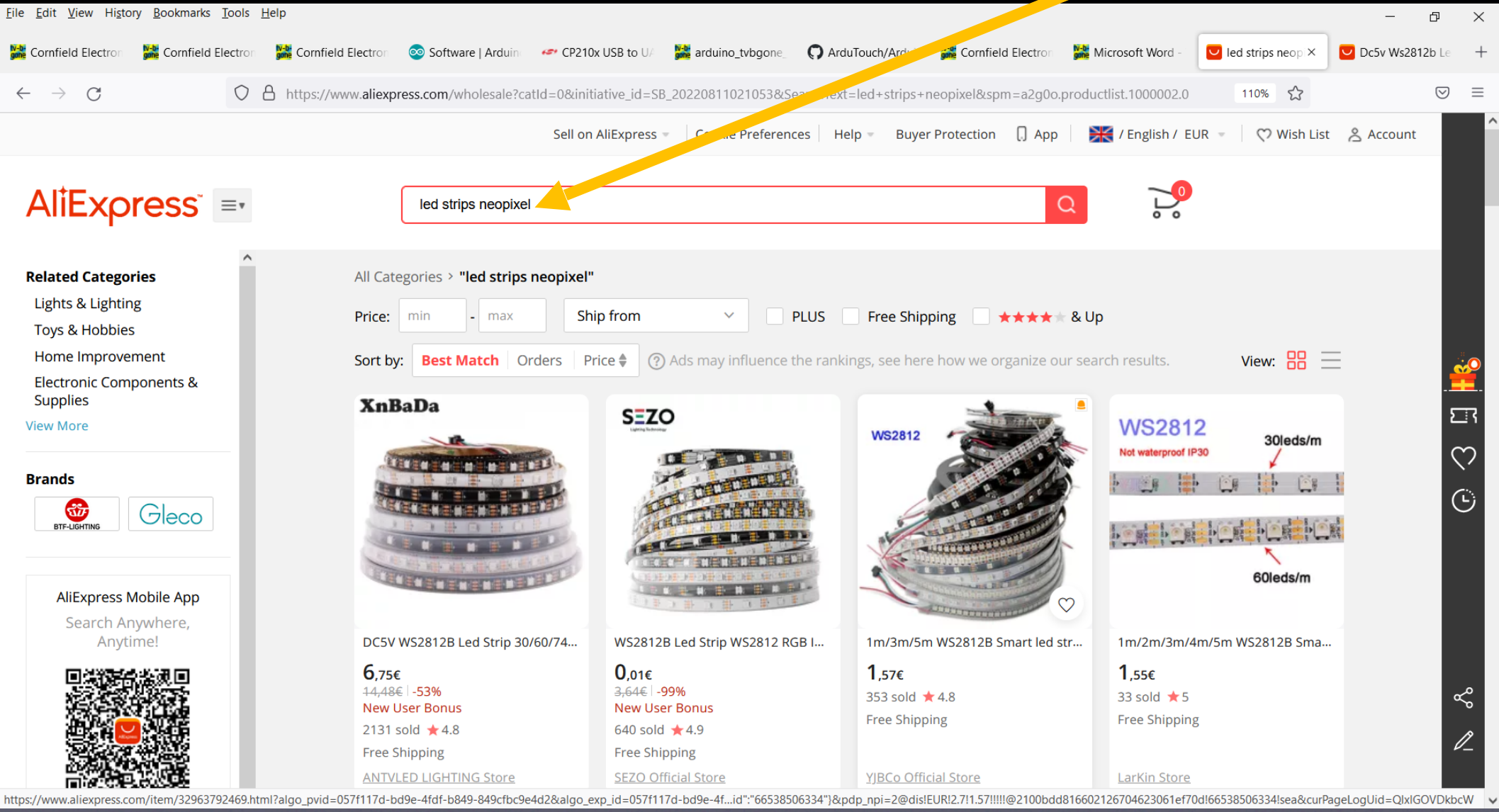
…and when it's completed successfully, it says: "Upload done"

Let’s Program Some LED Strips!



…and your LED strip is making colors!

Ordering LED Strips



Ordering LED Strips

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Emitting Color: Black PCB

Black PCB | White PCB

Wattage: 1M 30 IP30

1M 30 IP30	2M 30 IP30	3M 30 IP30	4M 30 IP30	5M 30 IP30
1M 30 IP65	2M 30 IP65	3M 30 IP65	4M 30 IP65	5M 30 IP65
1M 30 IP67	2M 30 IP67	3M 30 IP67	4M 30 IP67	5M 30 IP67
1M 60 IP30	2M 60 IP30	3M 60 IP30	4M 60 IP30	5M 60 IP30
1M 60 IP65	2M 60 IP65	3M 60 IP65	4M 60 IP65	5M 60 IP65
1M 60 IP67	2M 60 IP67	3M 60 IP67	4M 60 IP67	5M 60 IP67
1M 74 IP30	1M 74 IP65	1M 74 IP67	1M 96 IP30	1M 96 IP65
1M 96 IP67	1M 144 IP30	1M 144 IP65	1M 144 IP67	

Quantity:

Recommended For You

€ 3,24

€ 4,95

€ 5,02

LED Strips for Everyone Everywhere

Mitch Altman

Chief Scientist, **Cornfield Electronics**, San Francisco, CA
Inventor of **TV-B-Gone** universal remote controls
Co-founder of **3Ware** (successful Silicon Valley startup)
Pioneer of **VR** (in the mid-1980s)
Founding mentor at **HAX** (1st and biggest hardware accelerator)
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WeChat: **mitchaltman**
Fediverse: **@maltman23@mastodon.social**
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