

***County of Hawaii***

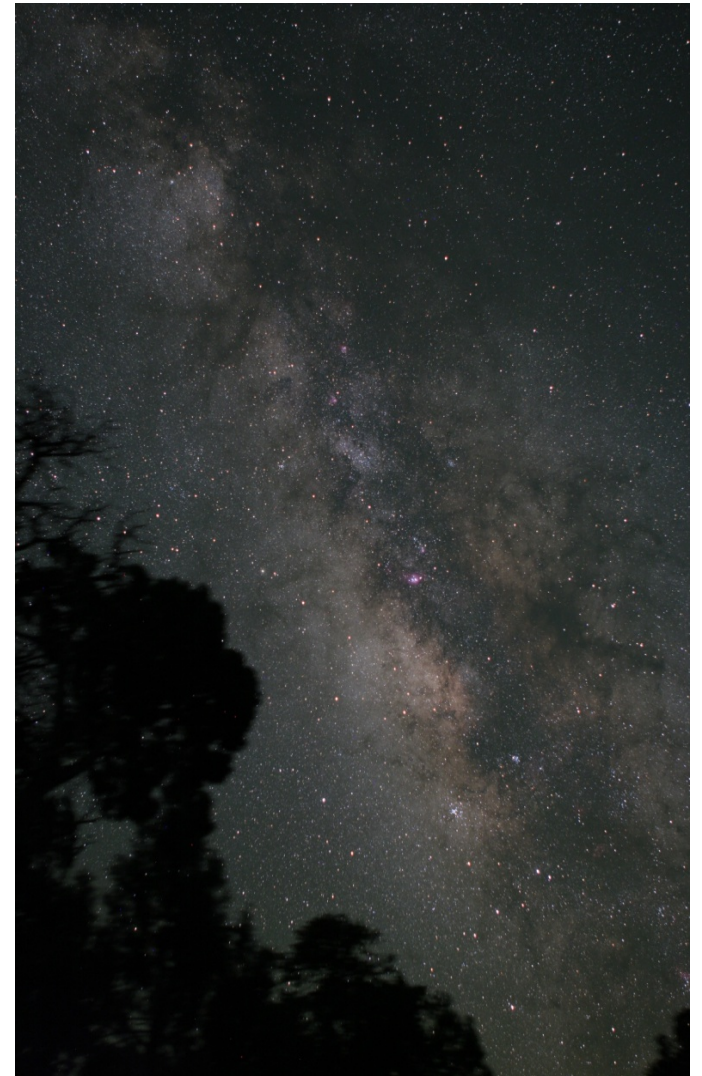
***An Unique LED  
Street Light  
Conversion***

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August, 2015

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**Ronald L. Thiel, P.E.**



D&LT Expedition 2010, Milky Way from the Grand Canyon

# ISSUES

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- **EXISTING LOW PRESSURE SODIUM**
- **2010 County of Hawaii paid \$0.40/kwh**
- **9,500 Street lights -\$2.0 mil annual bill**
- **Current LPS - 20 to 25 years old**
- **Service calls at 35% = 3,300 visits/year**

# ISSUES ADDRESSED

## LED CONVERSION

- *Astronomy concerns-Sky Glow*
- *Glare reduction – Drivers, Pedestrians & Residents*
- *Annoying amber/yellow color rendition & traffic signal conflict*



# Sky Glow

## Rayleigh scattering



# POLLUTION



Utah Section – International Dark Sky Association

# *Glare reduction for drivers*

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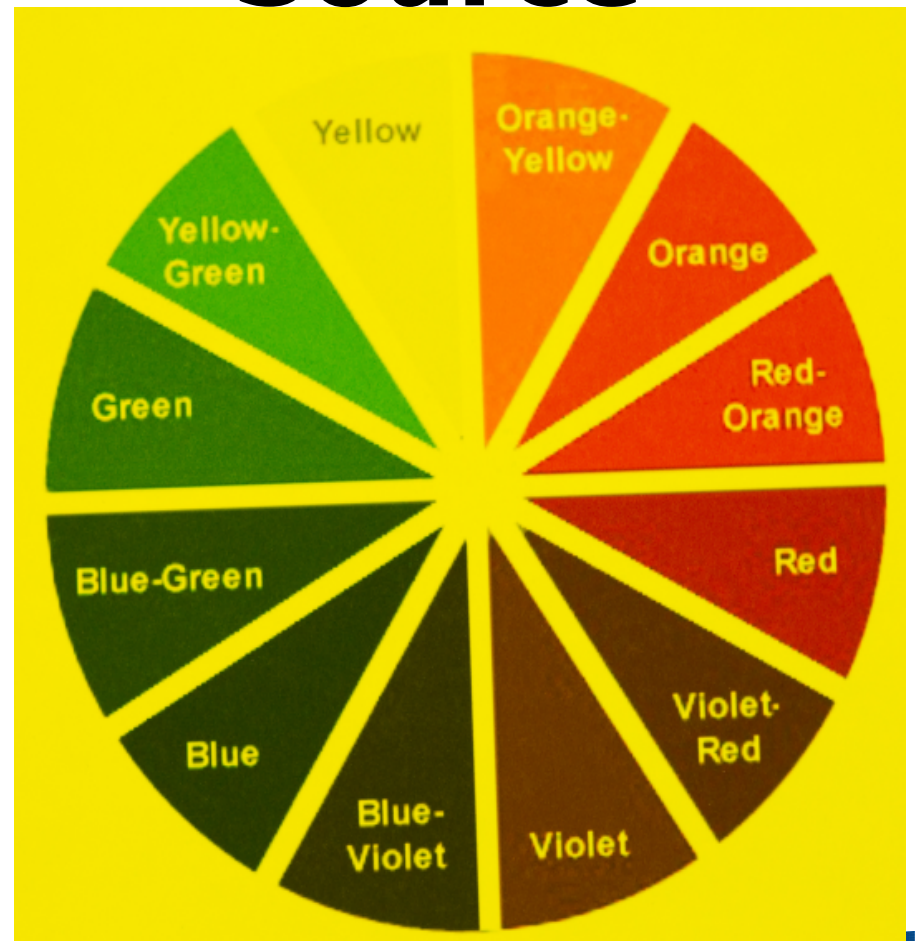


# *Annoying amber/yellow color*

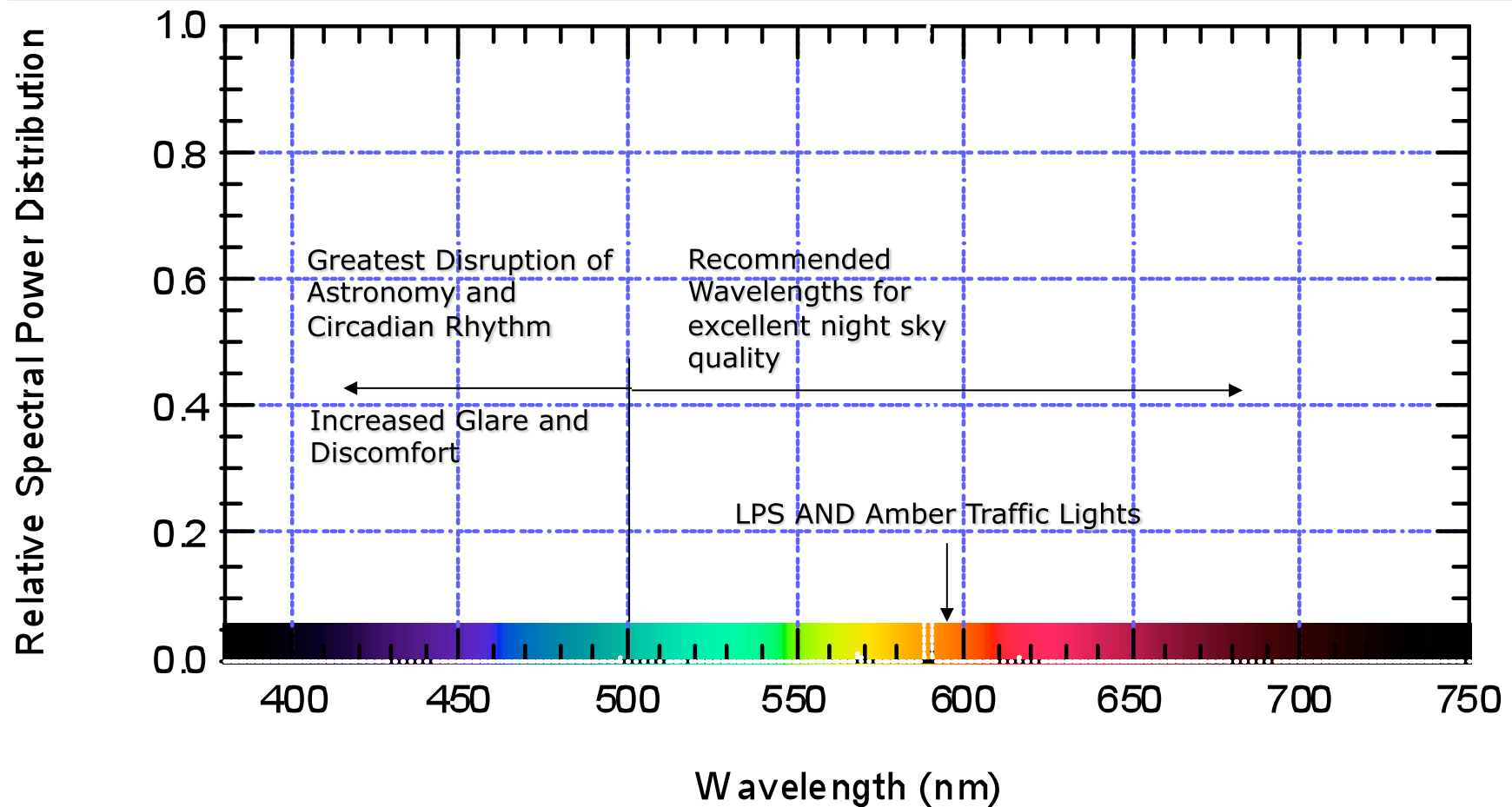
## **LPS Source**



## **Filtered LED Source**

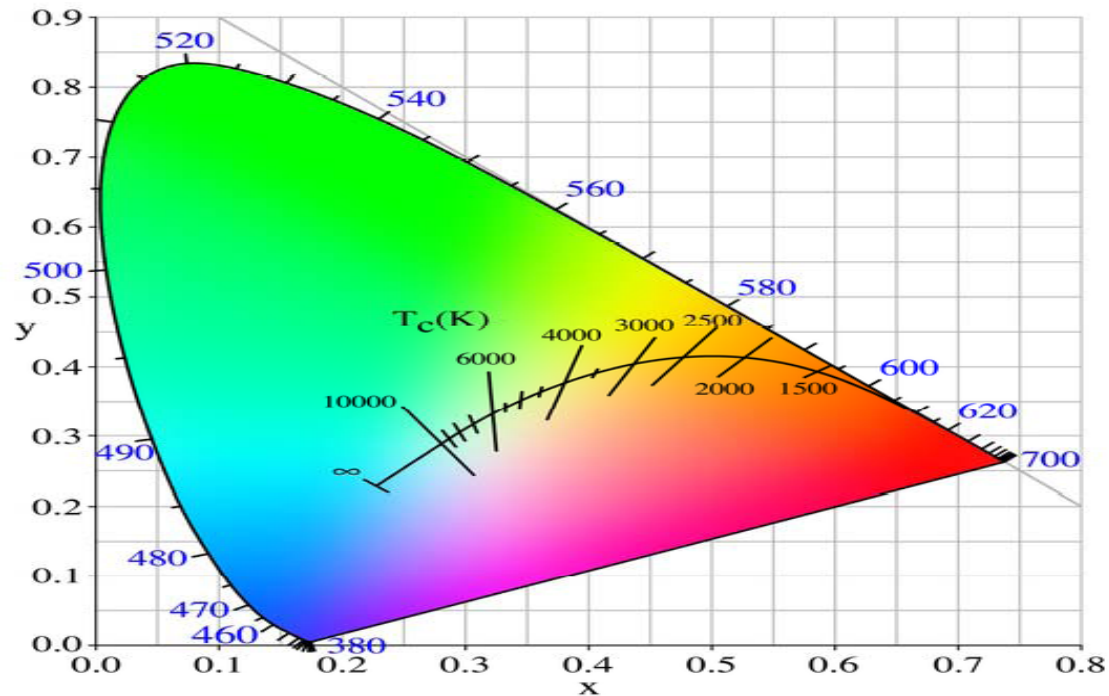


# AREAS OF CONCERN

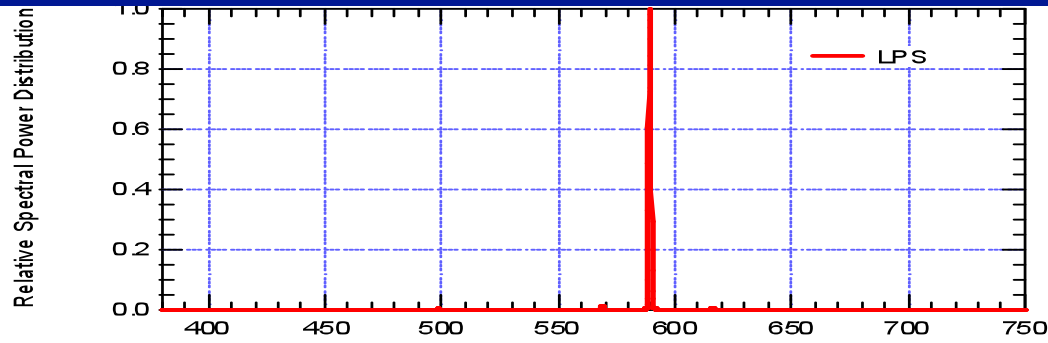




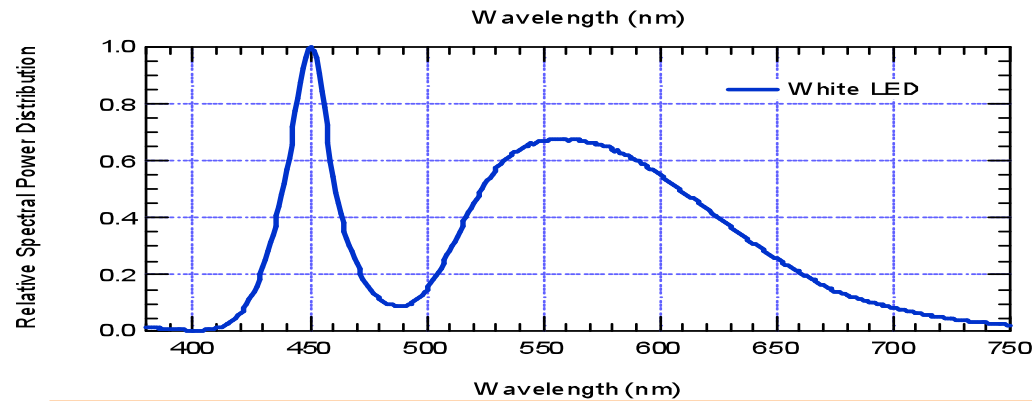
# Color temperature in Kelvin (K)



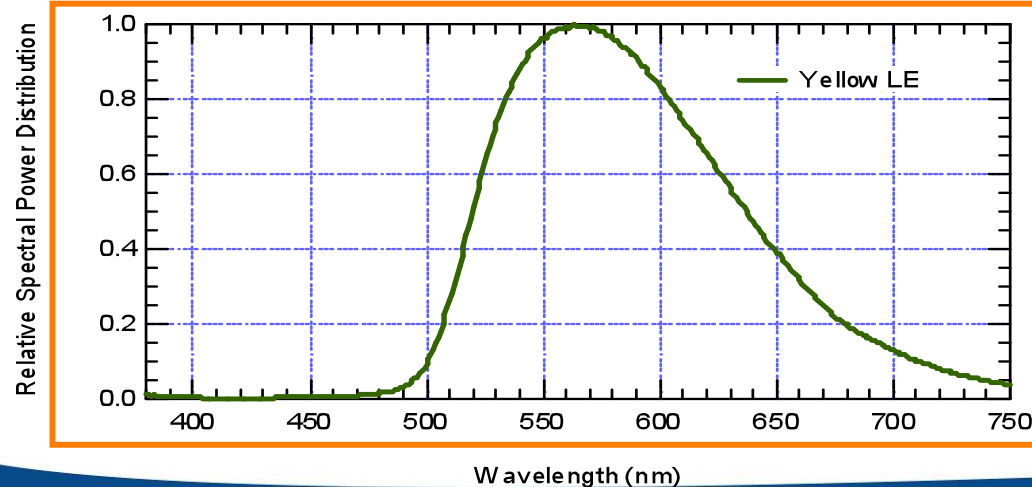
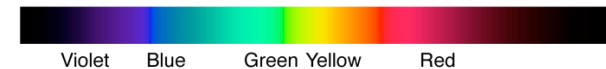
# SPECTRAL POWER DISTRIBUTION



SPD - existing LPS.



SPD - White LED Luminaire



SPD - Filtered Green/Yellow LED Luminaire

# **PHASE I - DEMO PROJECTS**

**a. 4 LEDs - Hilo - July 2007**

**Results = Too much blue light**

**b. 14 Filtered LEDs - Hilo - April 2010**

**Results = Very Satisfactory**

**c. 1,000 LEDs Island wide - May 2012**

# 1st DEMO – 4 LEDs - BLUE LIGHT

## 2nd DEMO 14- FILTERED LEDs

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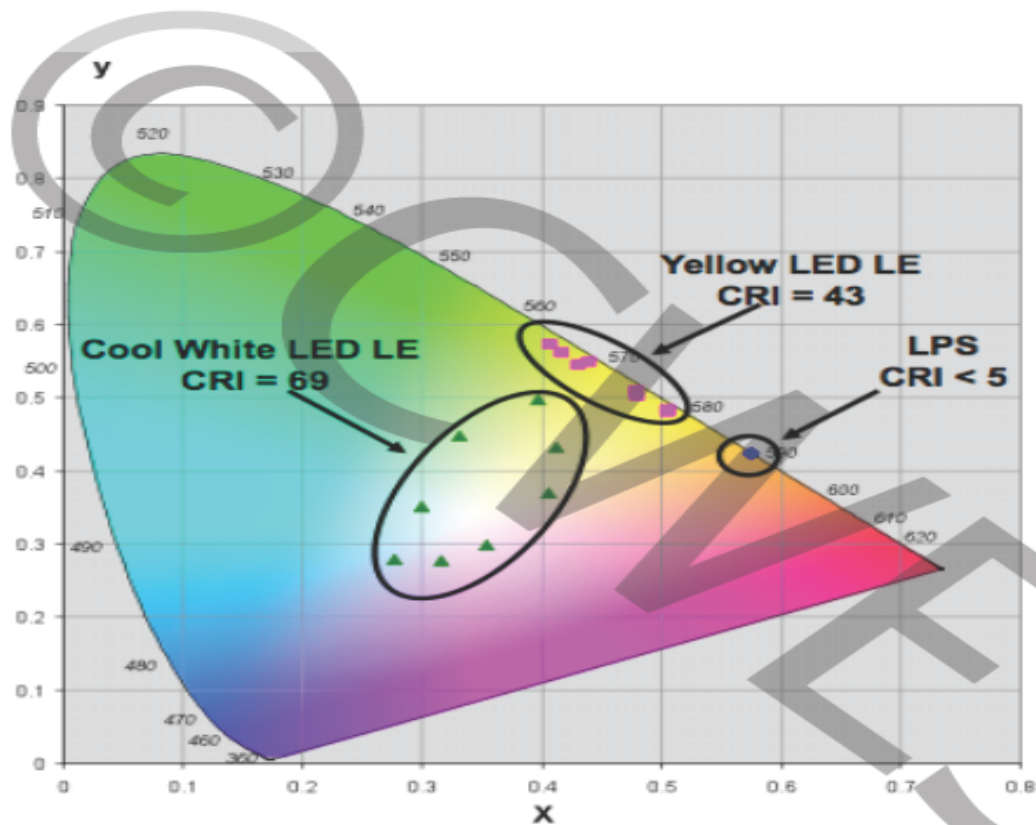




# COMPARE GREEN MOSS & GRASS TO LEDS



# Color Coordinates



# **PHASE II LED CONVERSION**

**9,500 LEDs – Jan 2015 to Dec 2016**

## **PAYBACK IN YEARS**

- **Material & Installation costs = \$6.8 mil**
- **Energy Saving (60%) = \$1.0 mil &  
Maintenance Saving (93%) = \$0.5 mil**
- **4.6 years to recover project costs.**



# **BIG ISLAND LIGHTING**

- **10,000 STREET LIGHTS**
- **10,000 AVERAGE # VEHICLES AT NIGHT**
- **80,000 +/- REMAINING LIGHTS**
  - **COMMERCIAL, STADIUMS, RESORTS & PRIVATE**
- **REPLACING EXISTING LIGHTS - SAME CRITERIA**
  - **RESIDENTIAL STREETS - 26w (72% savings)(84w LPS)**
  - **COLLECTOR STREETS - 42w (71% savings)(144w LPS)**
  - **URBAN & HIGHWAYS - 94w (60% savings) (229w LPS)**



# **EFFICACY CONSIDERATIONS**

- **1. 2700 KALVIN RENDERERS FIXTURE EFFICACY OF 30% TO 40% - MANUFACTURERS VARY**
- **2. OUR FILTERED LED RENDERERS FIXTURE EFFICACY OF 65%+**
- **3. BIG ISLAND OF HAWAII = \$0.3 MIL ANNUAL SAVINGS IN ENERGY**
- **4. DEMO WITH FLASHING LIGHT & FILTER**

# LASTING THOUGHT

- BRIGHT YELLOW IS A HIGH EYE SENSITIVE COLOR, AND IT ENCOURAGES **HOSTILITY AND AGGRESSIVENESS**, SUGGESTING THAT THE USE OF YELLOW LOW PRESSURE SODIUM STREET LIGHTING MAY NOT BE APPROPRIATE FOR EXTERIOR LIGHTING.
  - *SOURCE – Dr. Willard R. Daggett, President, International Center for Leadership in Education*