

# The Low Watt Revolution: LED replacement for HID light trapping?:



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NATURAL HISTORY 

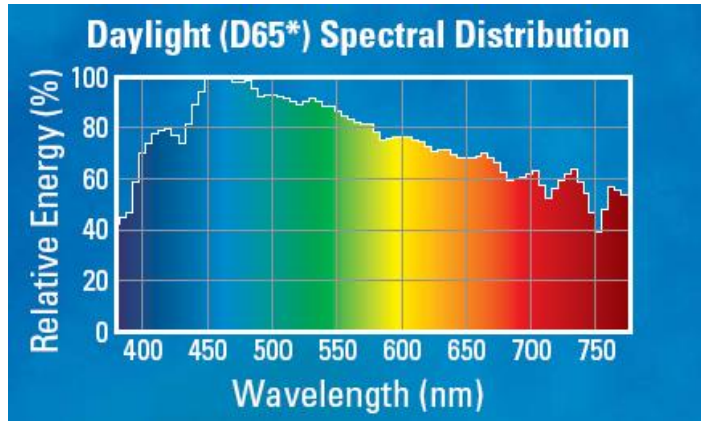




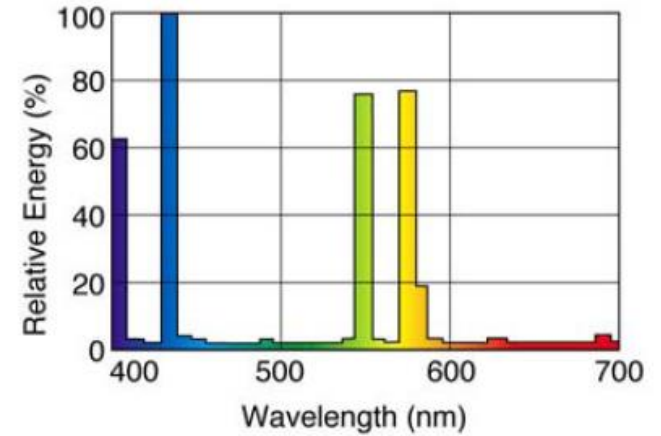


# Spectral Distribution

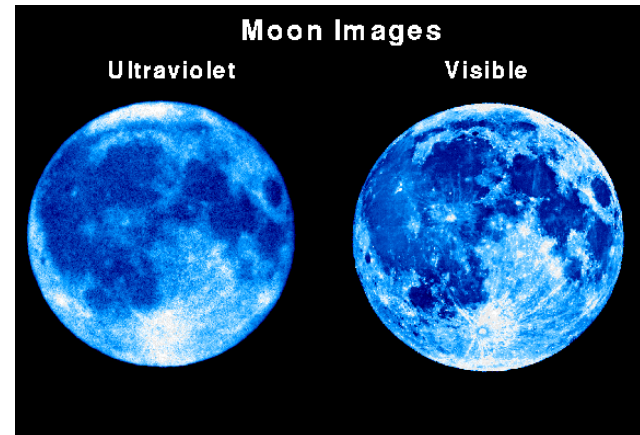
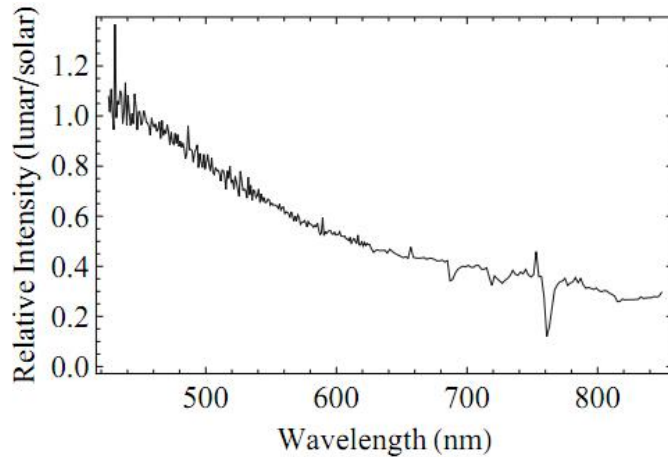
## Daylight



## Mercury Vapor Lamp

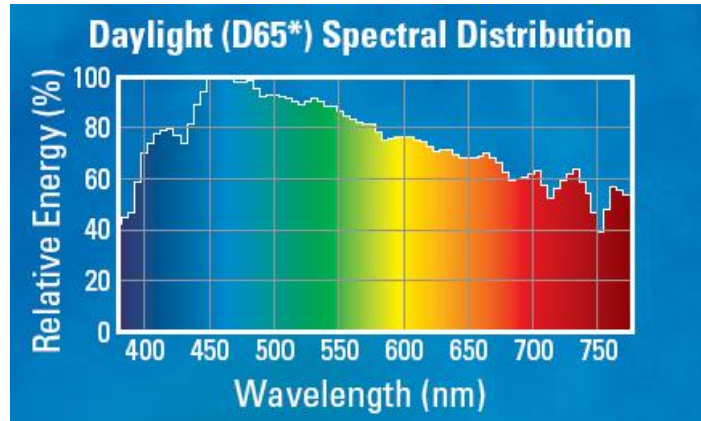


## Lunar Reflectance

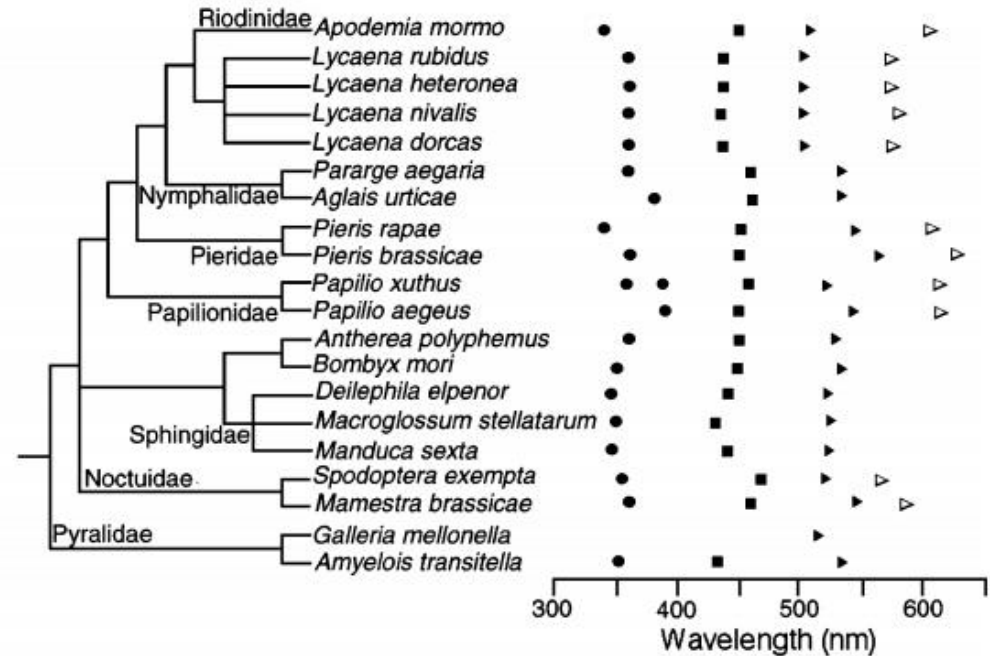


# Light Perception in Insects

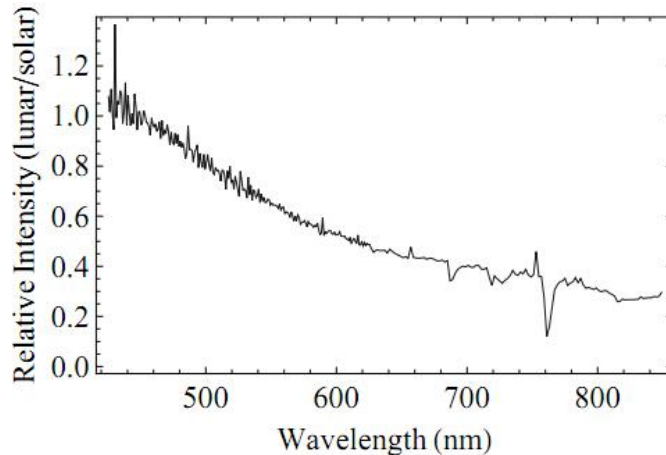
## Daylight



## Lepidoptera (Briscoe & Chittka, 2001)

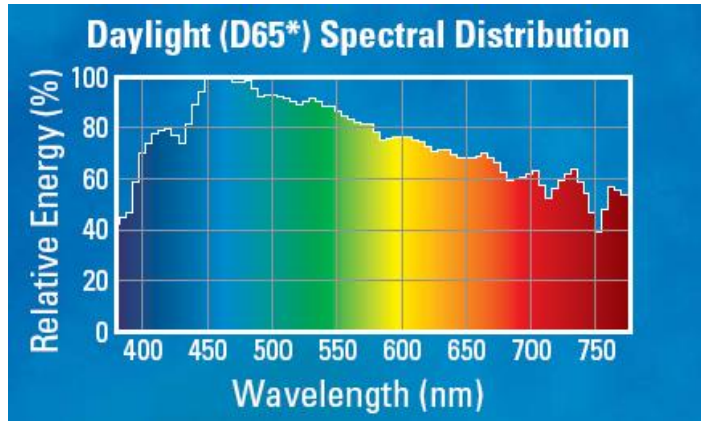


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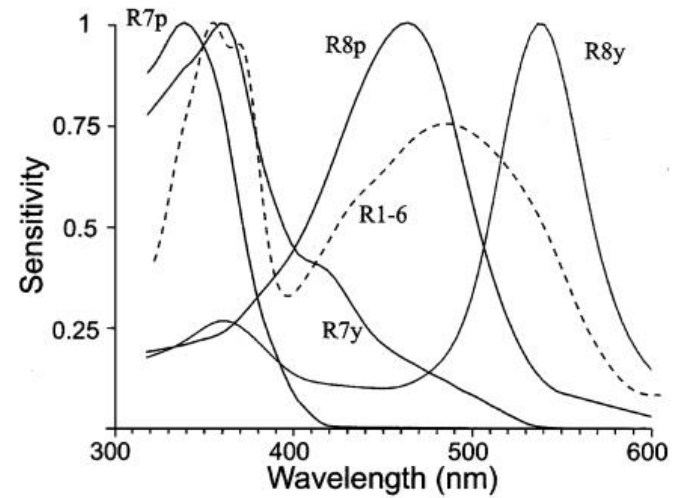
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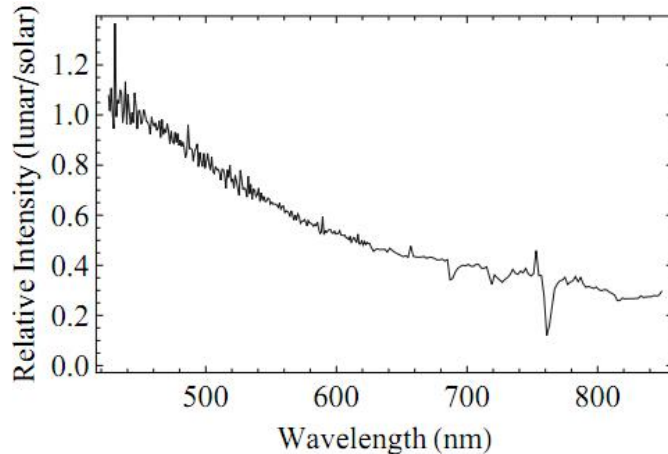


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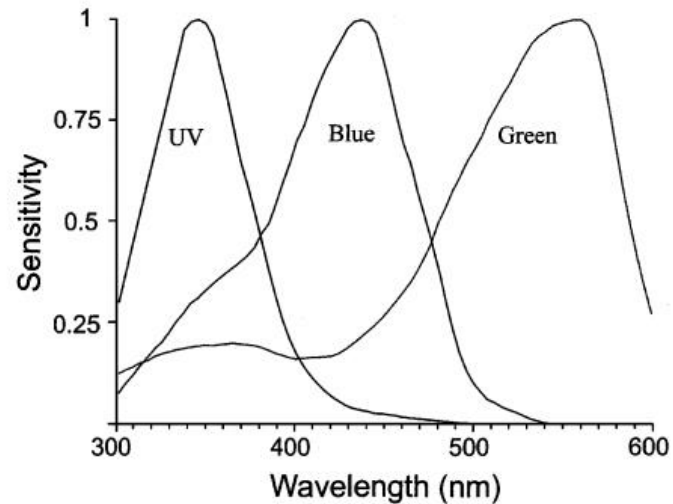
### HOUSE FLY



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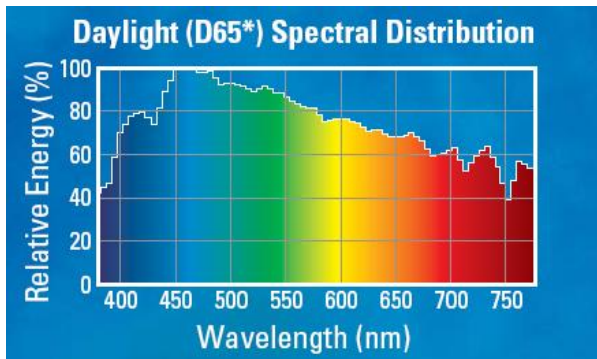


### HONEY BEE

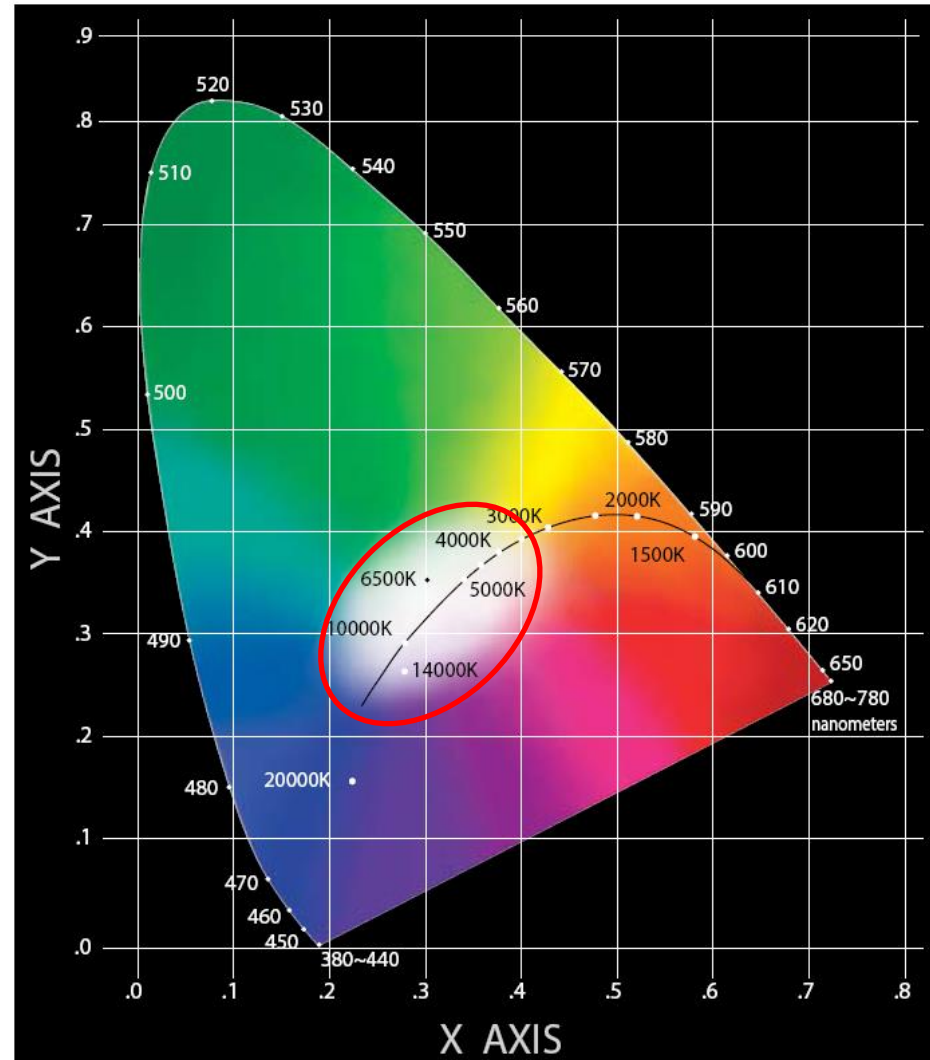
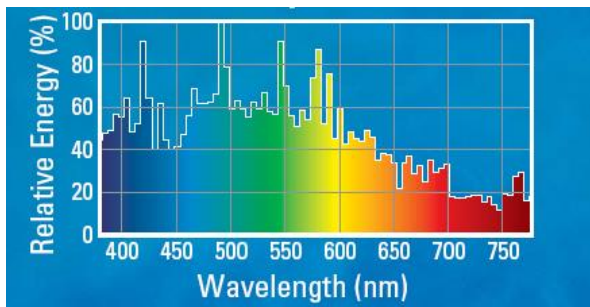


# Color Chromaticity Chart

- Color temperature can be used as a general rule of thumb to measure the appearance of “warmth” or “coolness” of a light source.
  - Daylight: 5,600 - 6,000K
  - Daylight overcast: 6,500K
  - Moonlight: 4,100 - 4,150K

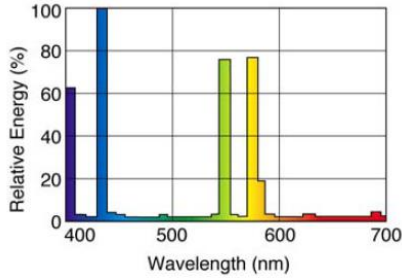


## Tuned Metal Halide

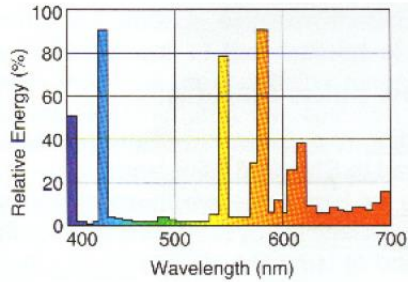




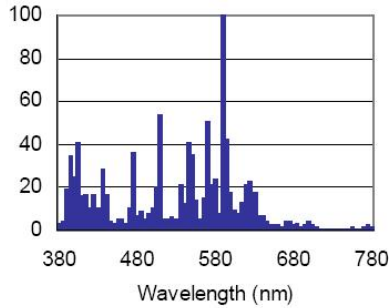
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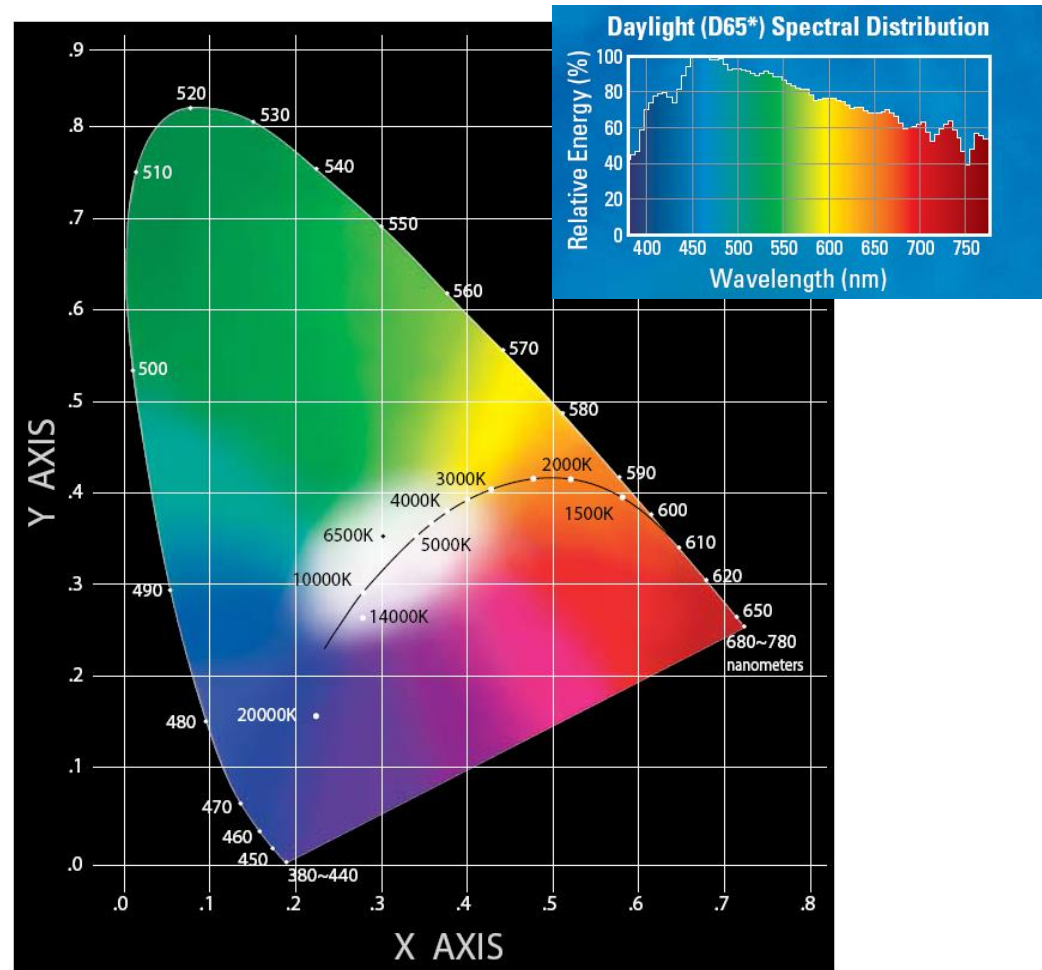
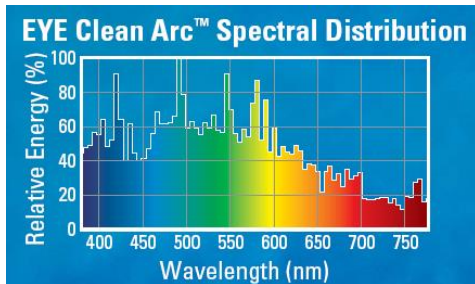
### Mercury Vapor, 250W Self-Ballasted, 3,300K



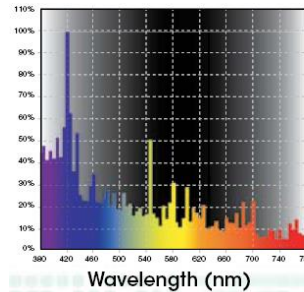
### Metal Halide, 250W Ballasted, 4,200K



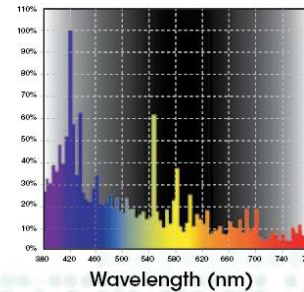
### Tuned Metal Halide, 250W Ballasted T15, 6,500K



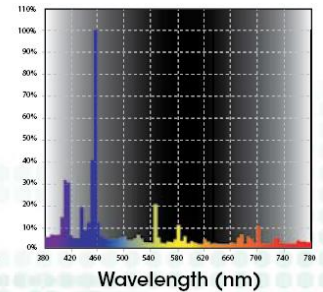
### 10,000K



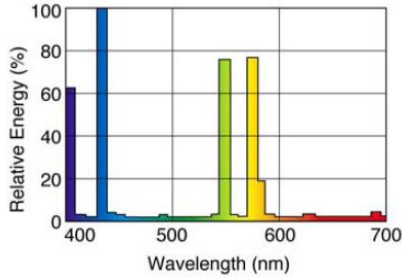
### 14,000K



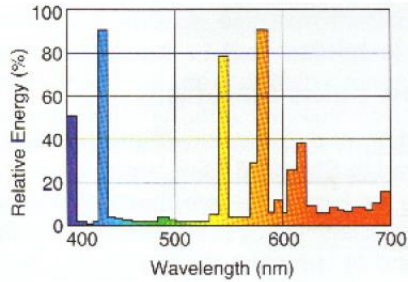
### 20,000K



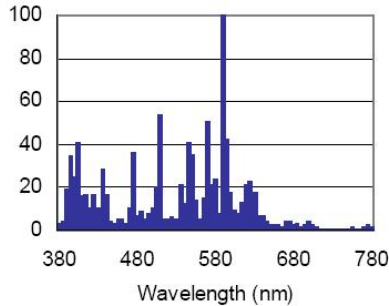
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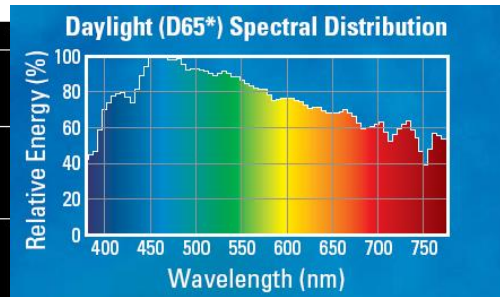
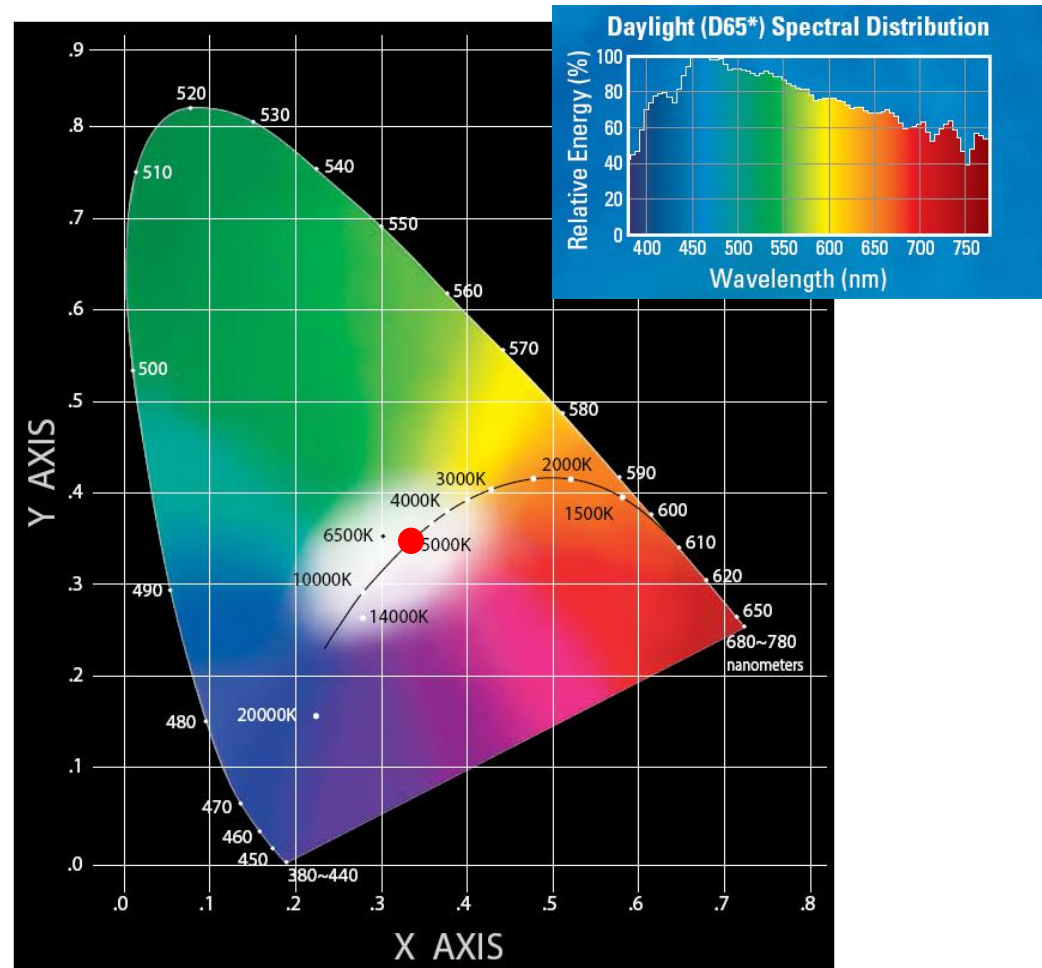
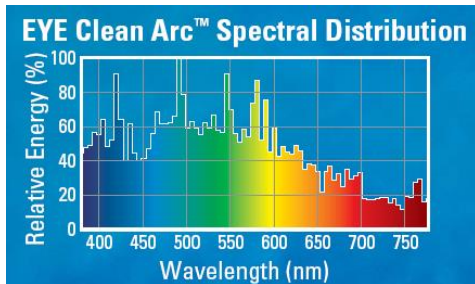
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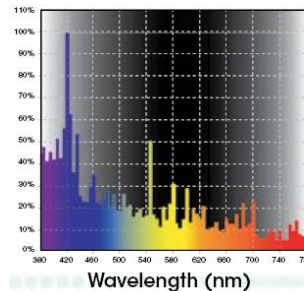
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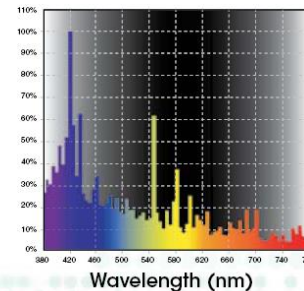
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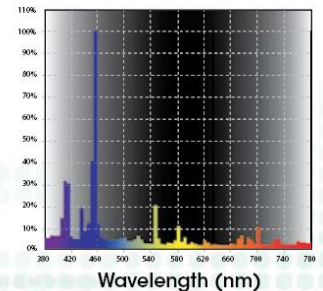
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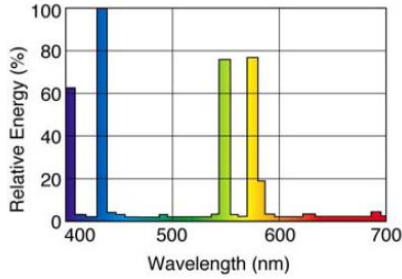
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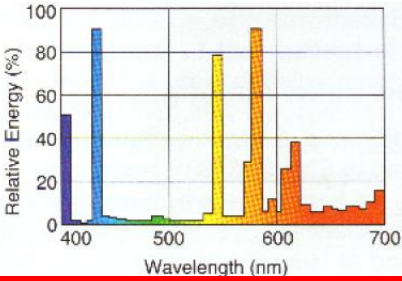
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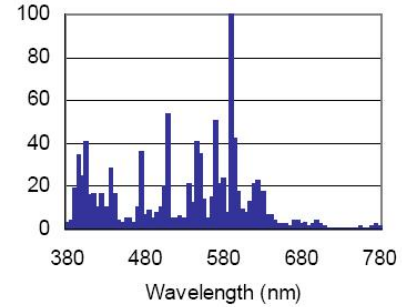
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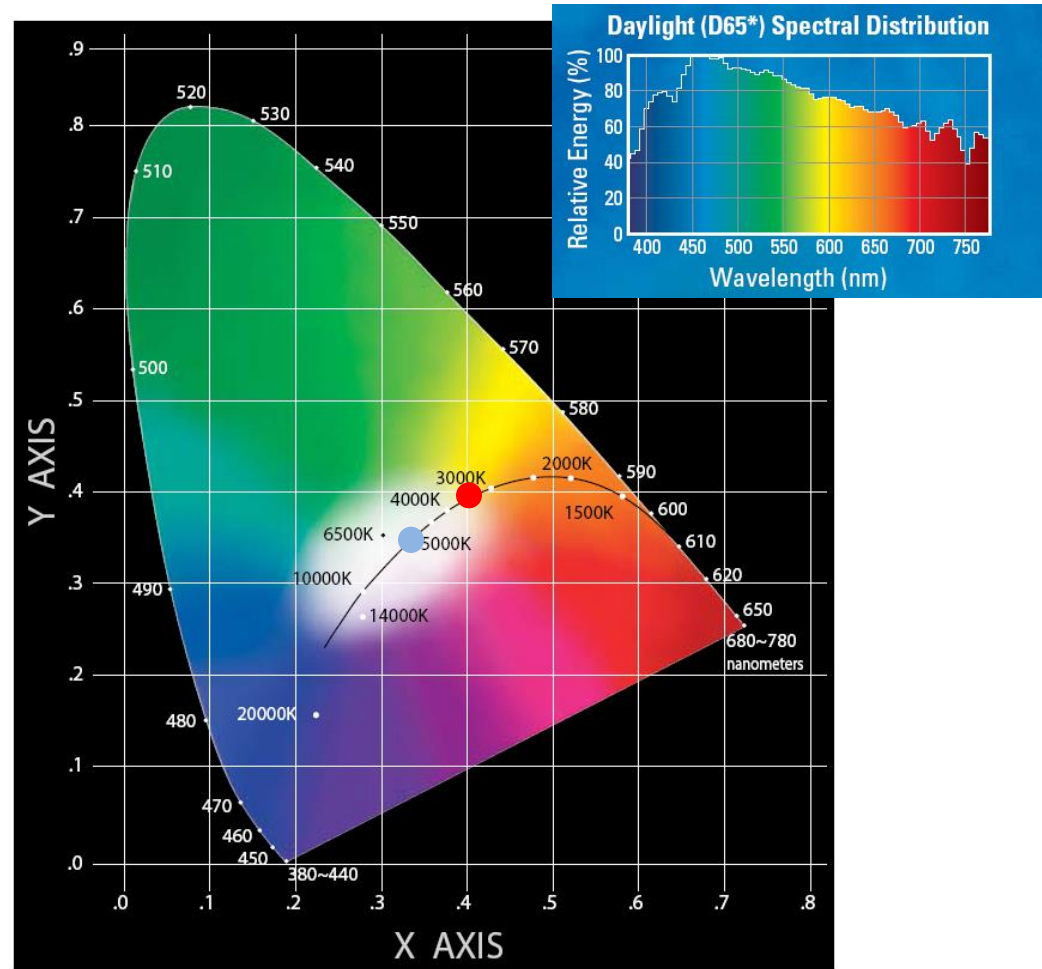
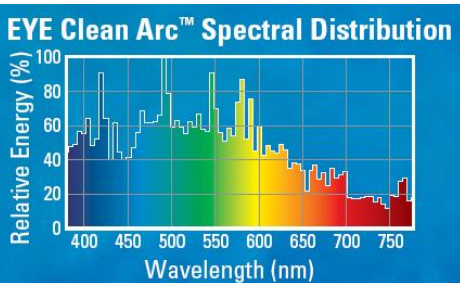
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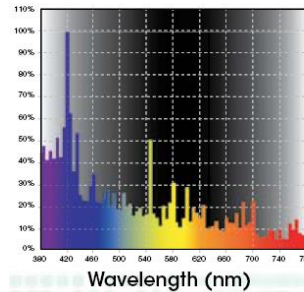
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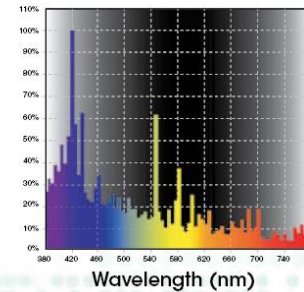
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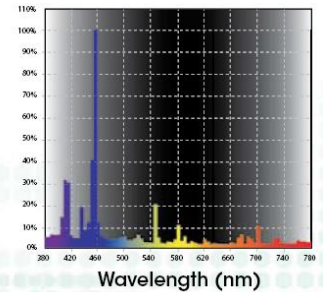
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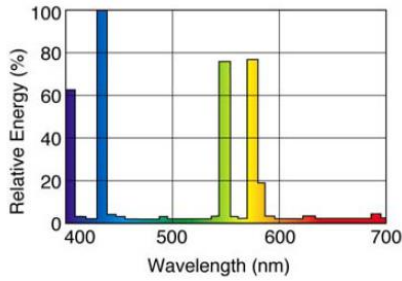
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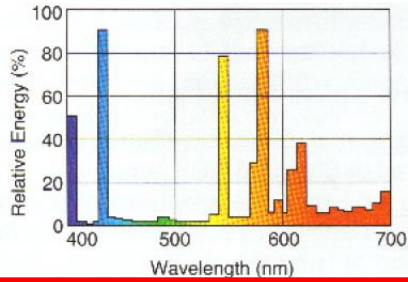
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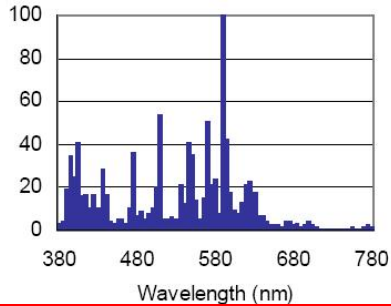
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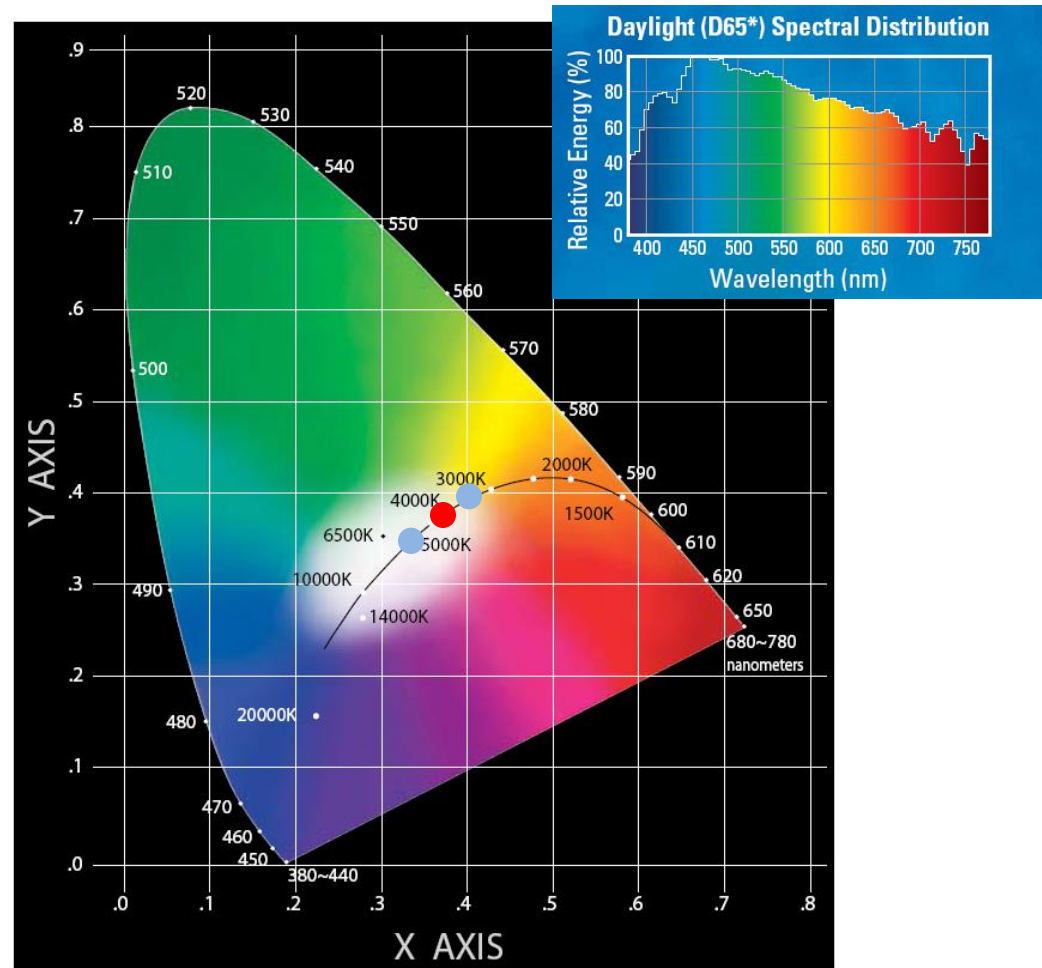
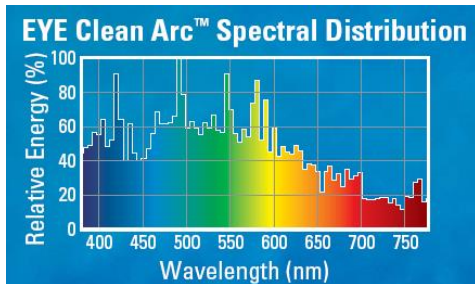
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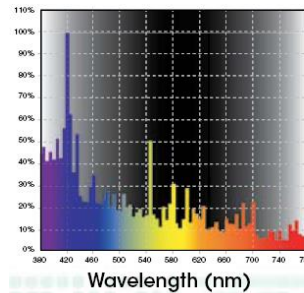
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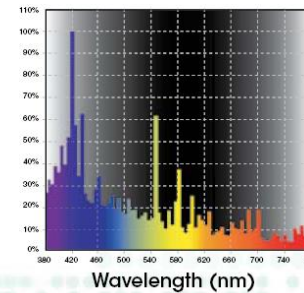
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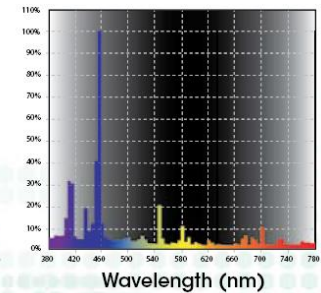
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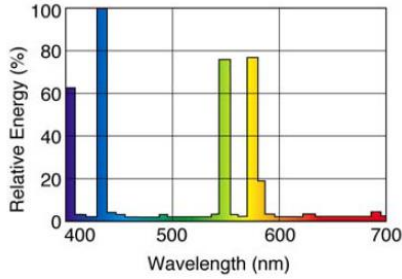
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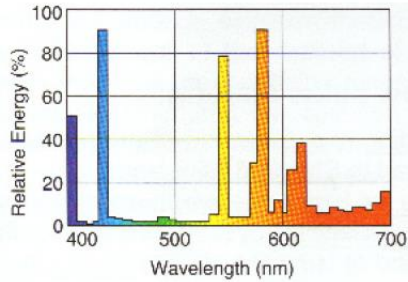
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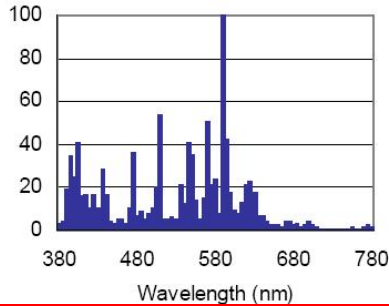
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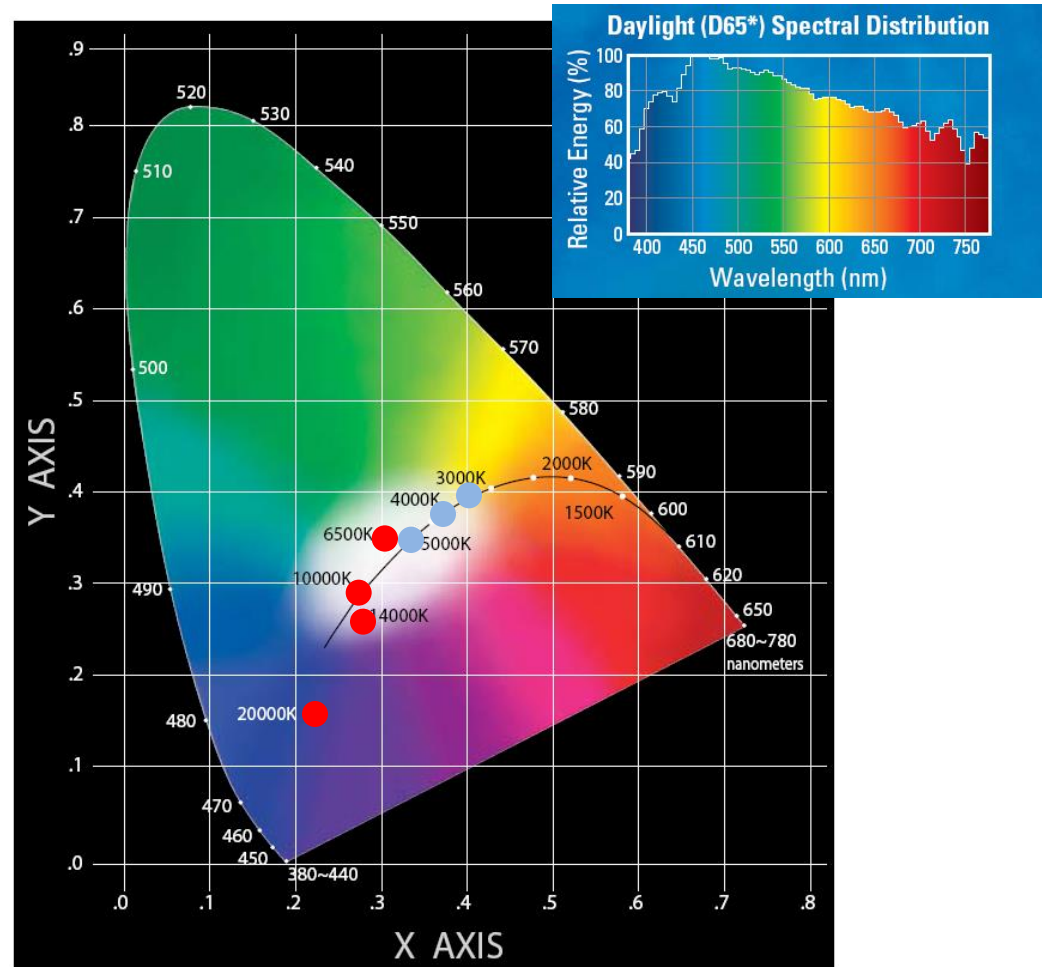
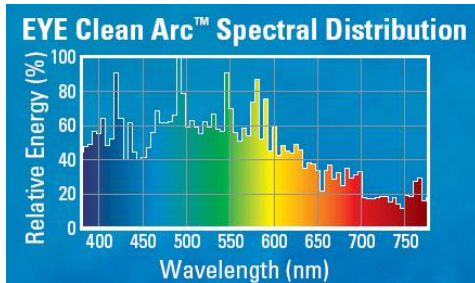
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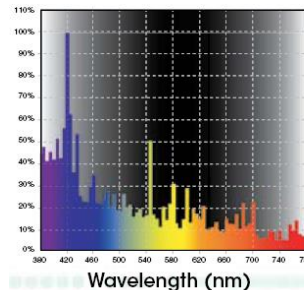
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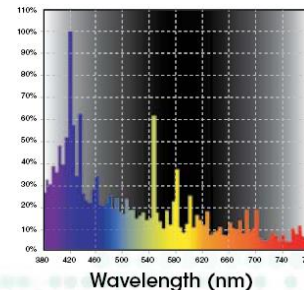
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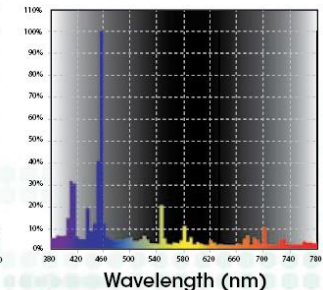
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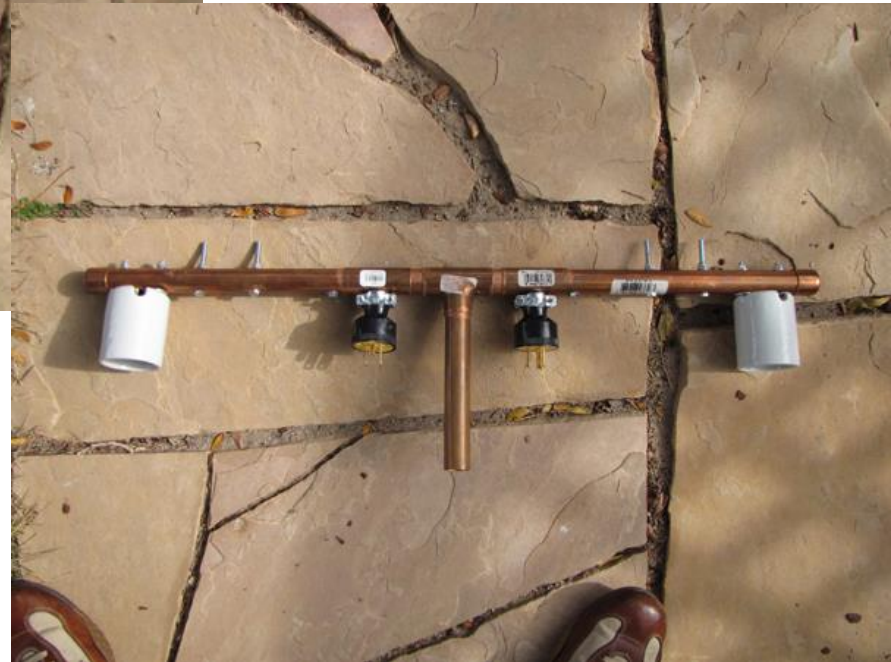
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### 20,000K



# HID System



# HID System

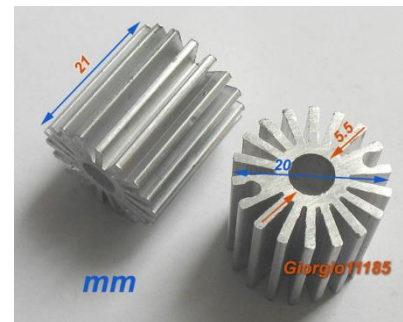
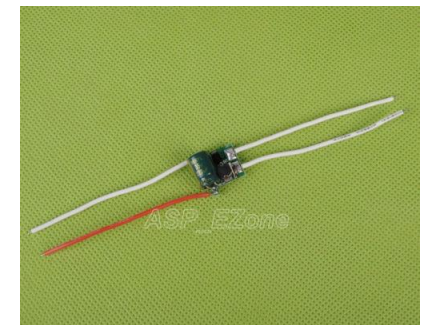






# LED Replacement

- 1-5 Watt single LEDs
  - Arrays available
- LED tuning
  - 350 nm to longer available
  - We tried 360-400nm
  - Mixed LEDs on single units
- Drivers required to regulate and convert current (wattage and voltage match with system)
  - AC to DC
  - DC regulator
- Heat sink required
  - Depends on wattage of system
  - Heat conductive silicone
- Speaker wire extension cords
- Water resistance
- Builds
  - Small
    - Twelve 3 watt LEDs (36 Watts)
  - Large
    - Four 20 Watt arrays (80 Watts)



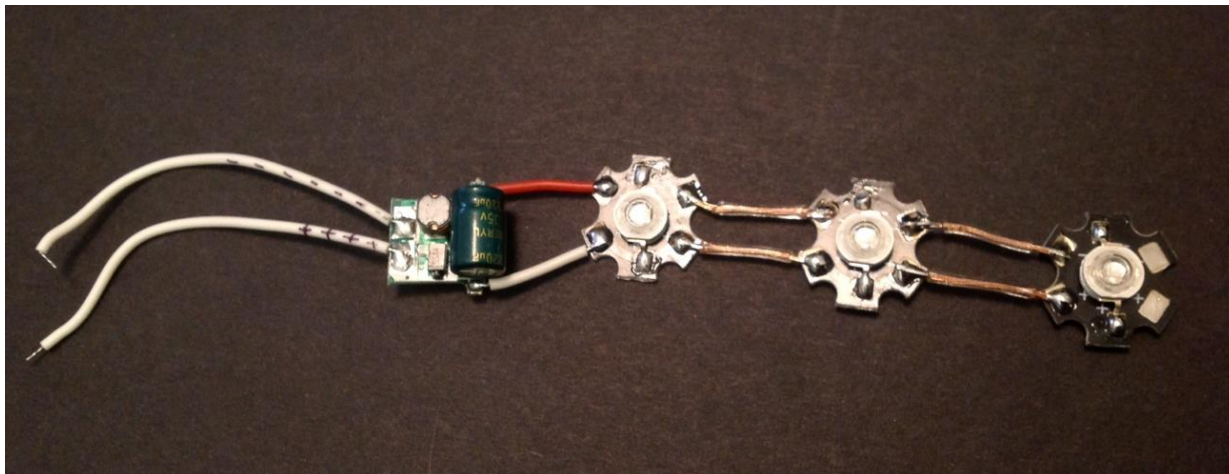
# LED Replacement

- LED lumens per watt is not scalable

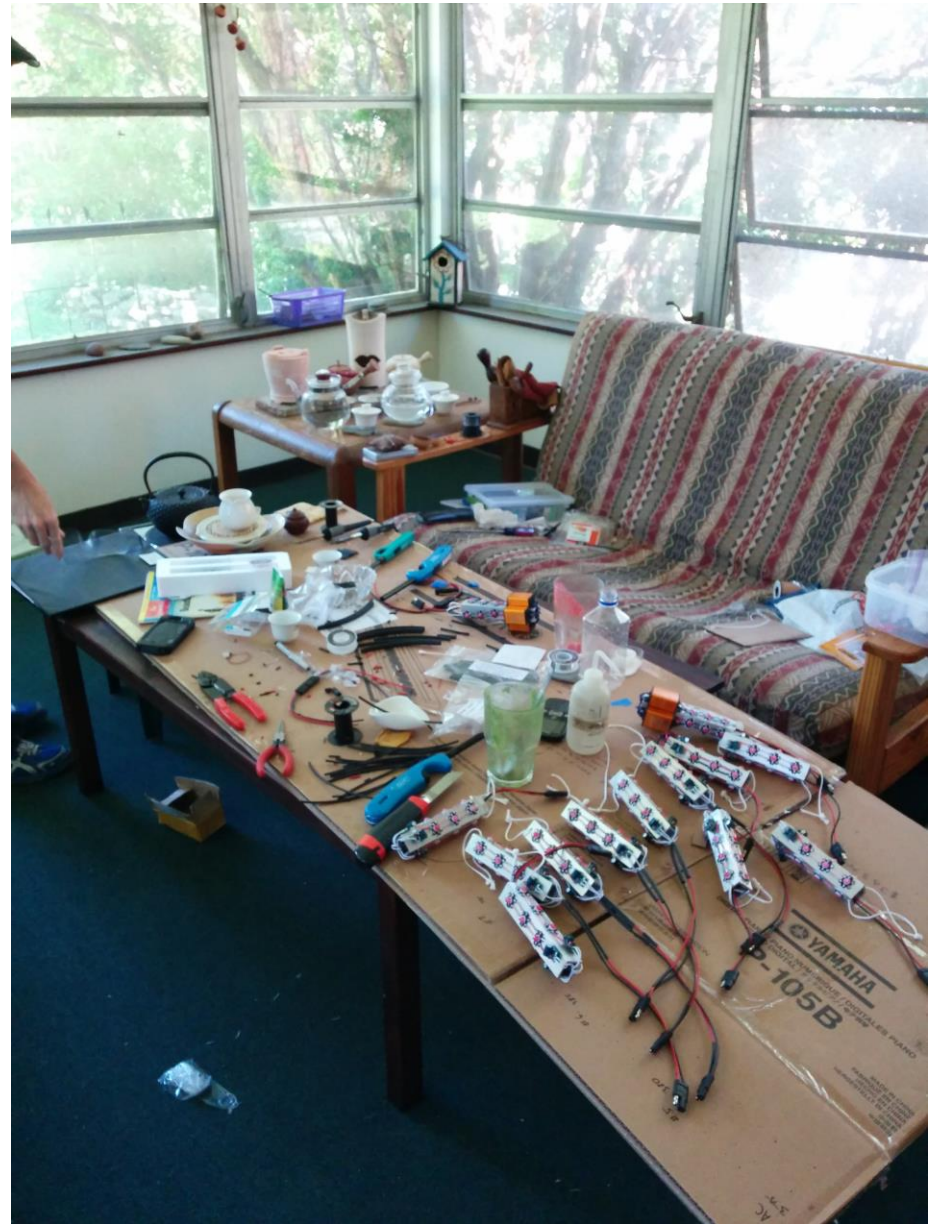
# LED Replacement- DC system



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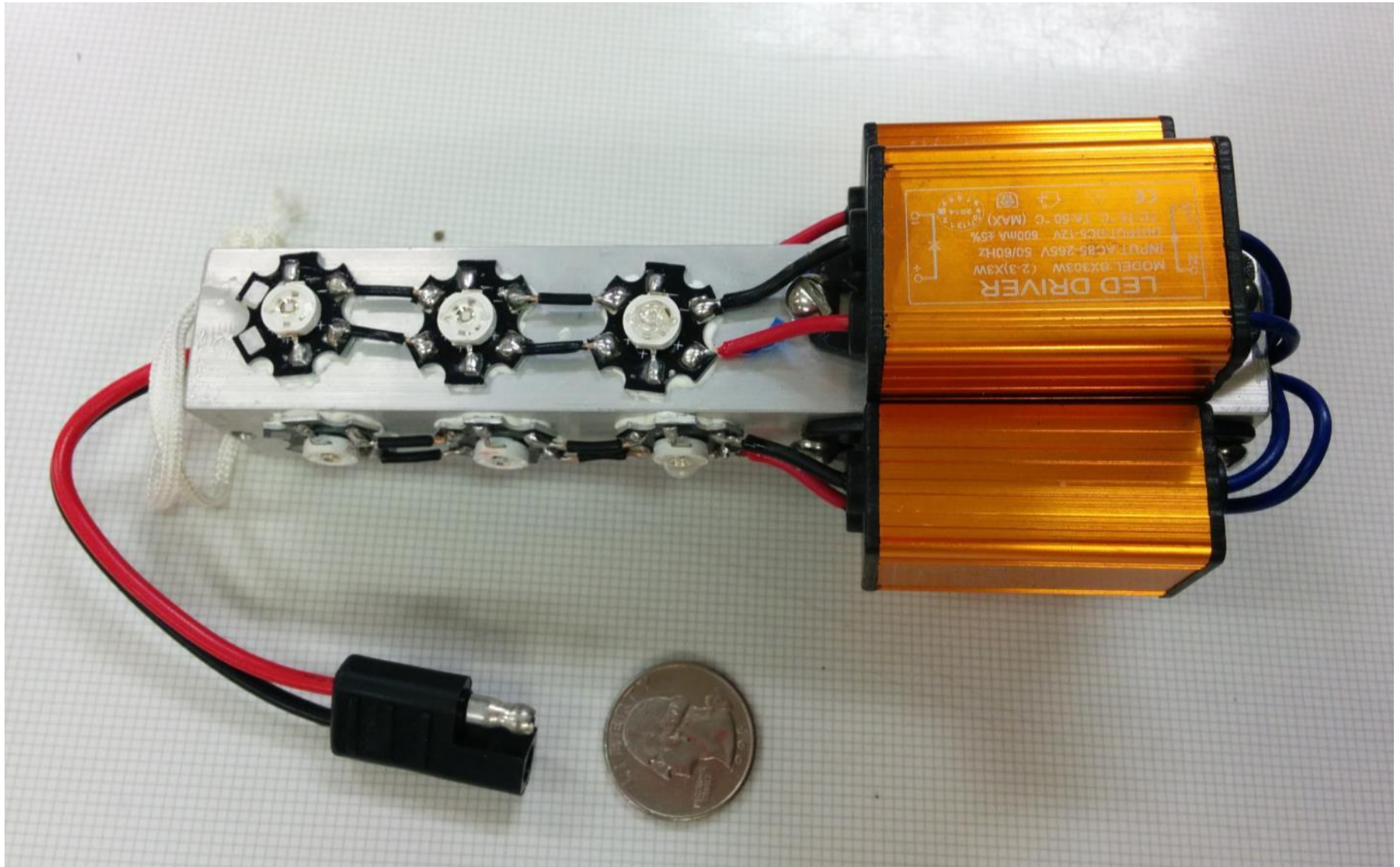
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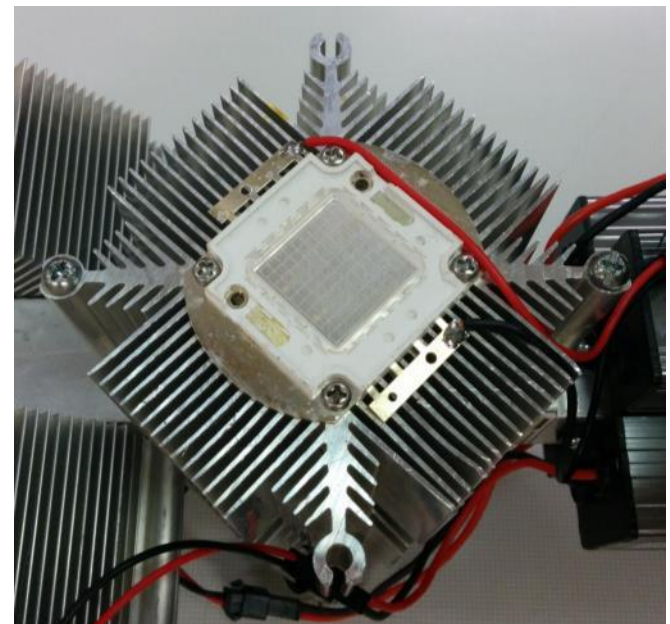
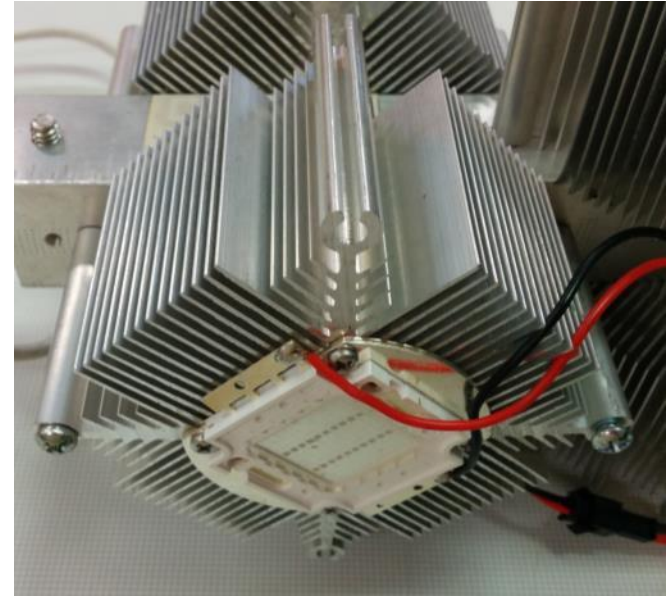
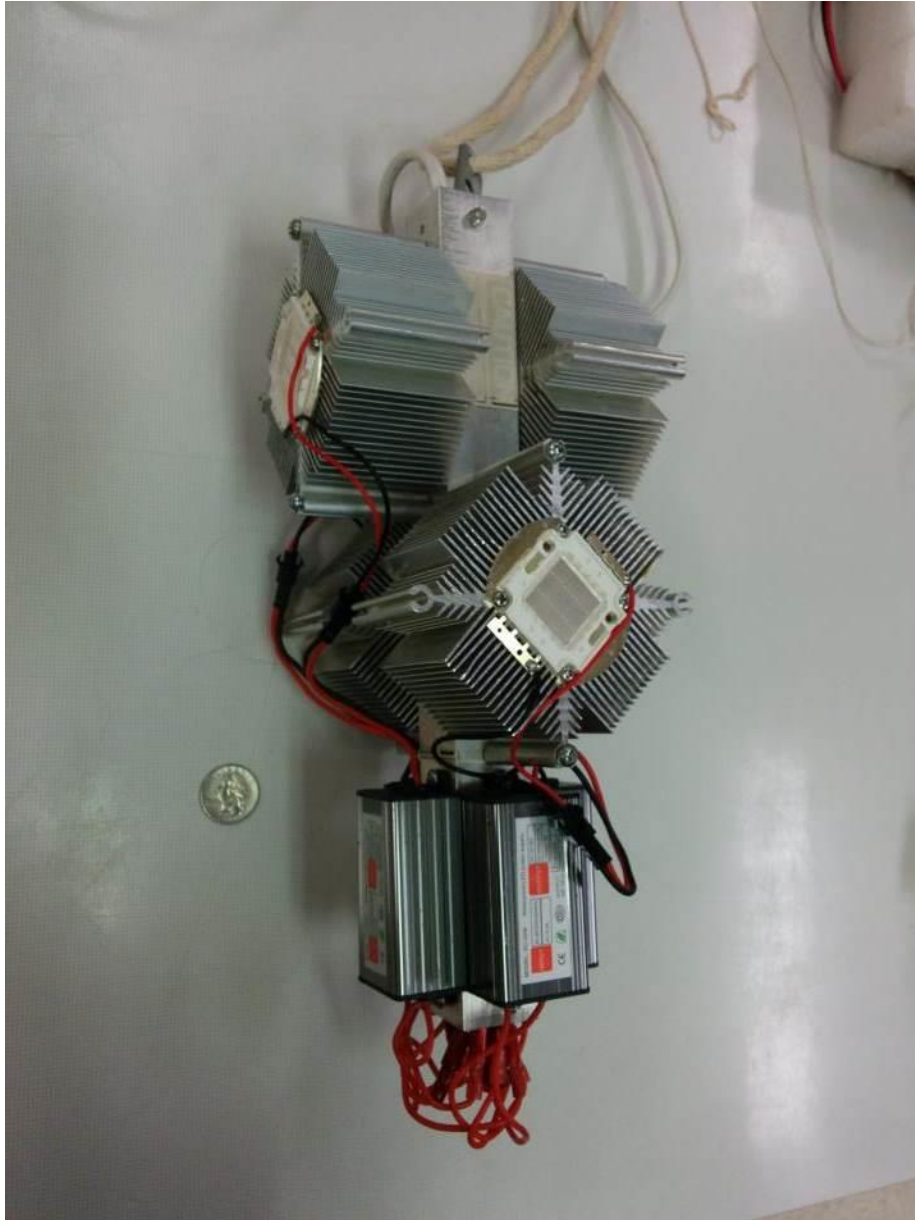
# LED Replacement- DC system



# LED Replacement- AC small system



# LED Replacement- AC large system





# LED Replacement- excluder





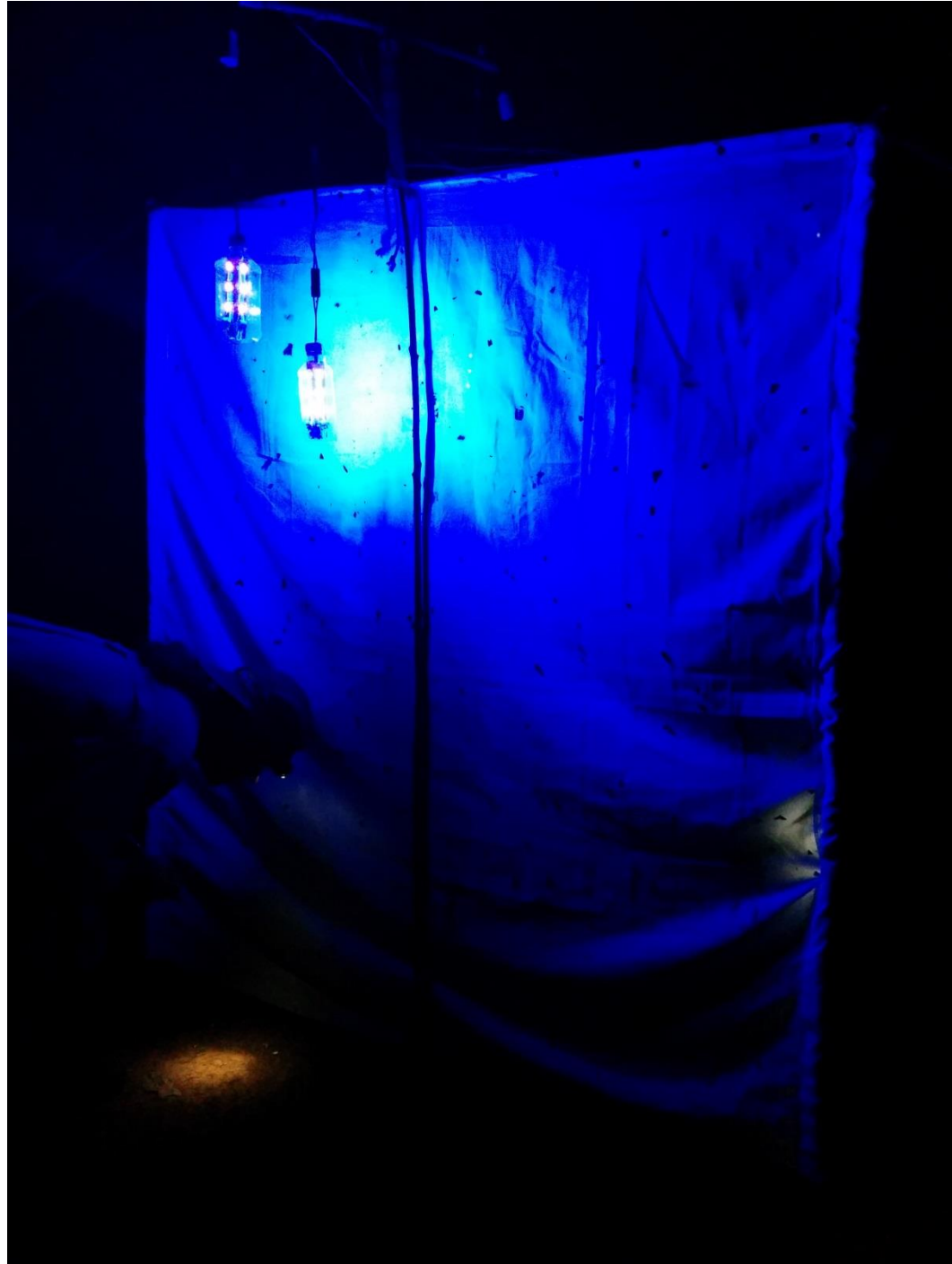














# Use Eye Protection!

UVC Rays- 100-280 nm: Really bad

UVB Rays- 280-315 nm: Bad

UVA Rays- 315 to visible UV: Not Great



# LED Replacement

## Results

- 3 systems on 12V car battery from dusk till takedown
  - Two weeks without failure
  - Battery recharging over nights topped off charge
  - Single system ran for two weeks all night every night
- DC systems performed better than HID and large AC LED system for mantis specimens
- No failure on LEDs in the field (Ethiopia and Rwanda)
  - Weather conditions a factor







Questions?

