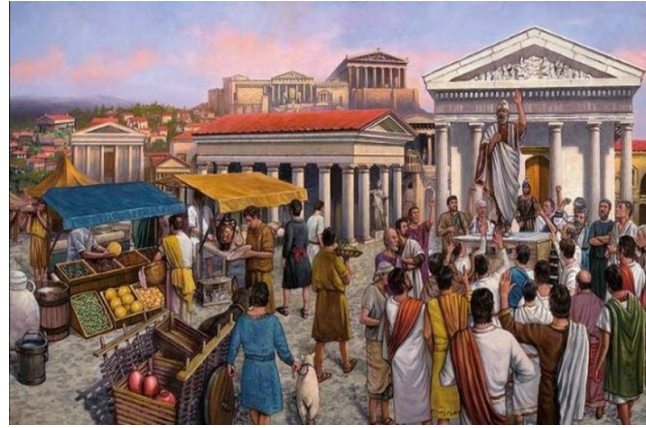




# Proxima Centauri-Emulating InGaN LED: Our Path to Extraterrestrial Agriculture

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# Importance of Extraterrestrial Agriculture



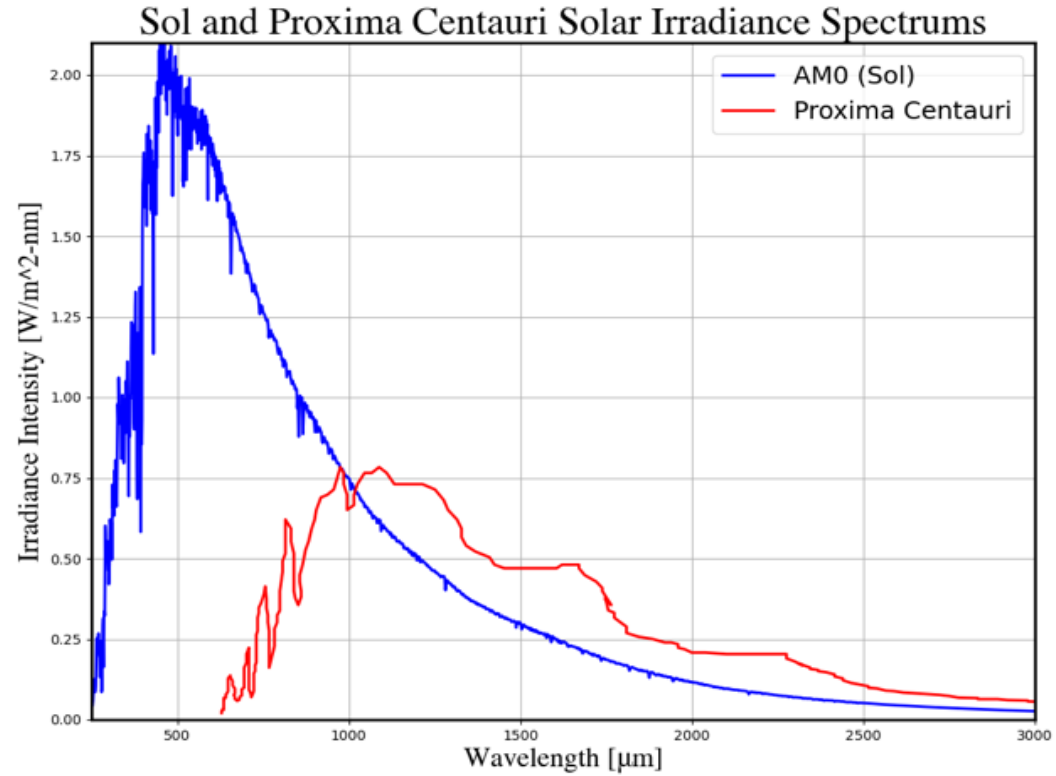
- Agriculture was the fundamental building block of the start civilization, and it **CONTINUES TO BE!**
- Space-faring humanity **REQUIRES** food in abundance on the worlds we inhabit
- Current methods of extraterrestrial agriculture **ARE NOT** practical outside of our solar system

What Happens If we are no longer getting our irradiance from Sol?



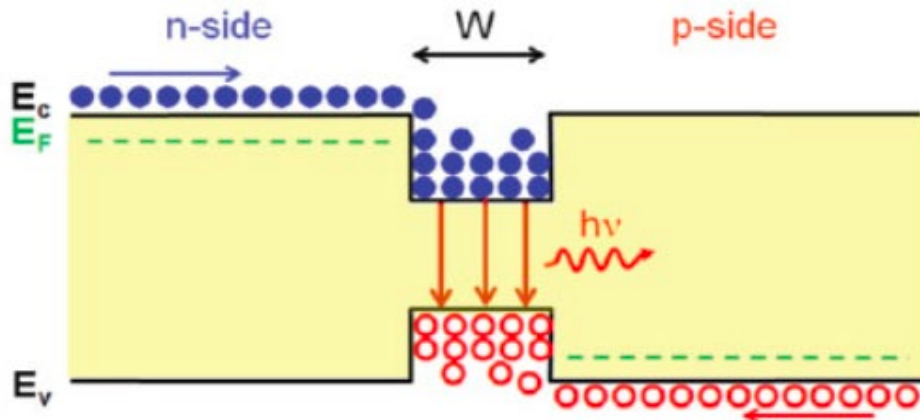


# Proxima Centauri



- **Proxima Centauri** is the **CLOSEST** star to our Solar System
- Orbiting it is **Proxima Centauri b** the closest potentially **HABITABLE PLANET** outside of our solar system

# Technical Background



## Quantum Well



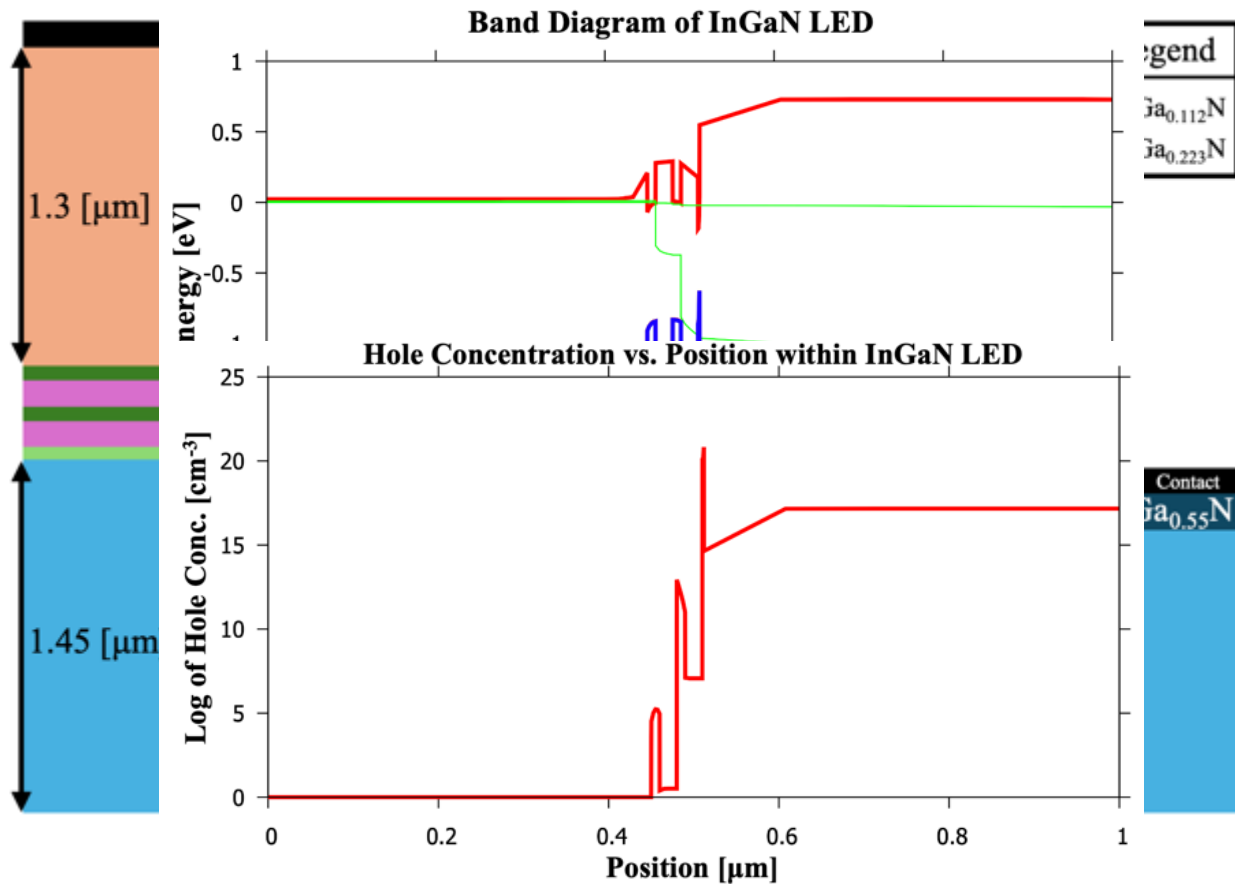
Can use **QWs** to Make **LEDs**

$$IQE = \frac{Bn^2}{An + Bn^2 + Cn^3}$$
$$PE = \frac{P_{out}}{P_{in}}$$

Can assess **LEDs** using:  
Internal Quantum Efficiency (IQE)  
And  
Power Efficiency (PE)

# High In Content InGaN Problem

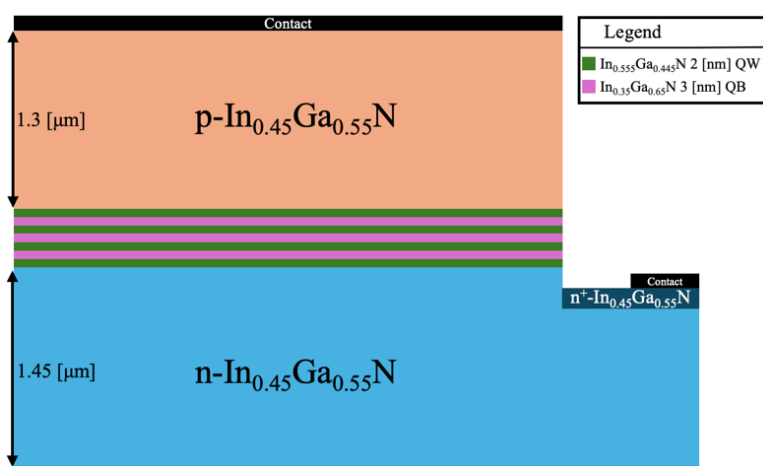
- High In content in InGaN is a **HUGE** problem
- Hole do not distribute themselves evenly across QWs



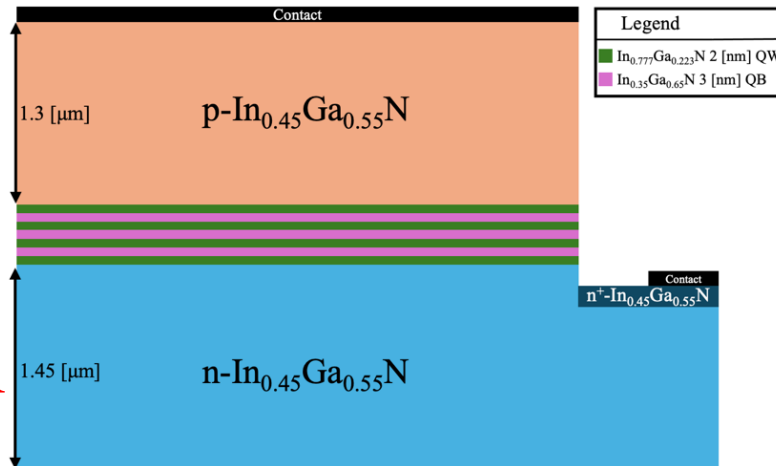
Causes:

- In **CLUSTERING**
- High **DEFECT** Density
- Small **DIFFUSION** constants and **MOBILITY**

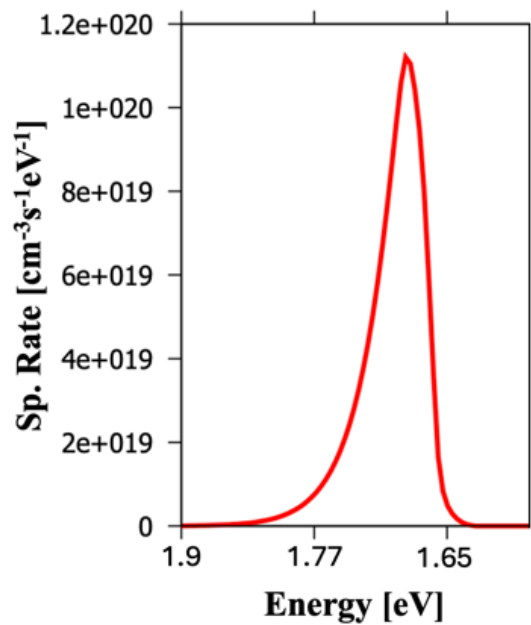
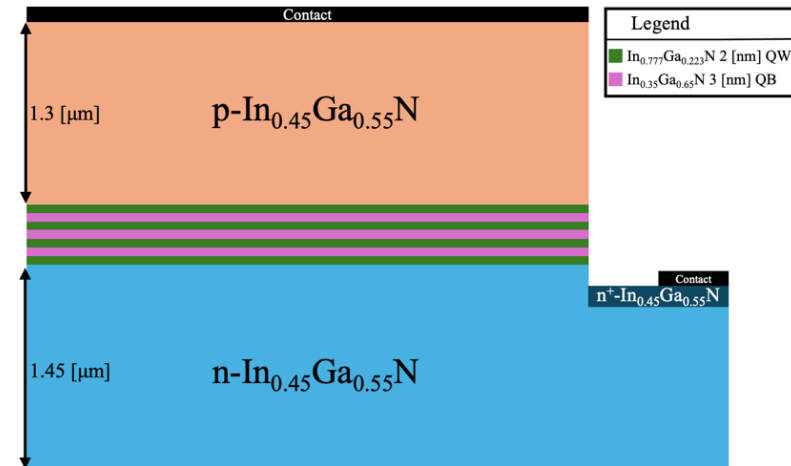
# High In Content InGaN Solution



EA

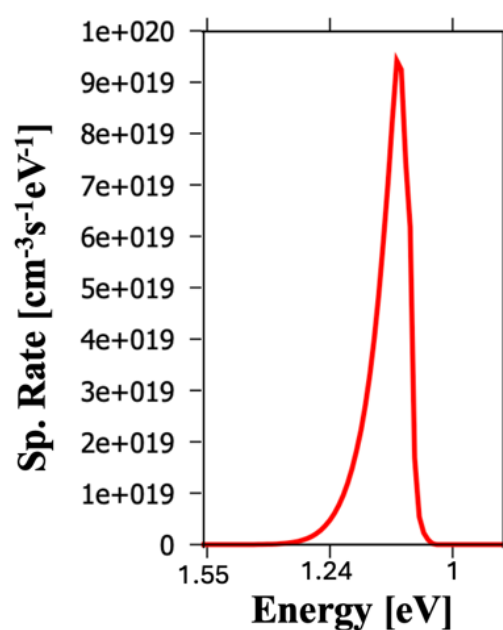


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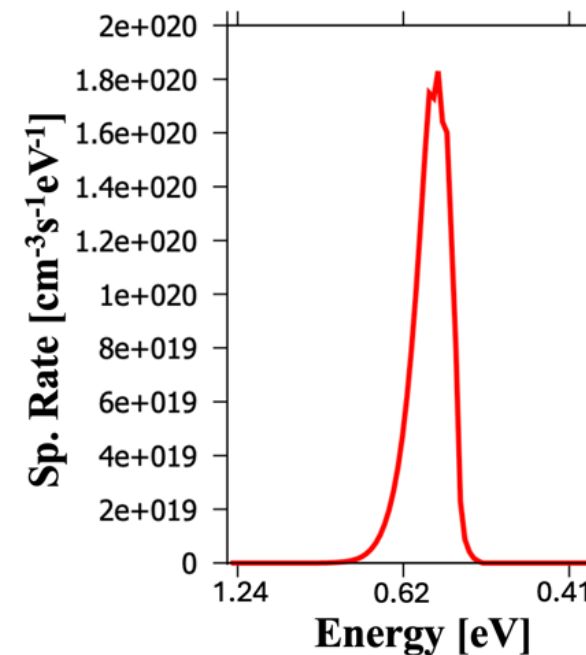


[CREAS]

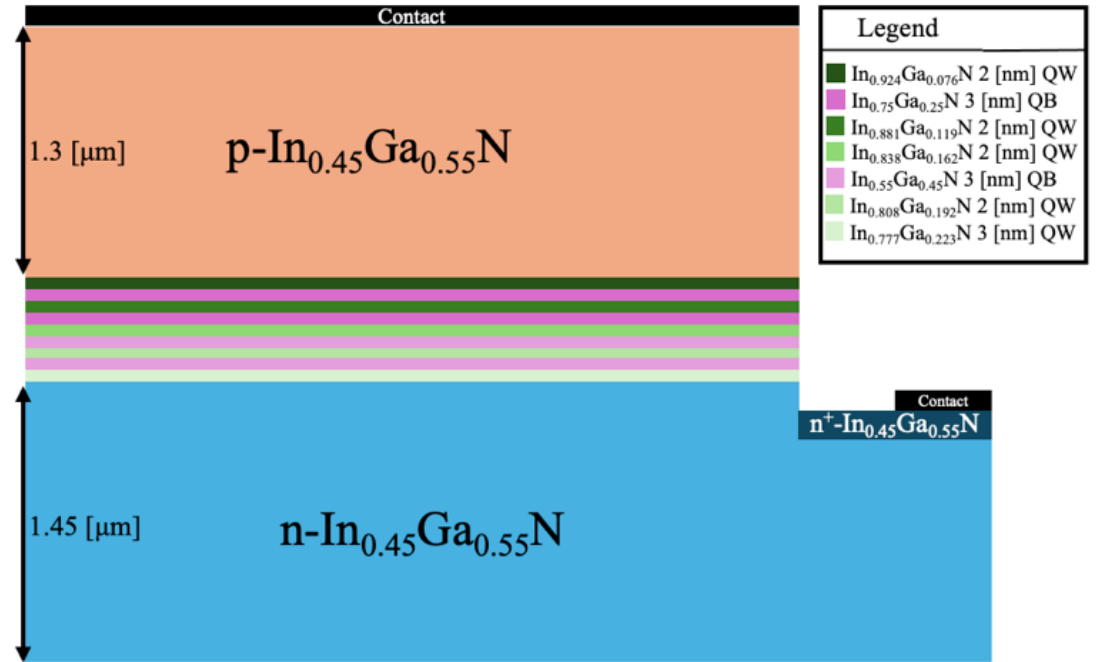
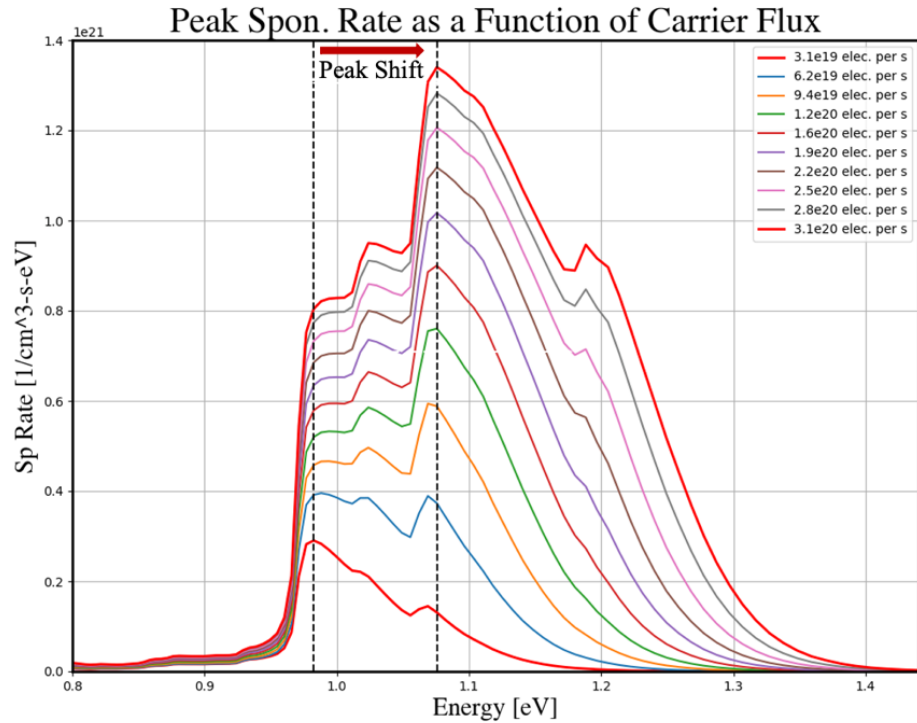
[CREAS]



of Holes



# Monolithic Structure Under High Level Injection

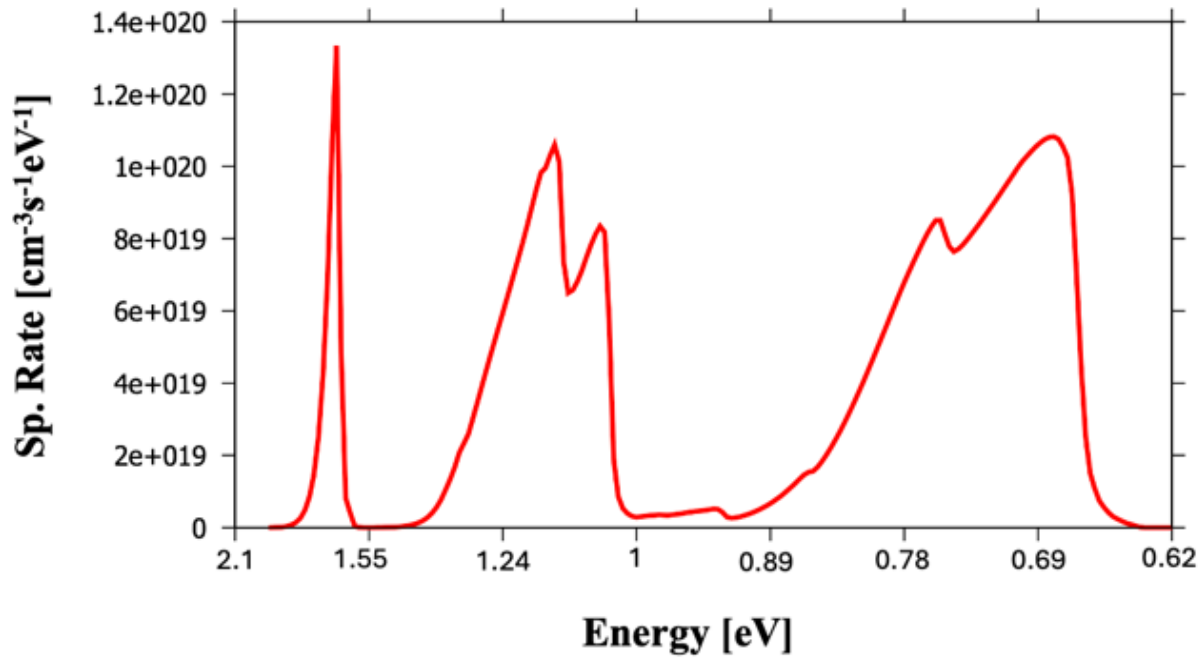


- There is a **BLUE SHIFT** in the peak of the device as the carrier injection is increased
- This structure, optimized to shift, can enable **EXPANDED USE** of InGaN LEDs

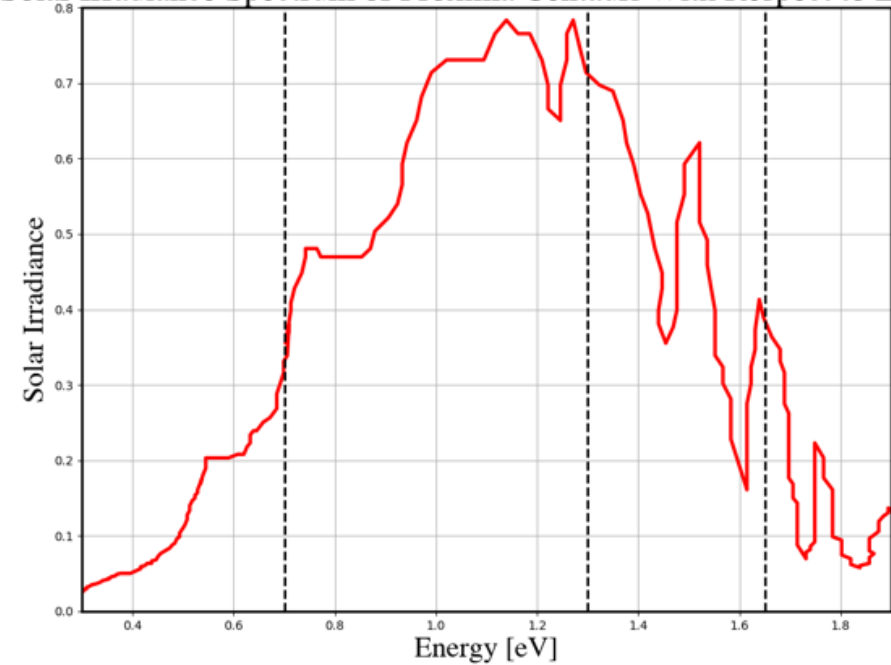


# A Proxima Centauri-Emulating InGaN LED

Sp. Rate vs Energy for Proxima Centauri LED

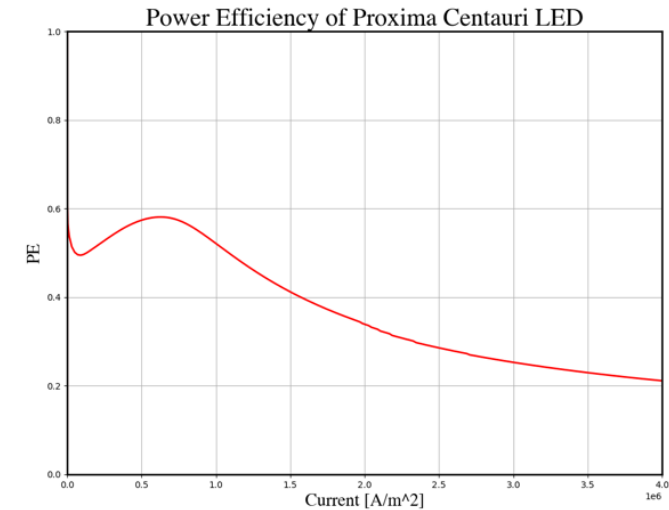
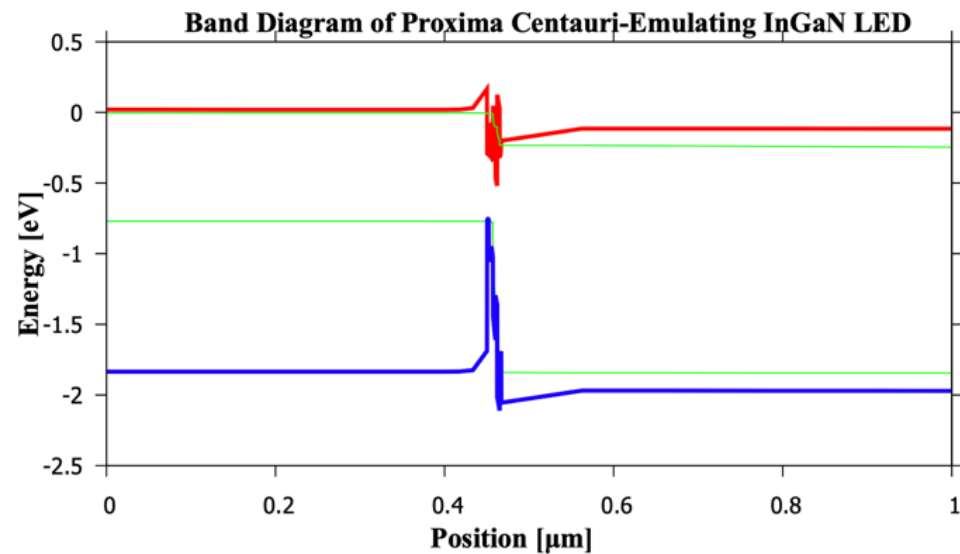
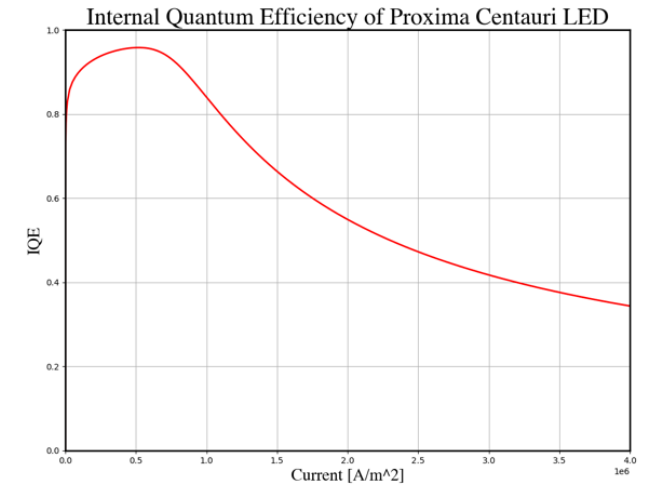
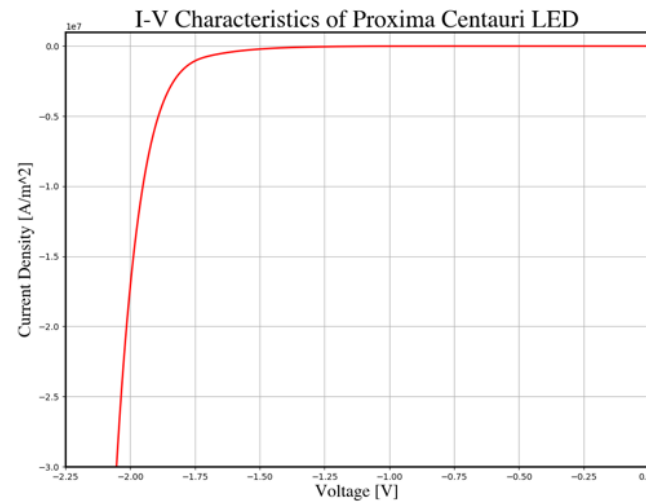
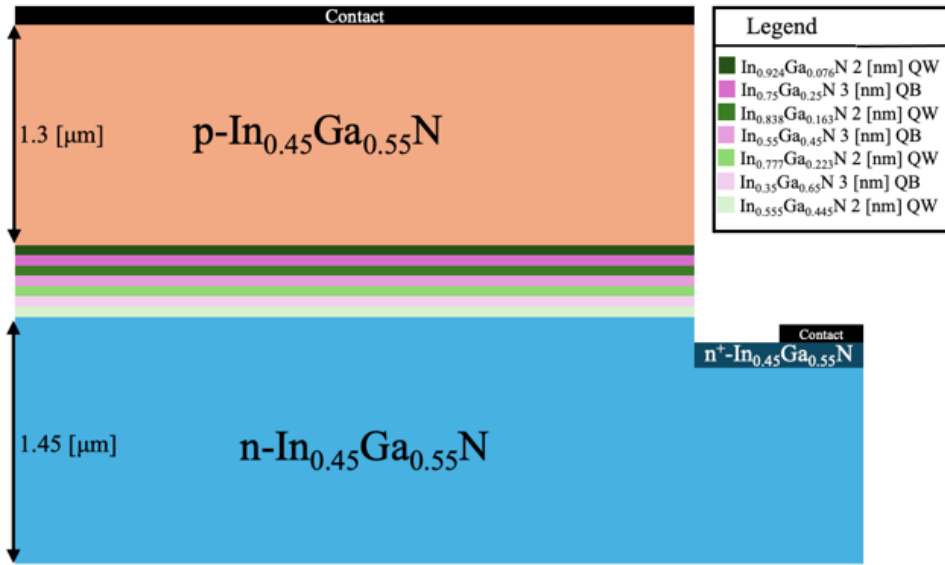


Solar Irradiance Spectrum of Proxima Centauri With Respect to Energy

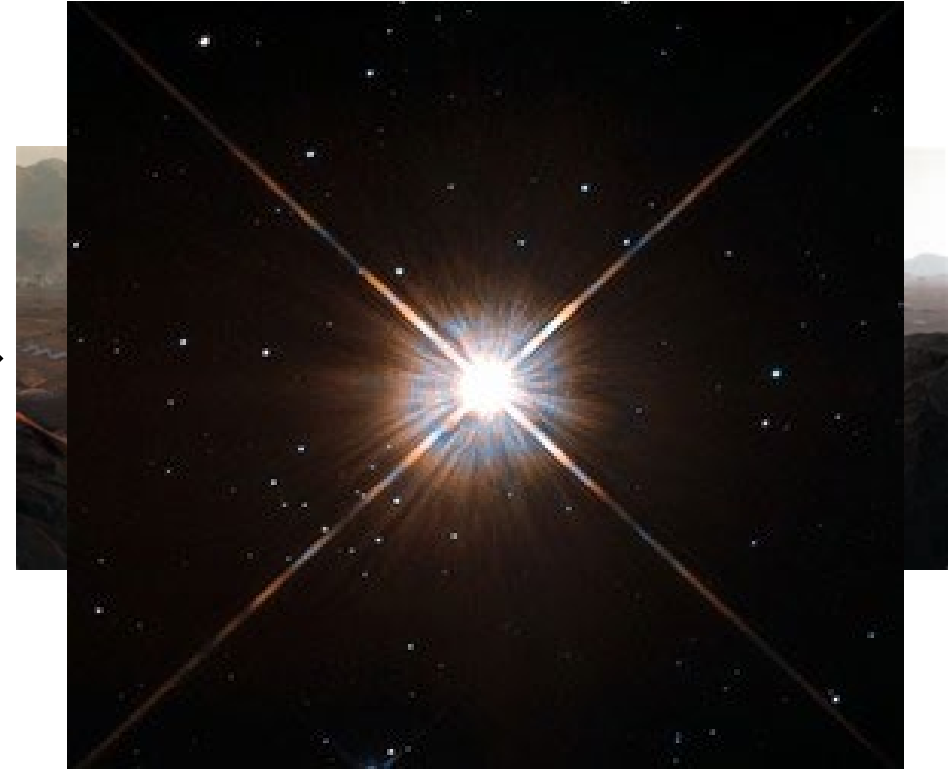
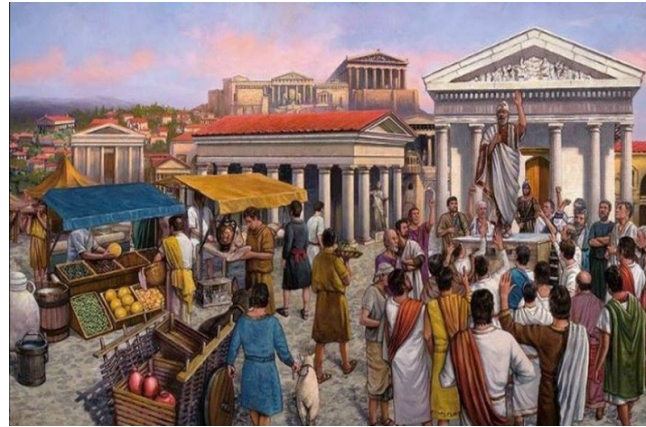


Targets: 1.65, 1.3, and 0.7 [eV]

# Proxima Centauri-Emulating InGaN LED

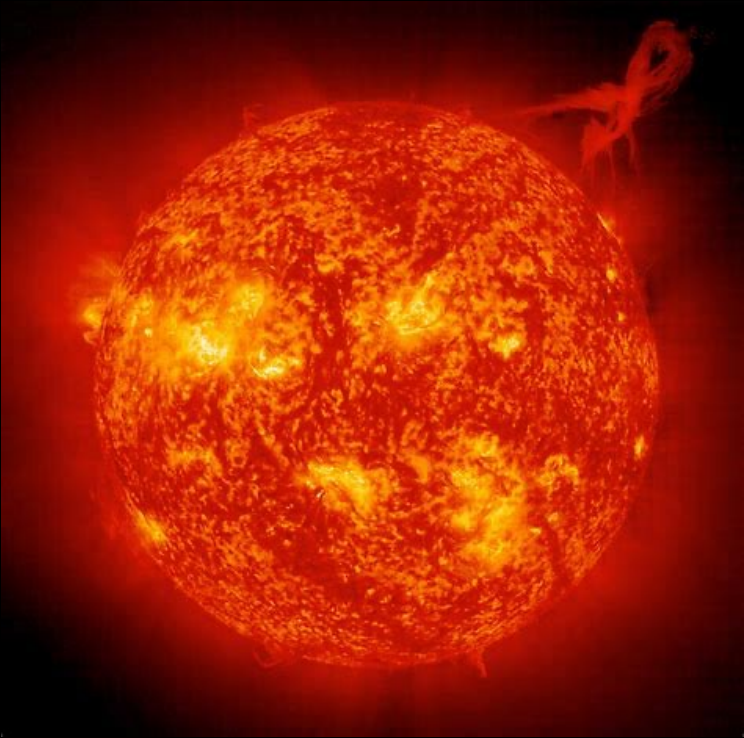


# Importance of Extraterrestrial Agriculture



- I suggest a **NOVEL** direction for **EXTRATERRESTRIAL AGRICULTURE**
- LEDs such as the InGaN one herein bring humans one step closer to calling **Proxima Centauri b HOME**

# THANK YOU FOR LISTENING!



*“Today’s science fiction is tomorrow’s science fact.” – Isaac Asimov*