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10-12-2018

## Optical Transmission of Irradiated Optical Filters

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Keeler, Ashlan; Dennison, JR; Wood, Brian; and Mojica Decena, Jonh, "Optical Transmission of Irradiated Optical Filters" (2018). Fall 2018 Four Corner Section Meeting of the American Physical Society.

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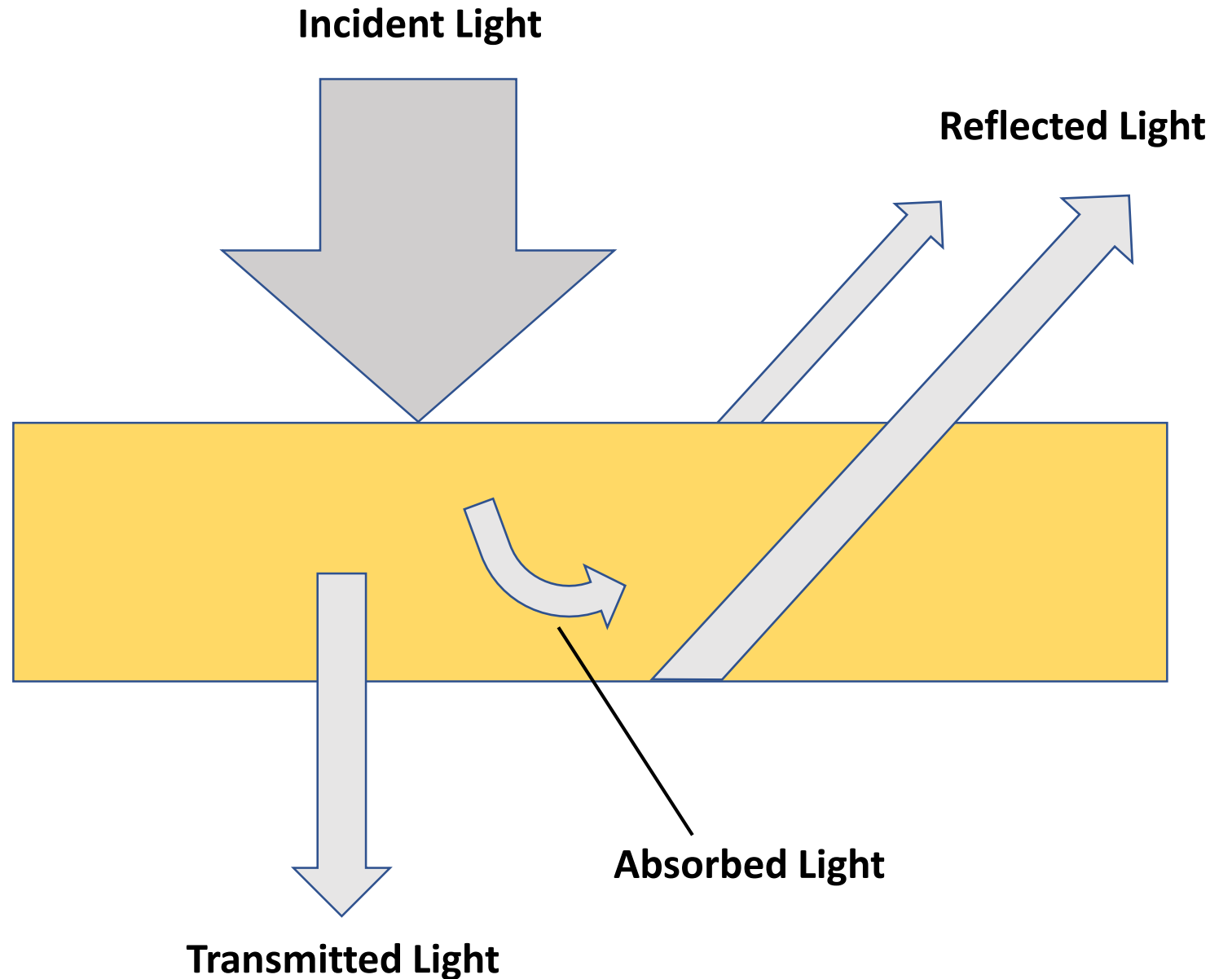


# Optical Transmission of Irradiated Optical filters

Ashlan Keeler, JR Dennison, Brian Wood, Jonh Carlos Mojica Decana

*Materials Physics Group*  
*Utah State University*

# Transmission, Absorption, and Reflection



**Total Incident Light**

=

*Transmitted* Light

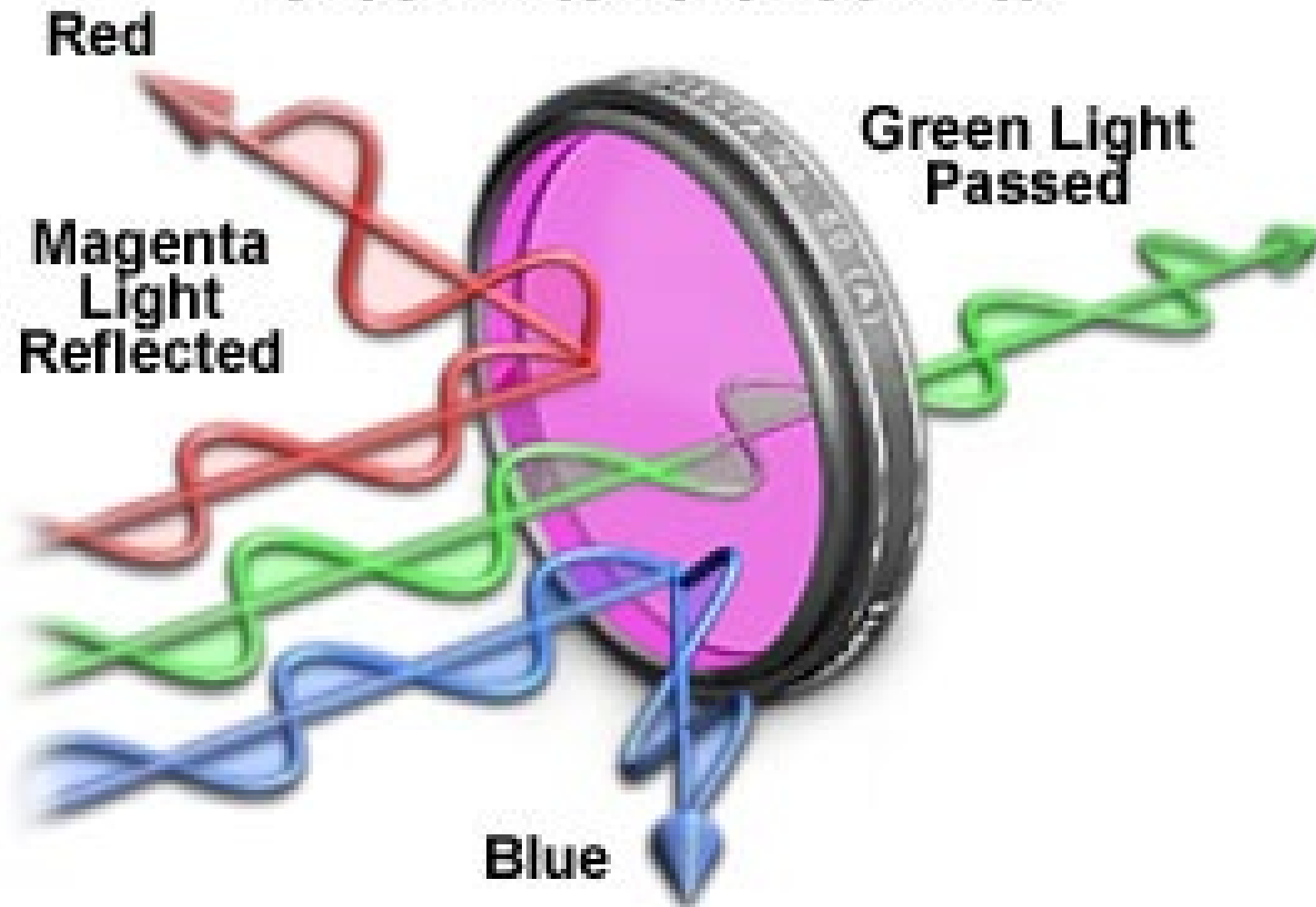
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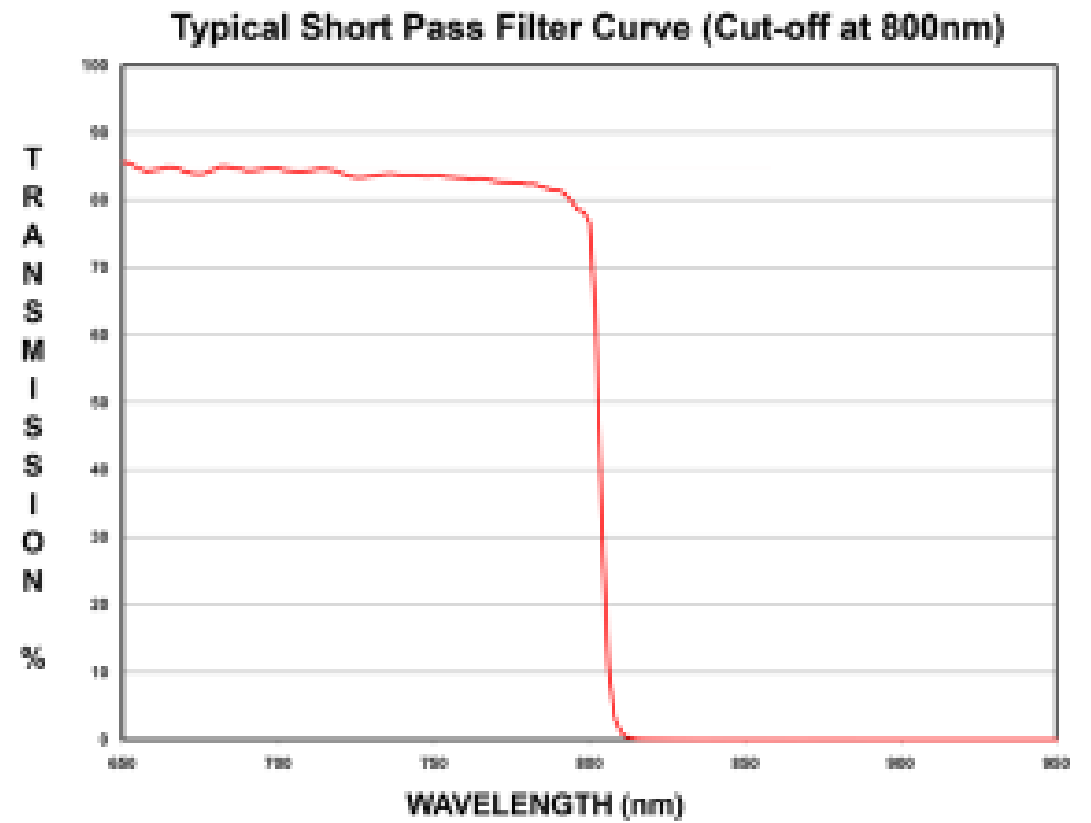
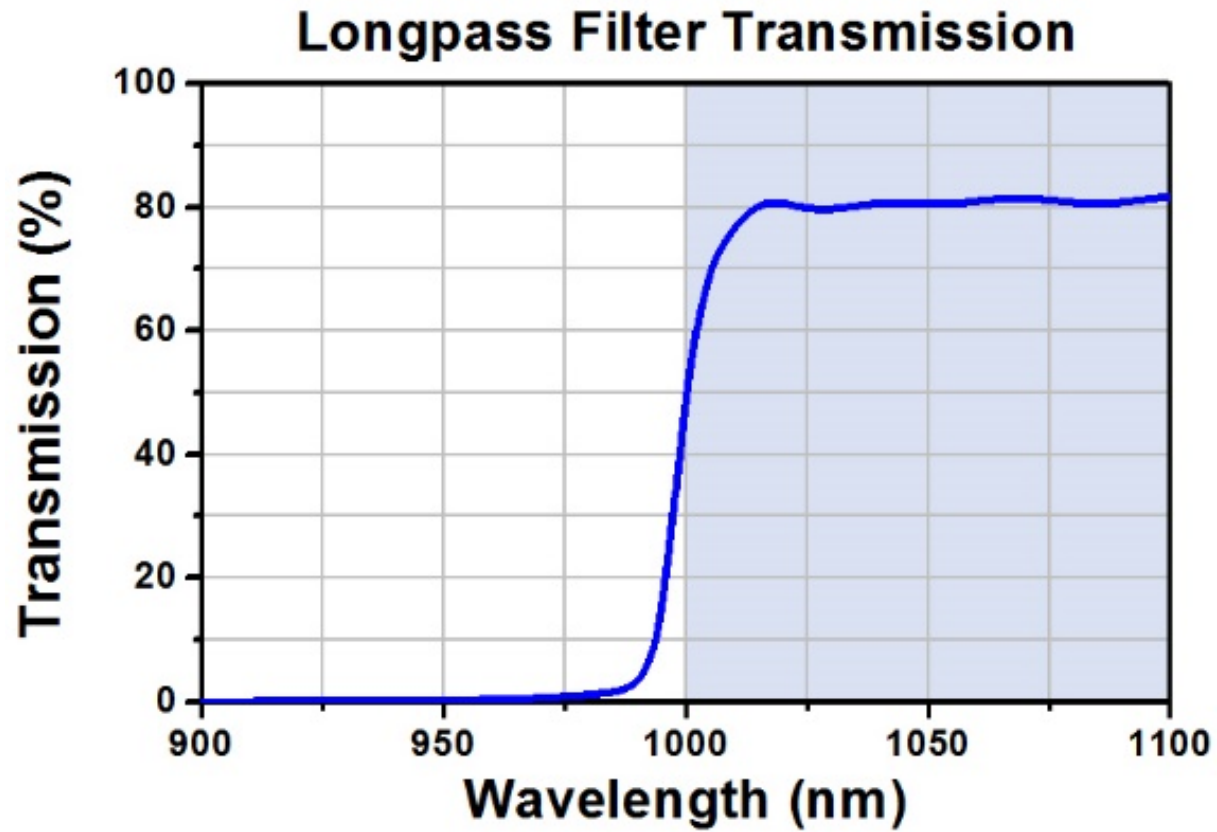
*Absorbed* Light

+

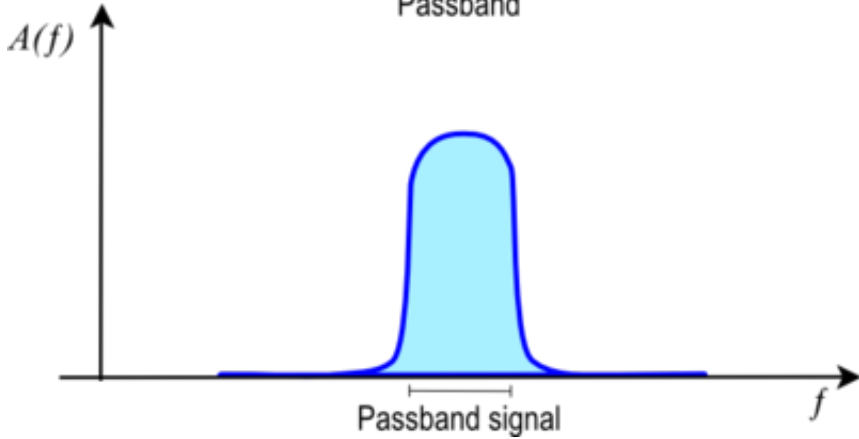
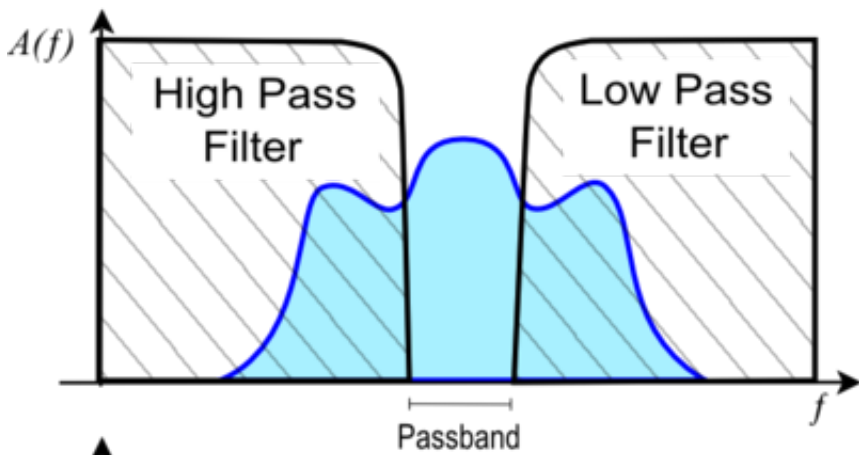
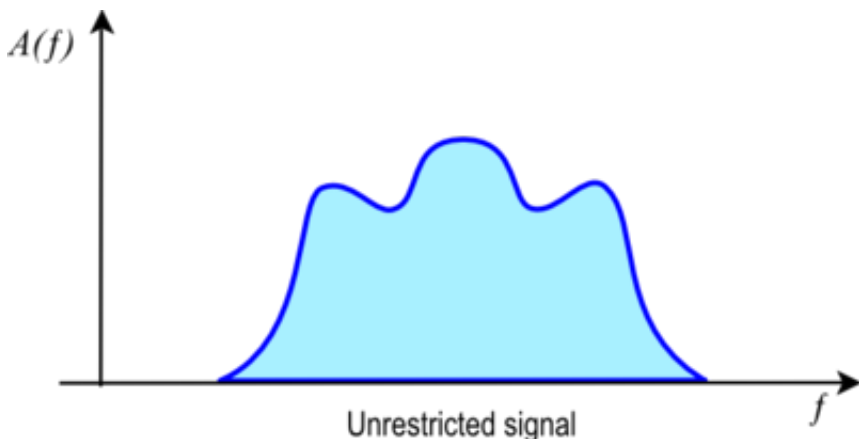
*Reflected* Light

## Green Interference Filter

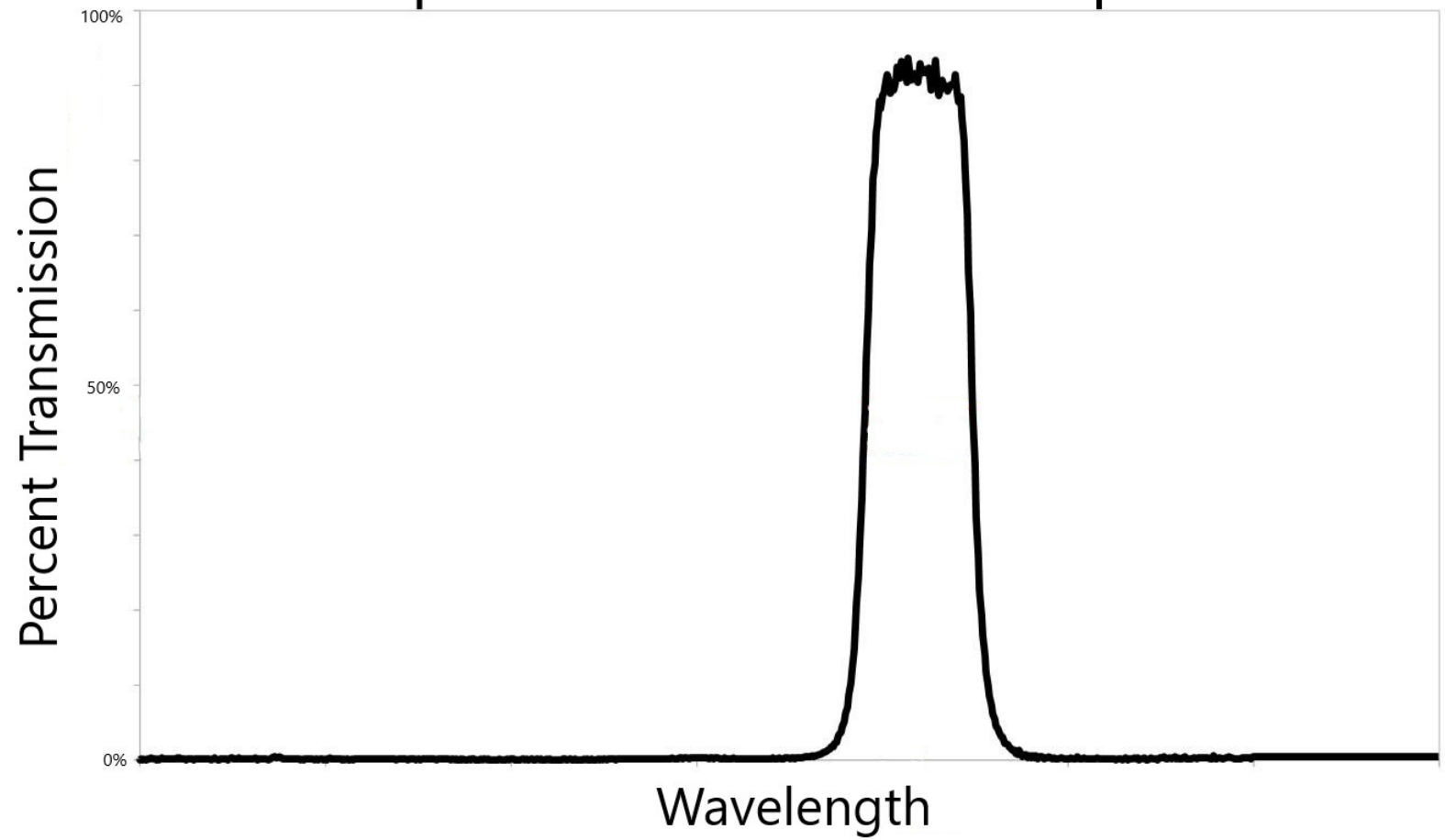




$$T \propto |I_o|^2 e^{-2\alpha z}$$

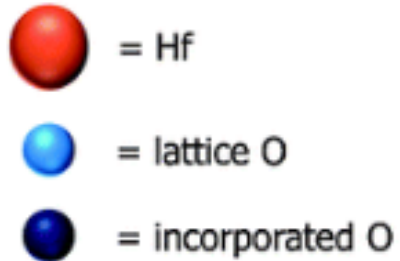
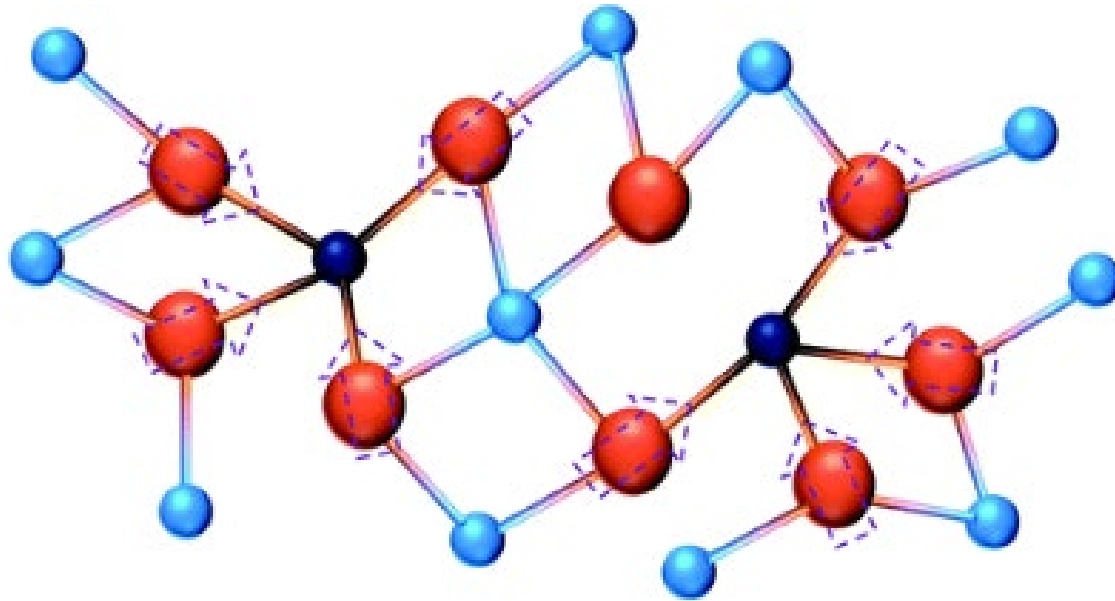


# Bandpass Transmission Graph









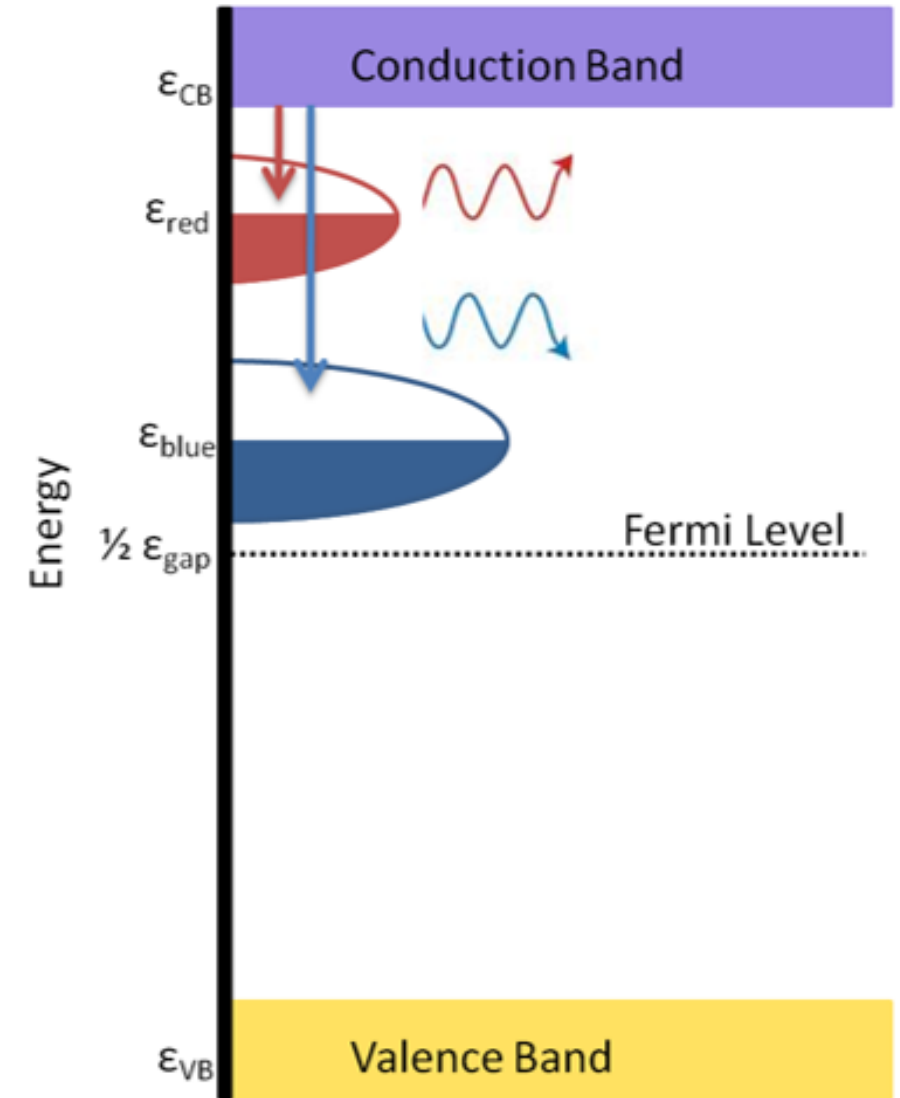
## Radiation Induced Defect Types

Broken bonds

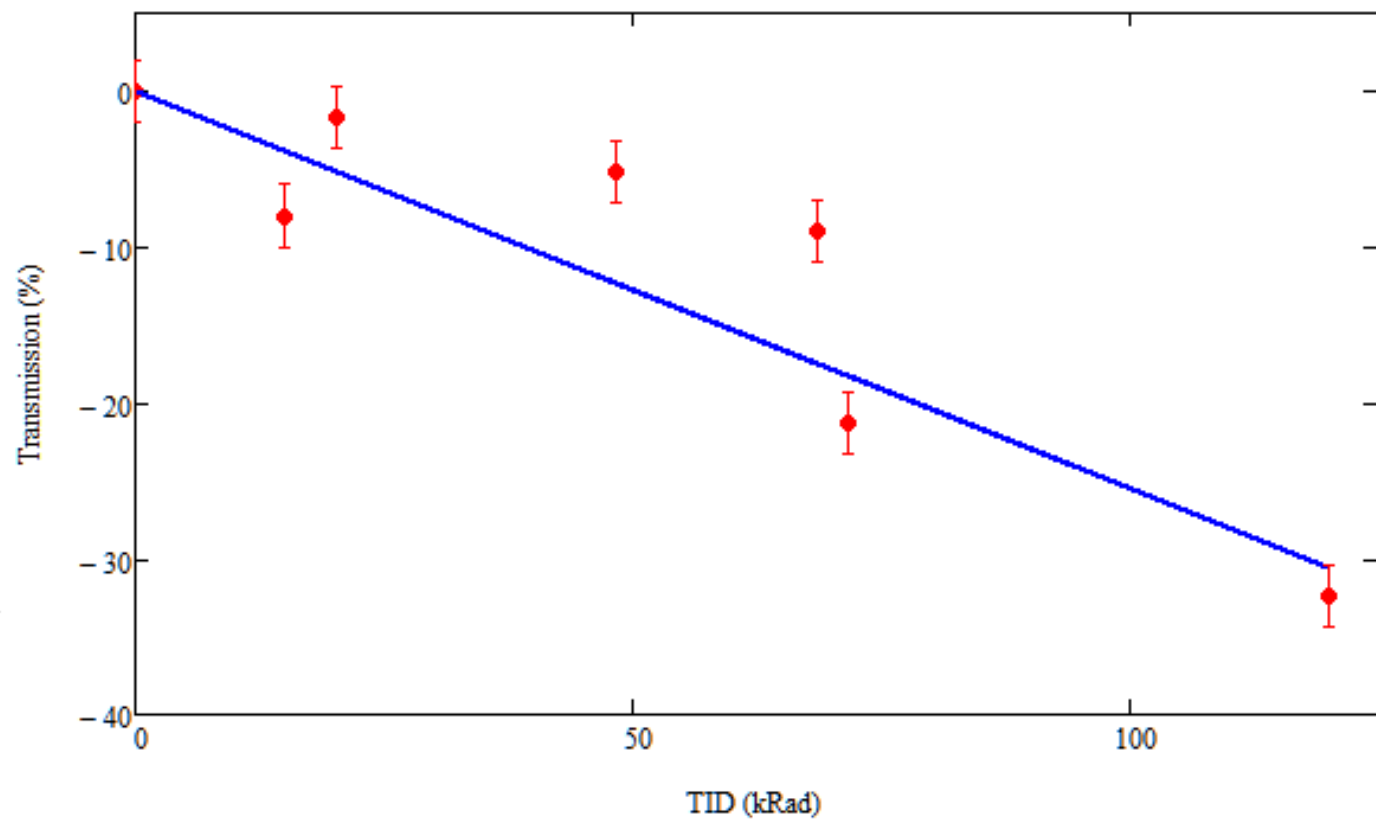
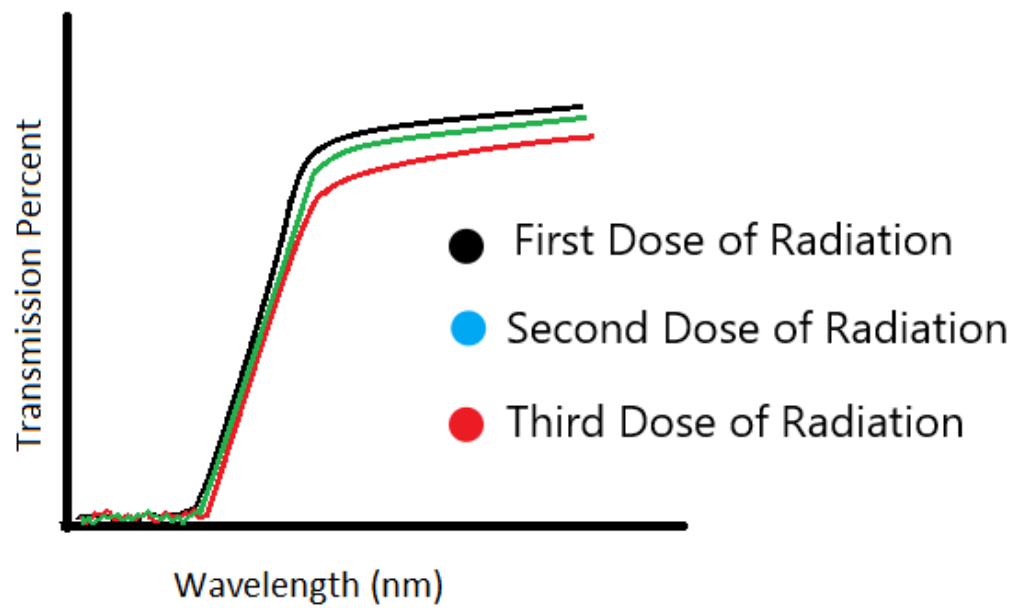
Bent Bonds

Oxygen Deficiencies

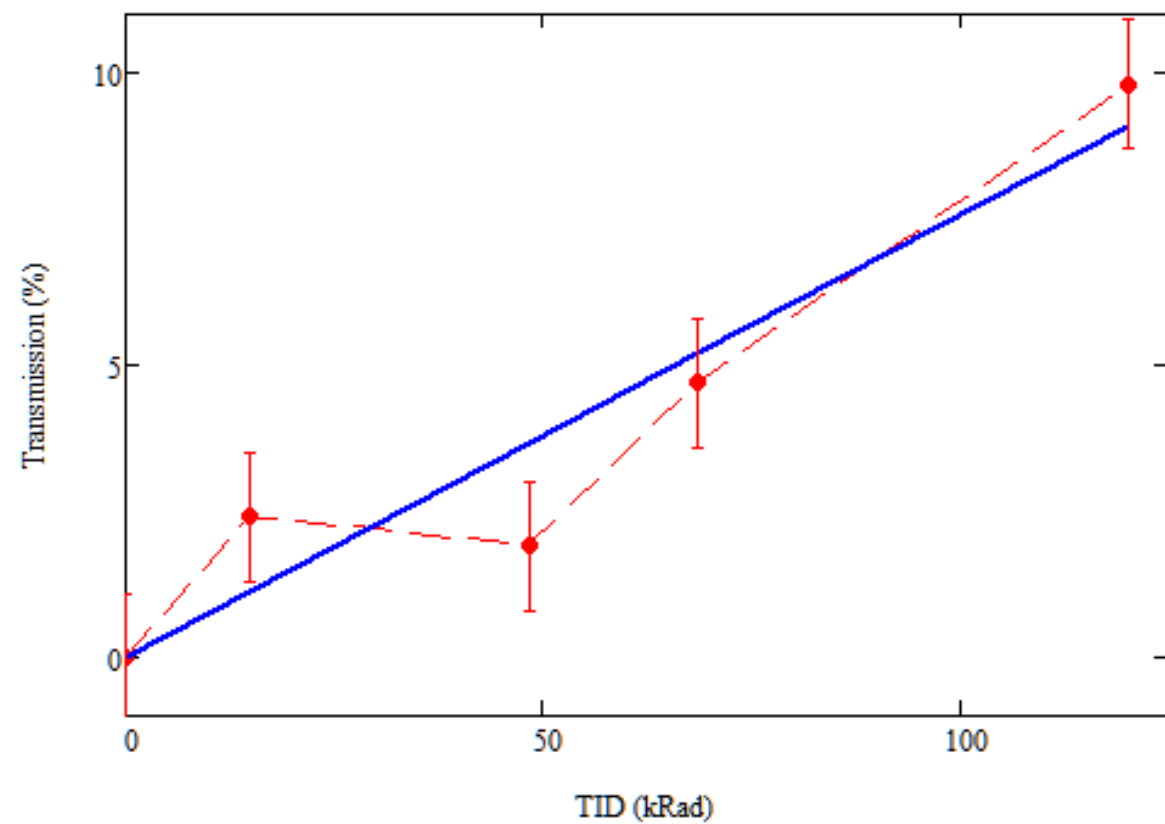
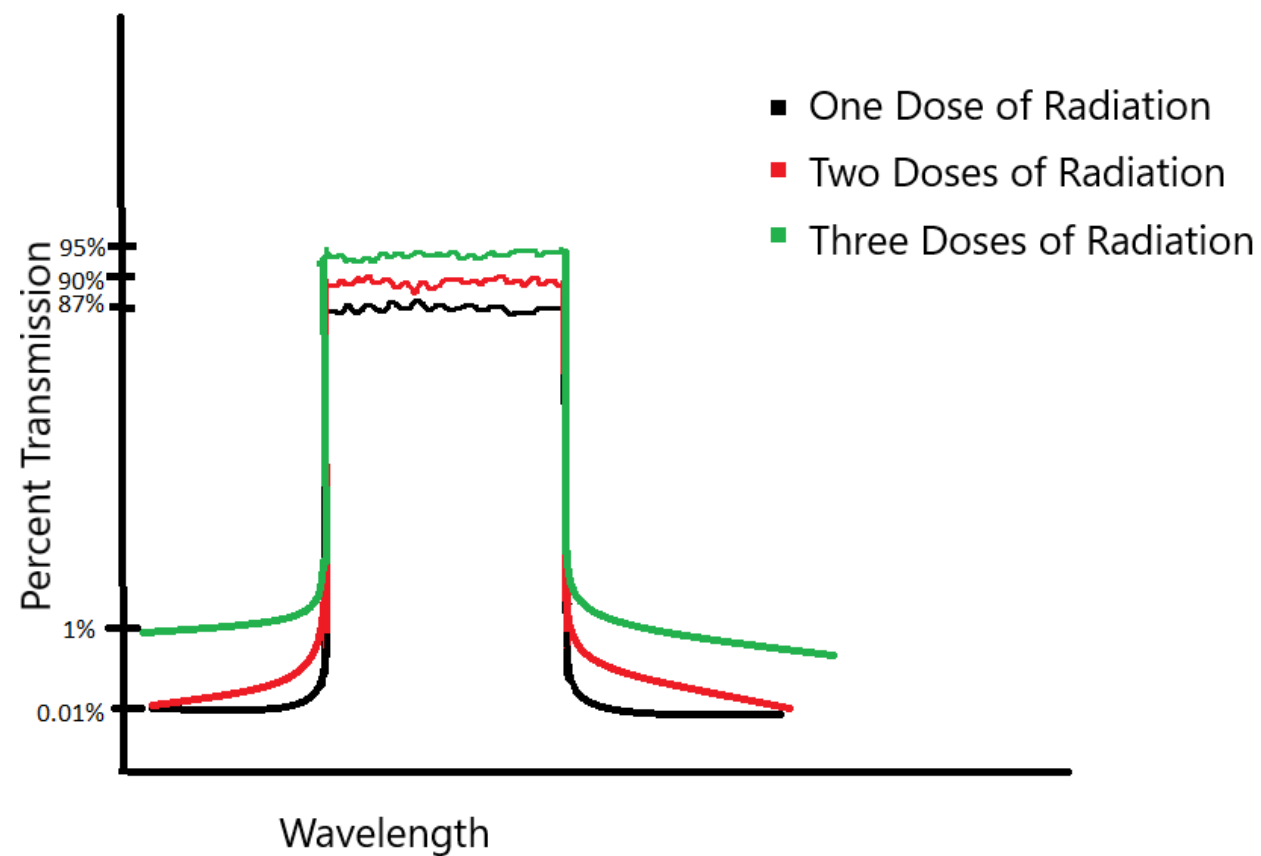
Oxygen Surplus



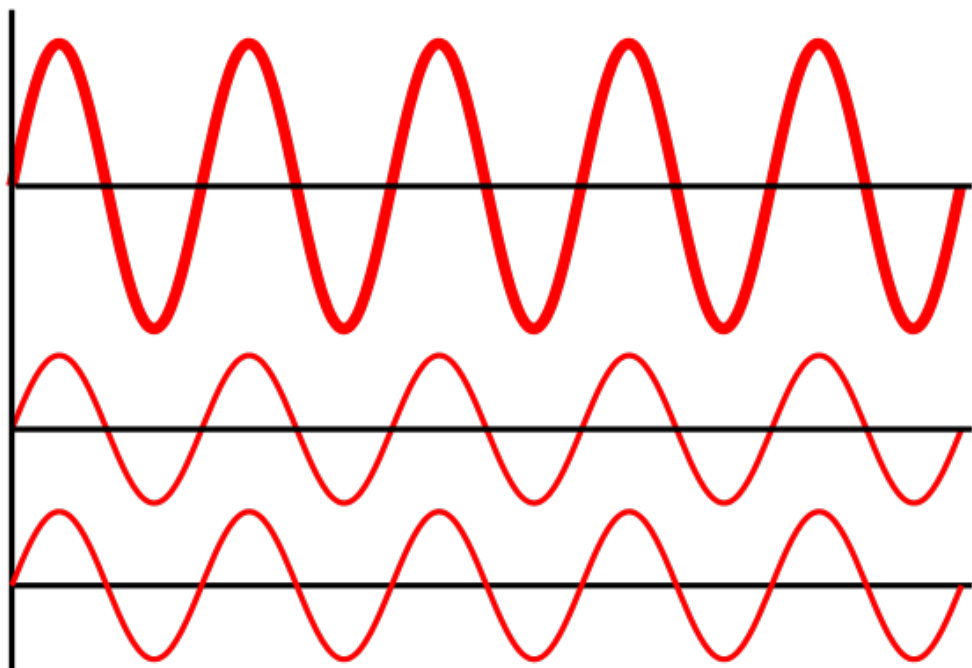
Percent Transmission for a Irradiated Longpass Filter



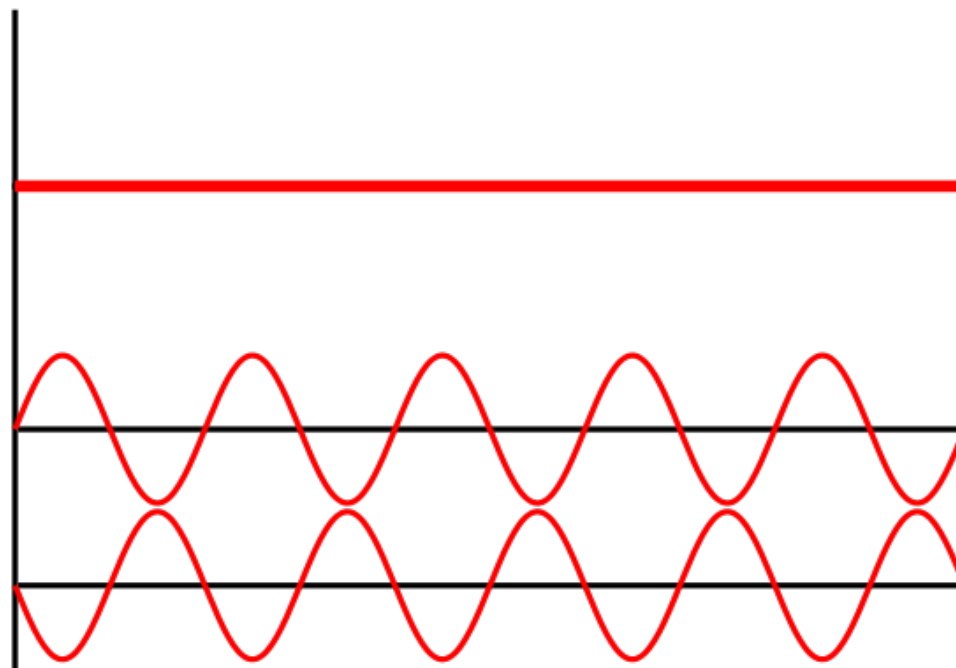
Percent Transmission for Irradiated Bandpass Filter



**Constructive interference**



**Destructive Interference**



Incident Light

Reflected Light



Layer 1

Layer 2

Substrate

Transmitted Light

# Conclusion

- Radiation has a significant affect on optical filter transmission, on the order of 1 % change in transmission per Gy.
- For an absorptive long pass filter, the transmission *decreased* with increased defect generation due to increased defect density as expected.
- For an interference bandpass filter, the transmission *increased* with increased defect generation contrary to expectations.

# Conclusion

- Radiation has a significant affect on optical filter transmission, on the order of 1 % change in transmission per Gy.
- For an absorptive short pass filter, the transmission decreased with increased defect generation due to increased defect density as expected.
- For an interference bandpass filter, the transmission increased with increased defect generation contrary to expectations.

## Questions?