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## Temperature Dependence of SiO<sub>2</sub> Electron-Induced Luminescence

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# Temperature Dependence of SiO<sub>2</sub> Electron-Induced Luminescence

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Physics Department, Utah State University



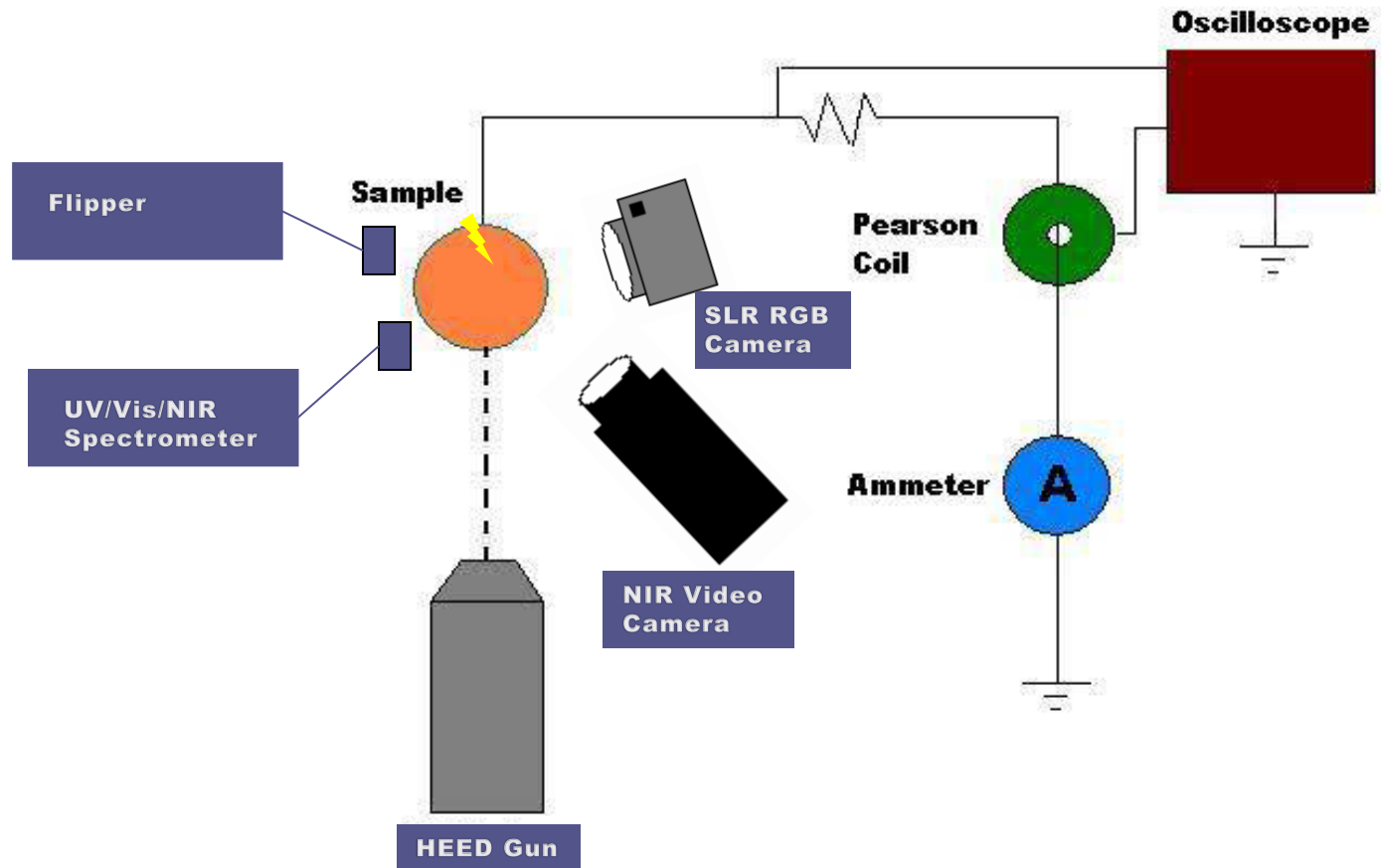
# Motivation

- Space telescope optical instrumentation



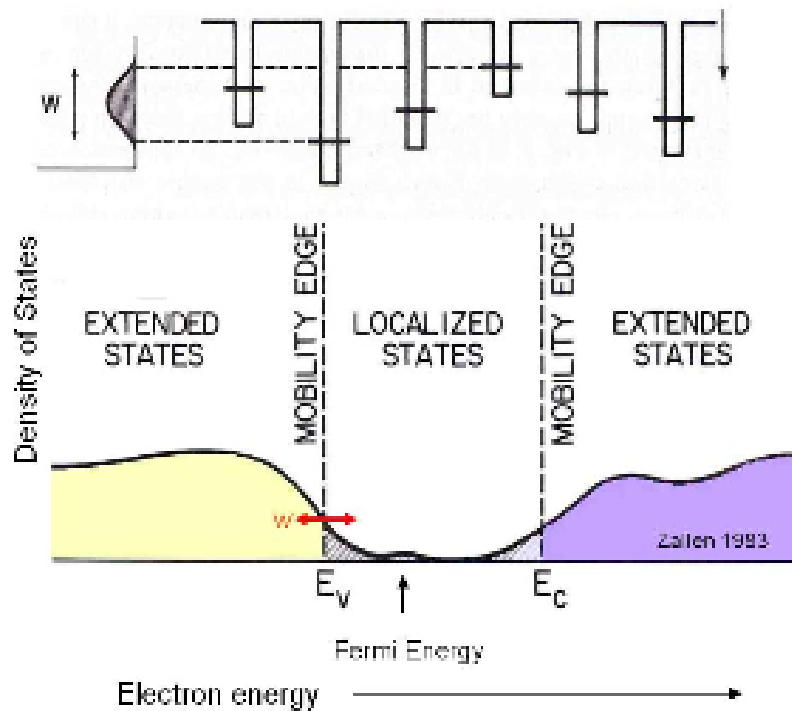
- Wilson, **Electron Energy Dependent Charging Effects of Multilayered Dielectric Materials**, Session M3

# Experimental Set-Up

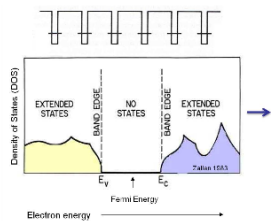


# Band Theory Model

## Crystal with defects

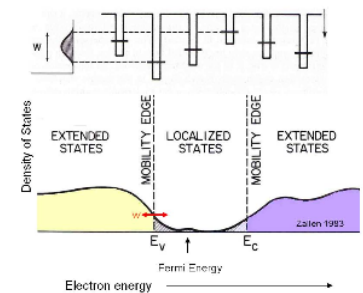


### Crystalline Structure

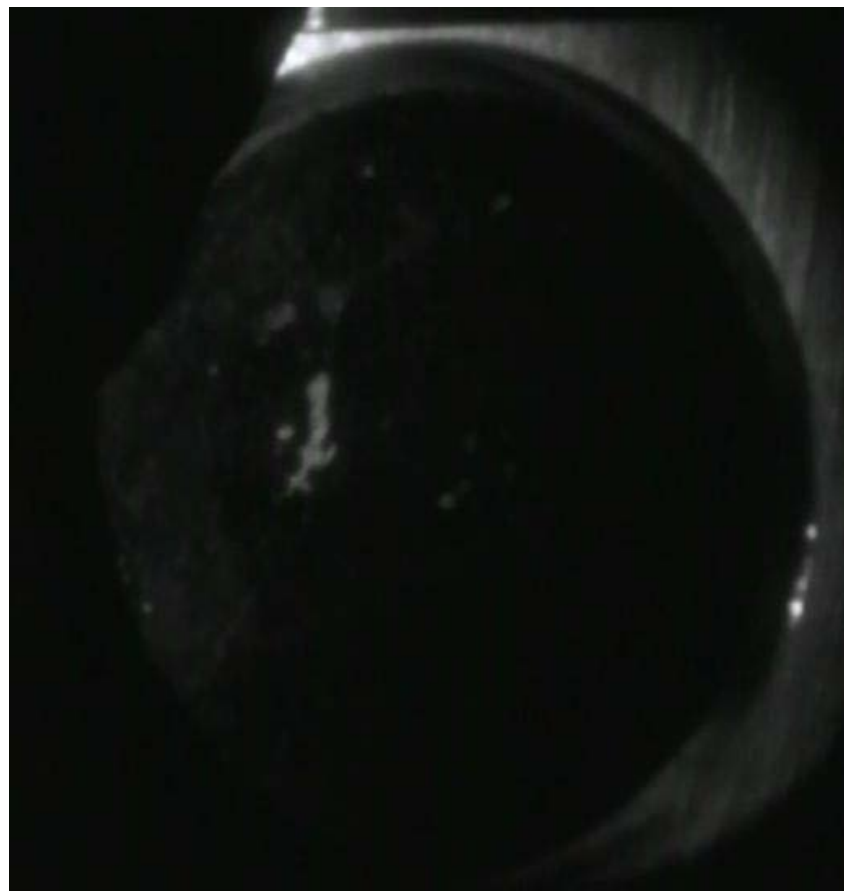


SiO<sub>2</sub>: 8.9 eV ~Transparent

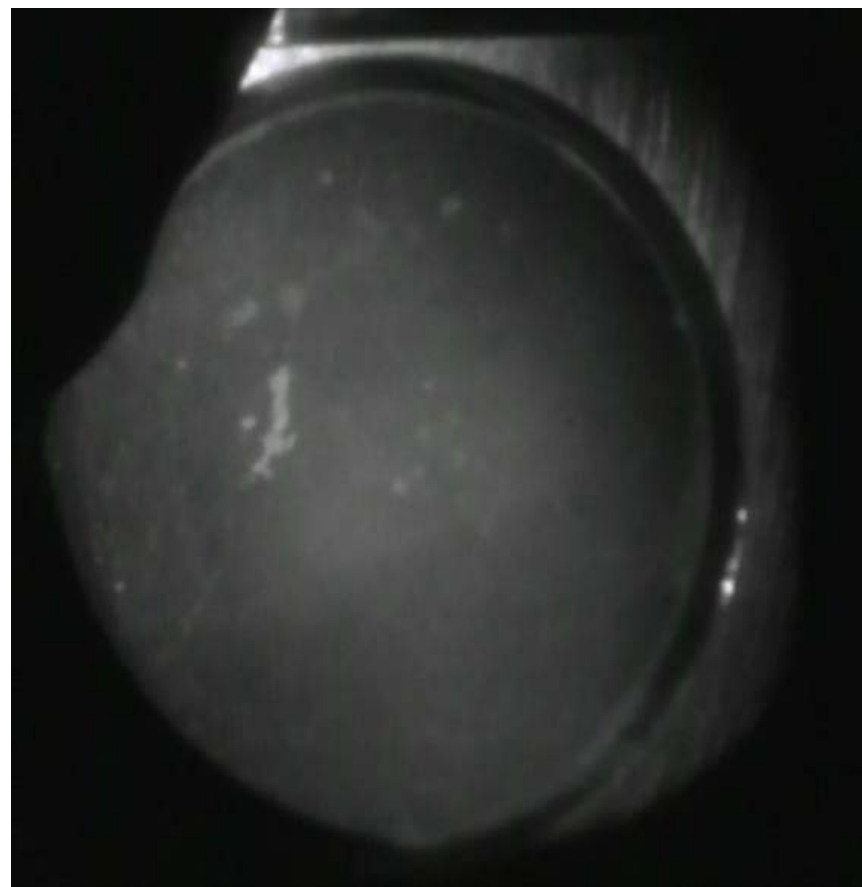
### Crystal with defects



# Electron-Induced Luminescence of SiO<sub>2</sub> Mirror

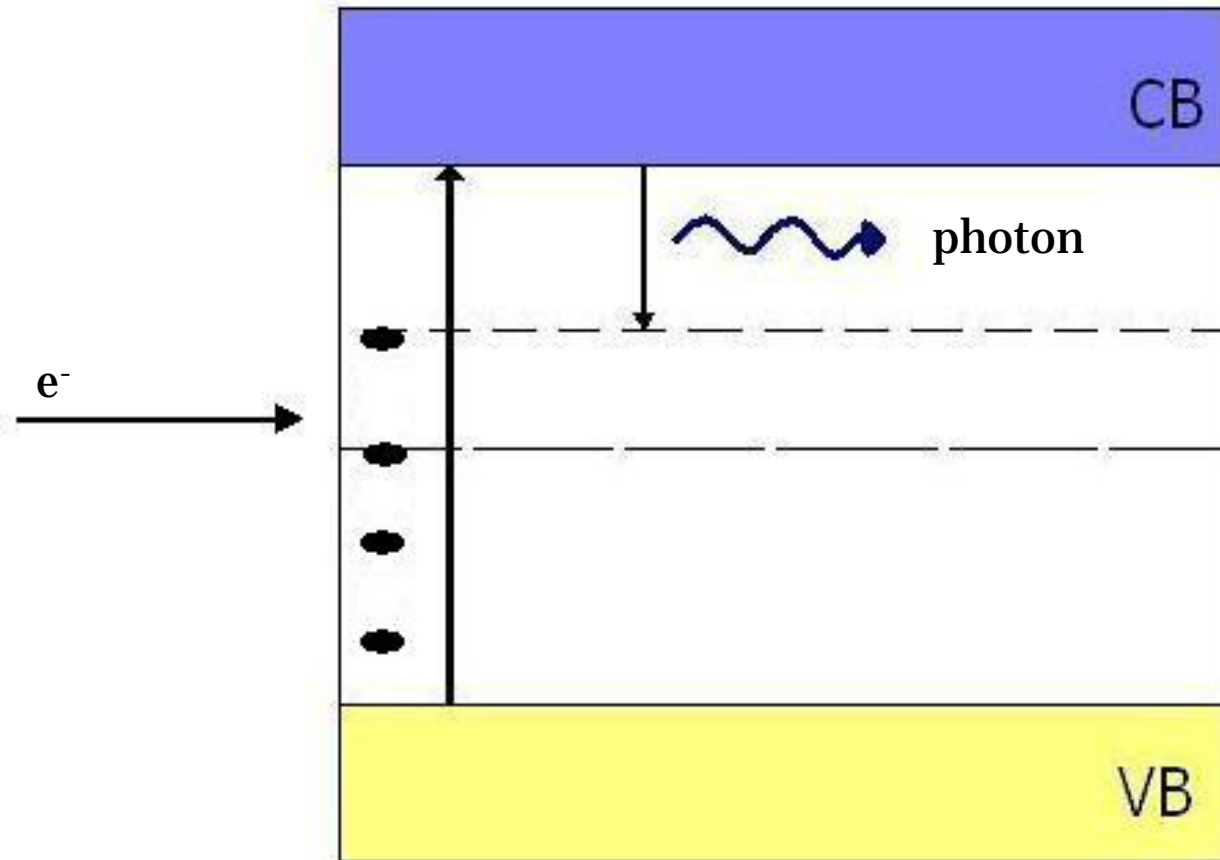


**Beam off**

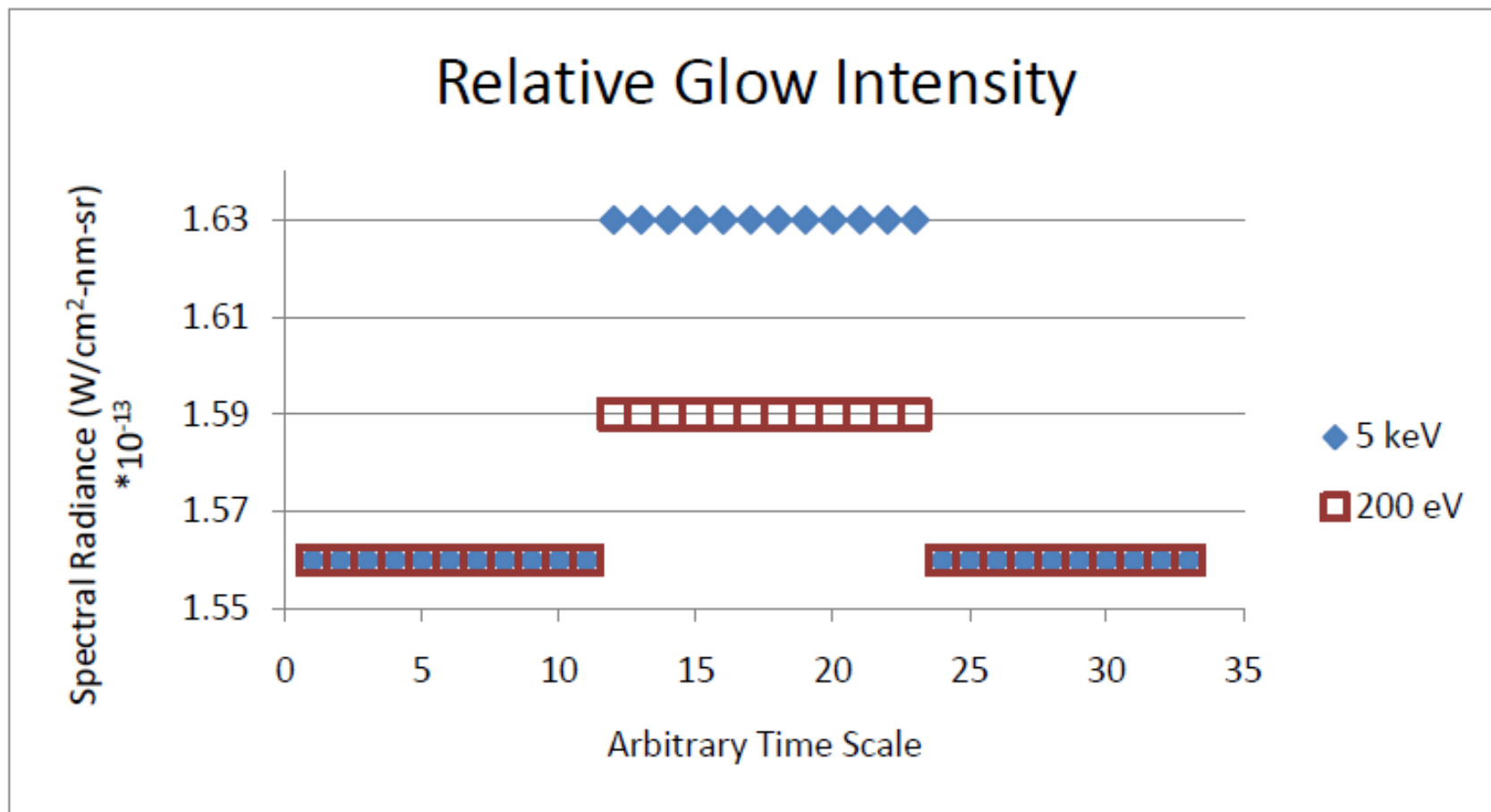


**Beam on**

# Excitation and Relaxation

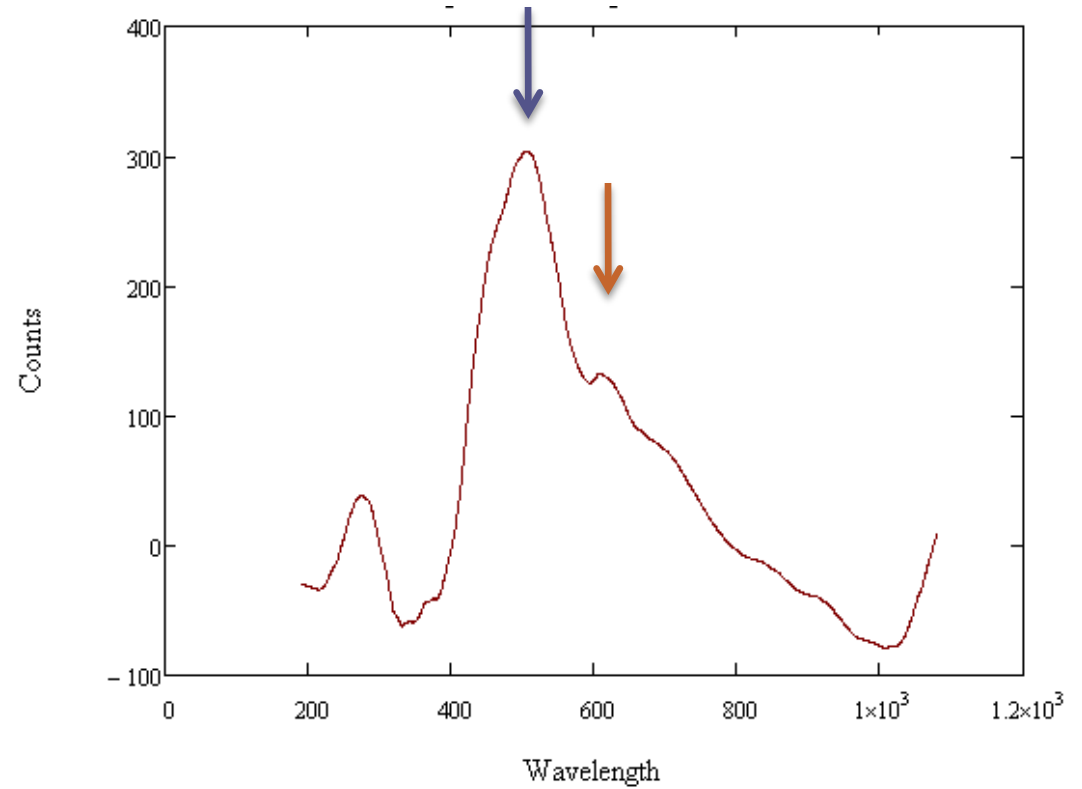
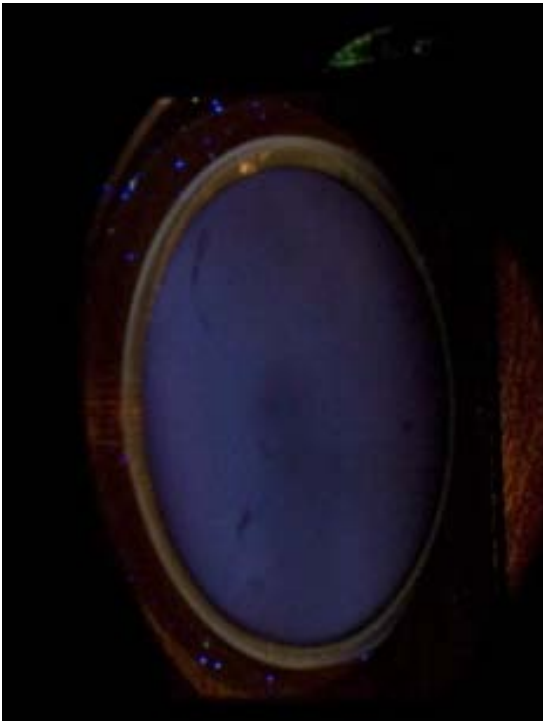


# Effect of Beam Energy

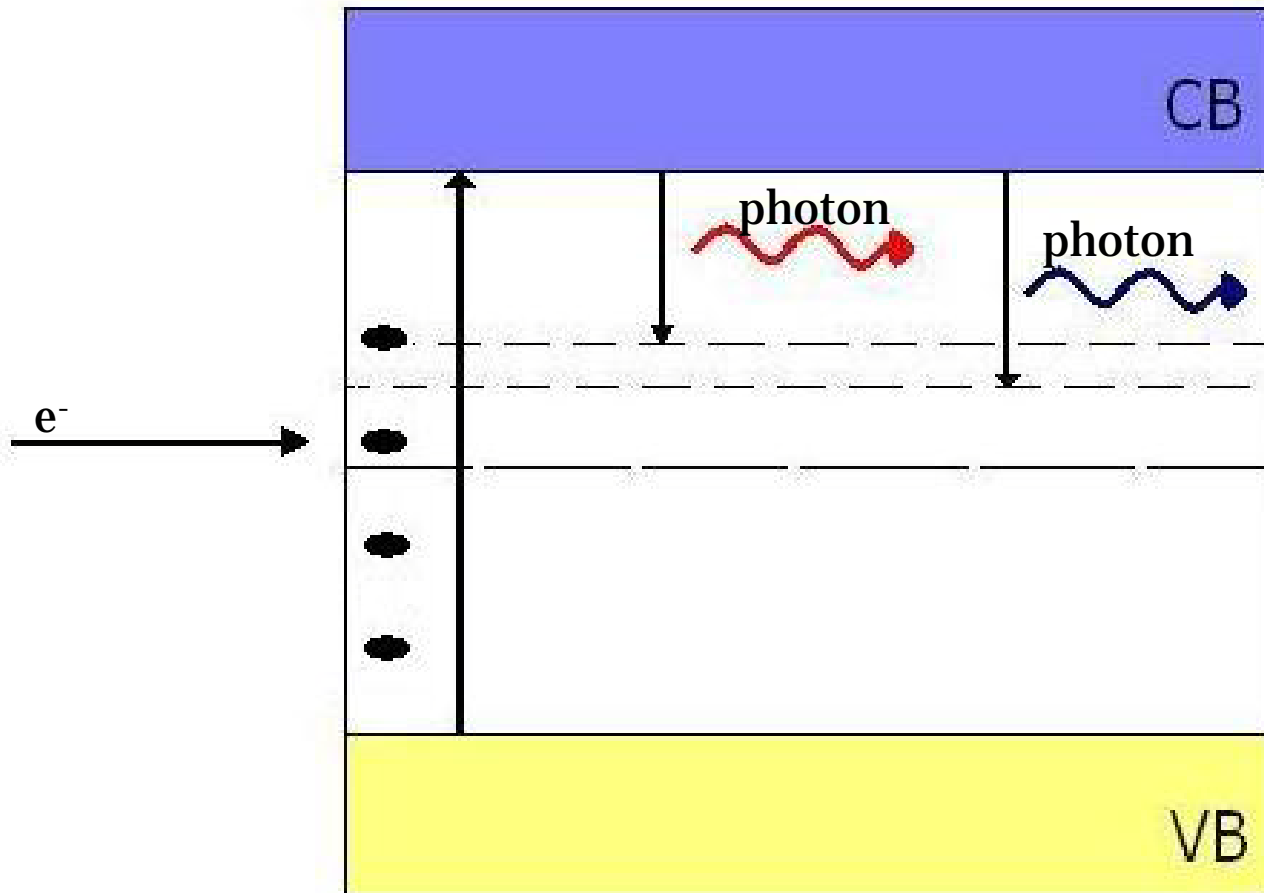




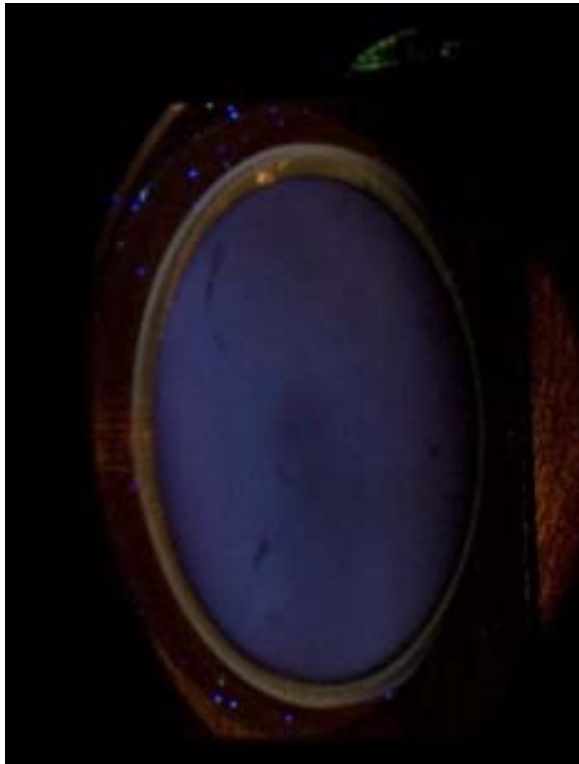
# Multi-Photon Luminescence



# Multi-Photon Relaxation



# Temperature Dependent Luminescence



**-4 C**

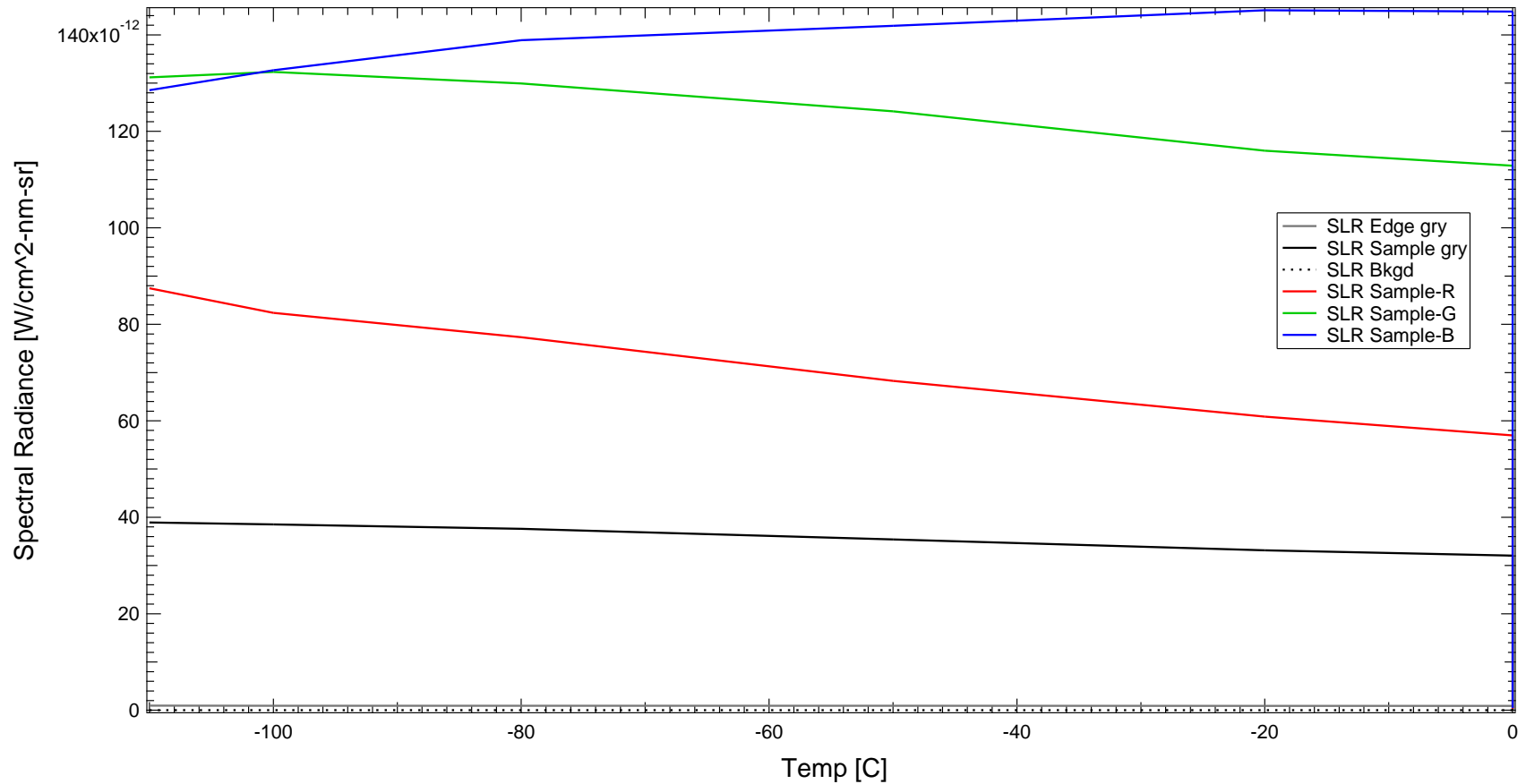


**-80 C**

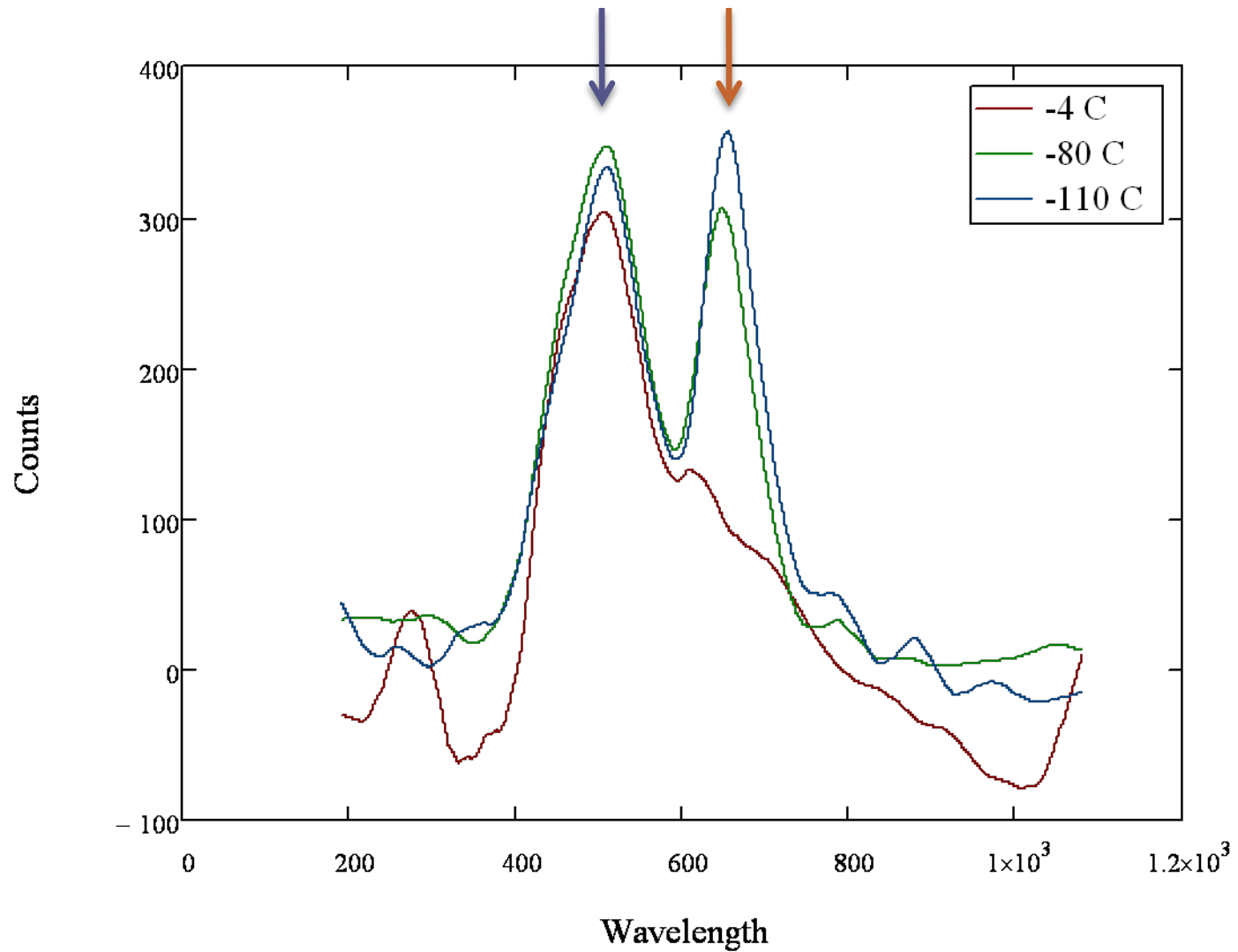


**-110 C**

# SLR Spectral Radiance vs Temperature



# Temperature Dependent UV-Vis Spectra



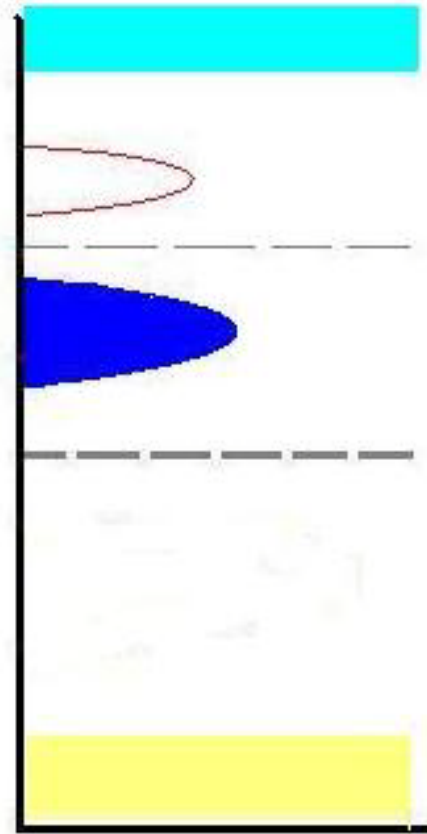
# Temperature Model

$$T = 0$$



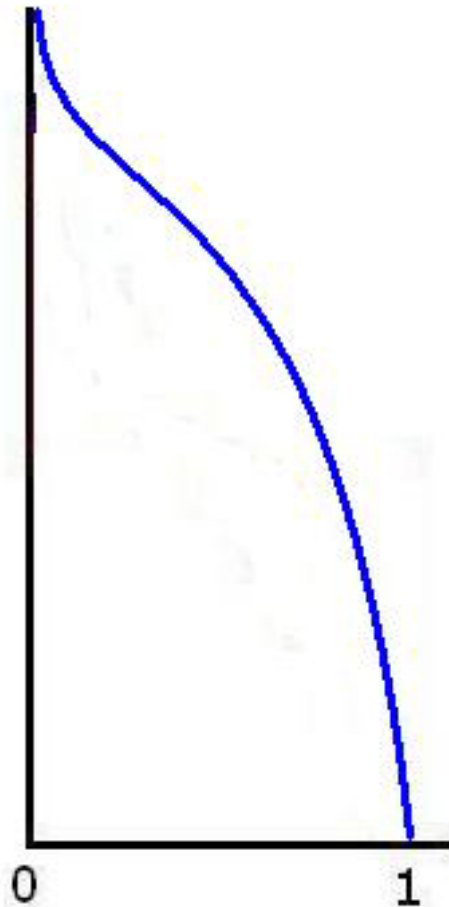
Effective Fermi Level

Fermi Energy



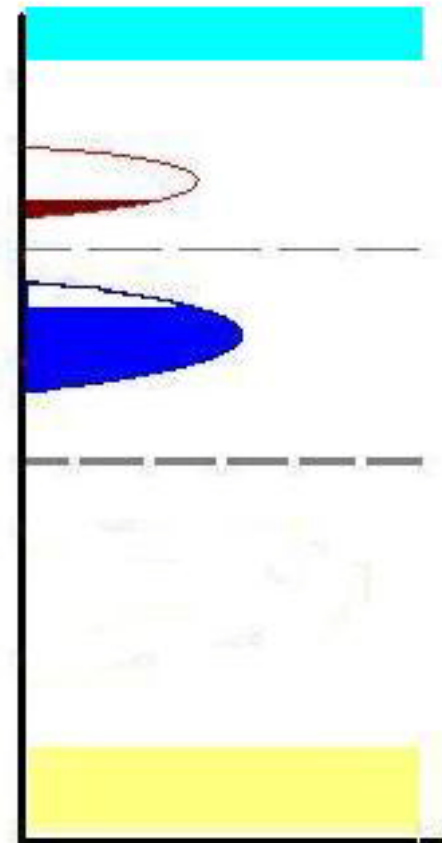
# Temperature Model

## Low T



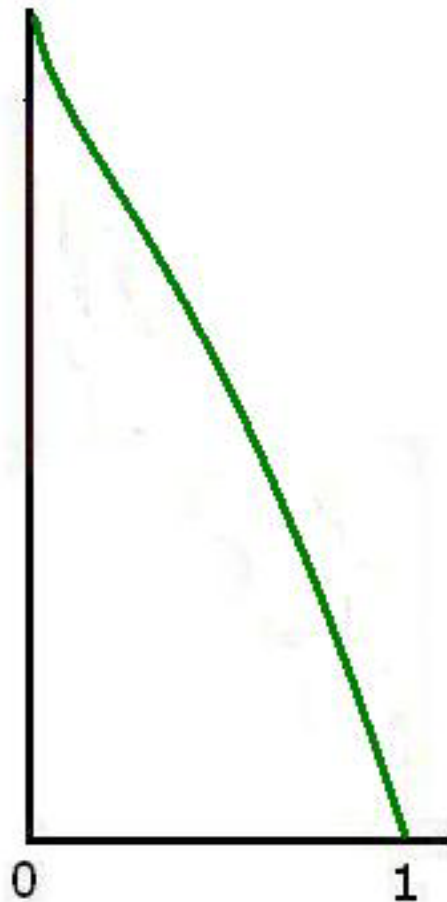
Effective Fermi Level

Fermi Energy



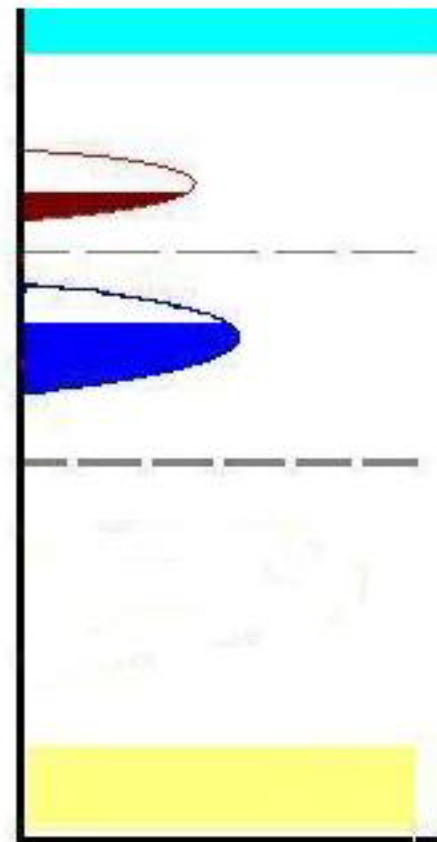
# Temperature Model

## High T



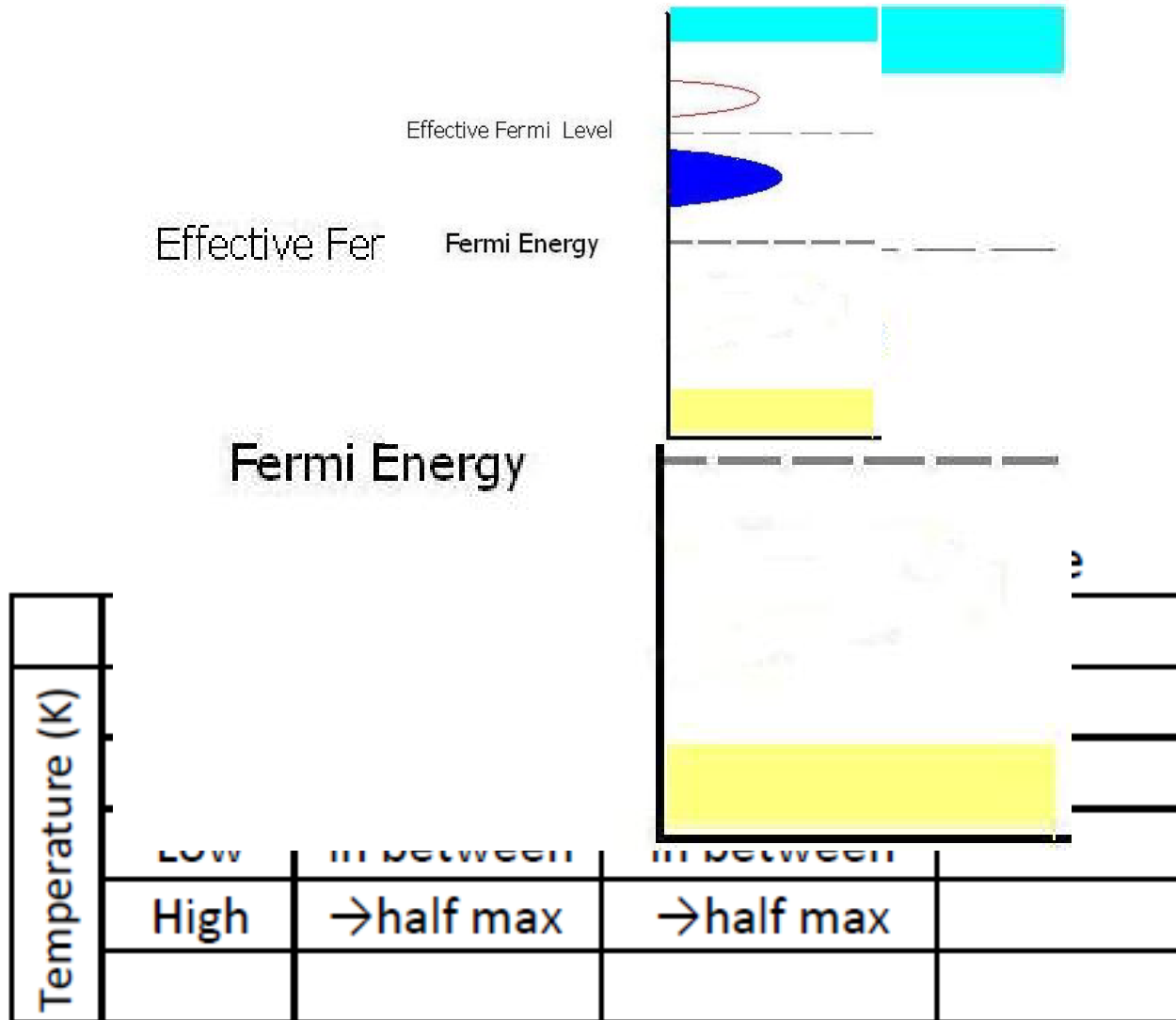
Effective Fermi Level

Fermi Energy

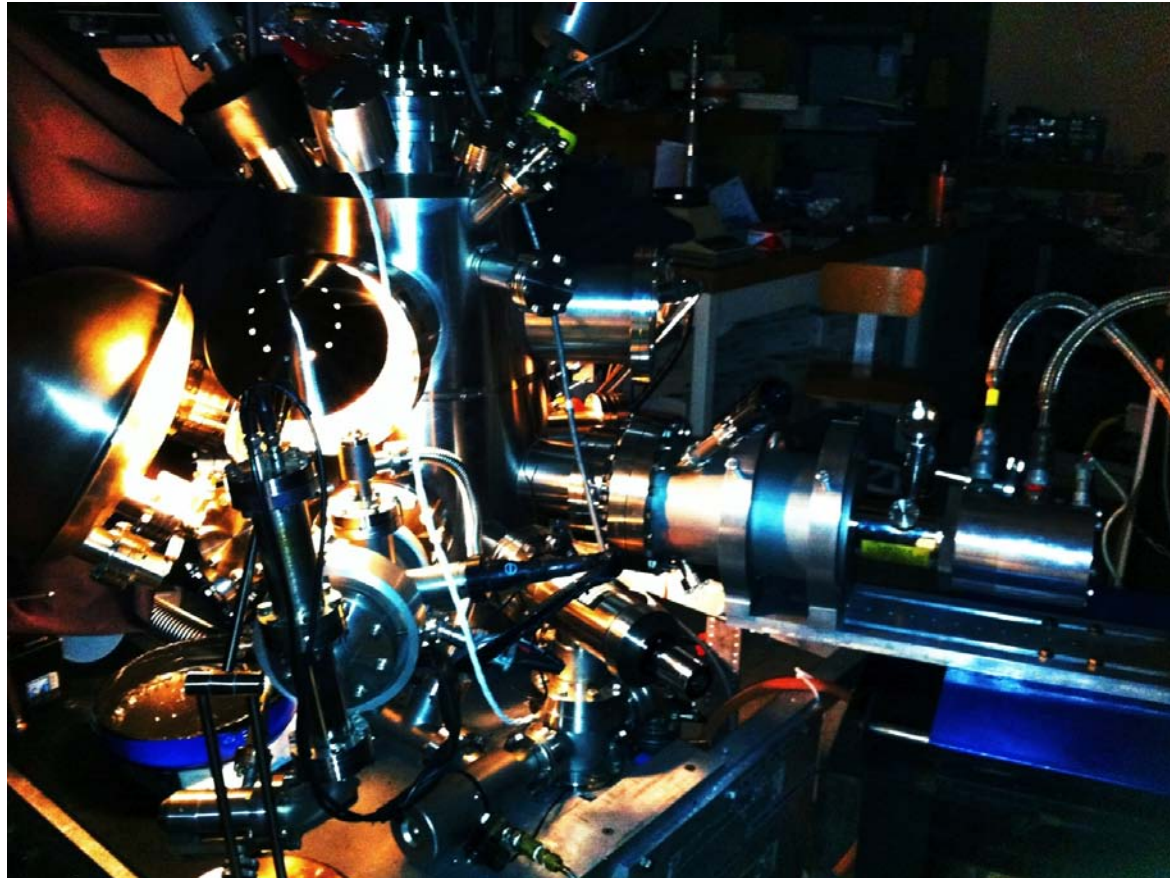




# Conclusions



# Future Work



## **Acknowledgement**

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