

# Blackbody Radiation

---

Daniel Geisz & Heidi Hu

# Contents

 Theory

 Procedure

 Data

 Analysis

 Conclusion

# Theory

$$B_\lambda(\lambda, T) = \frac{2hc^2}{\lambda^5} \frac{1}{e^{\frac{hc}{\lambda k_B T}} - 1}$$

# Theory

$$\lambda_{max} = \frac{b}{T} \qquad b = \frac{hc}{xk_B}$$

$$\frac{xe^x}{e^x - 1} - 5 = 0$$

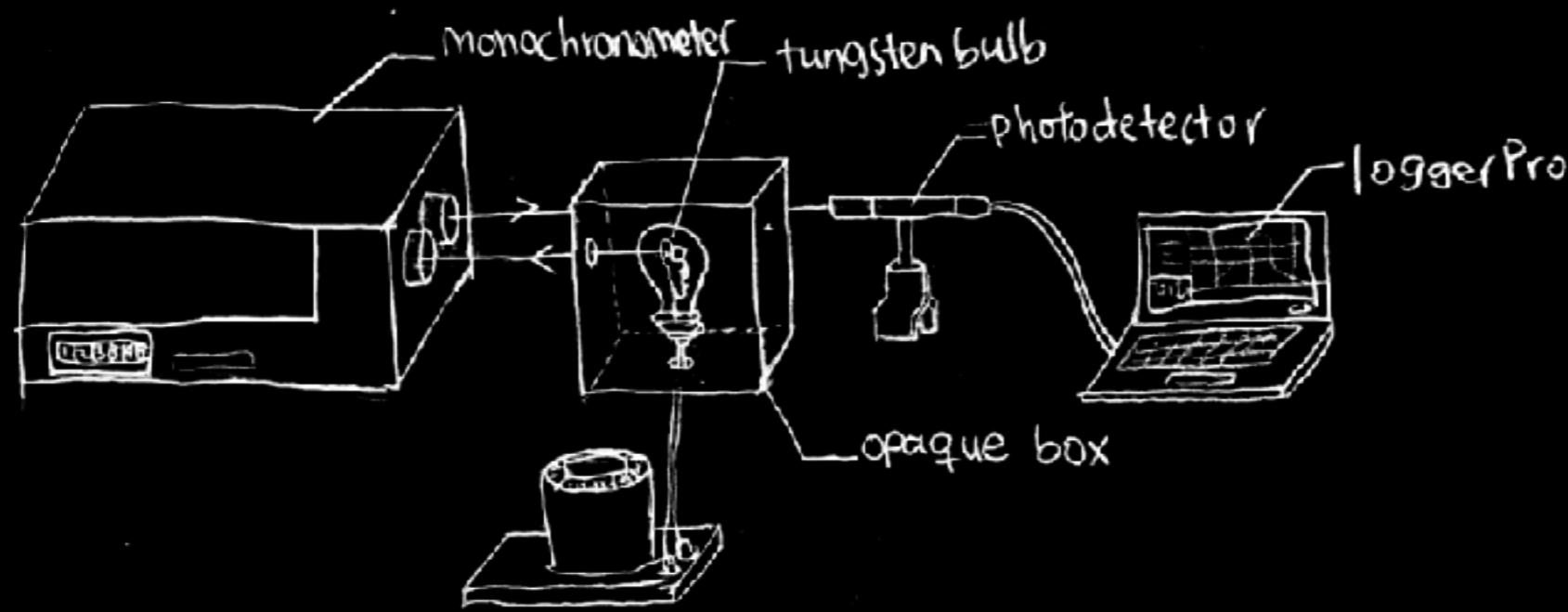
$$x \approx 4.965114231744276$$

# Equipments

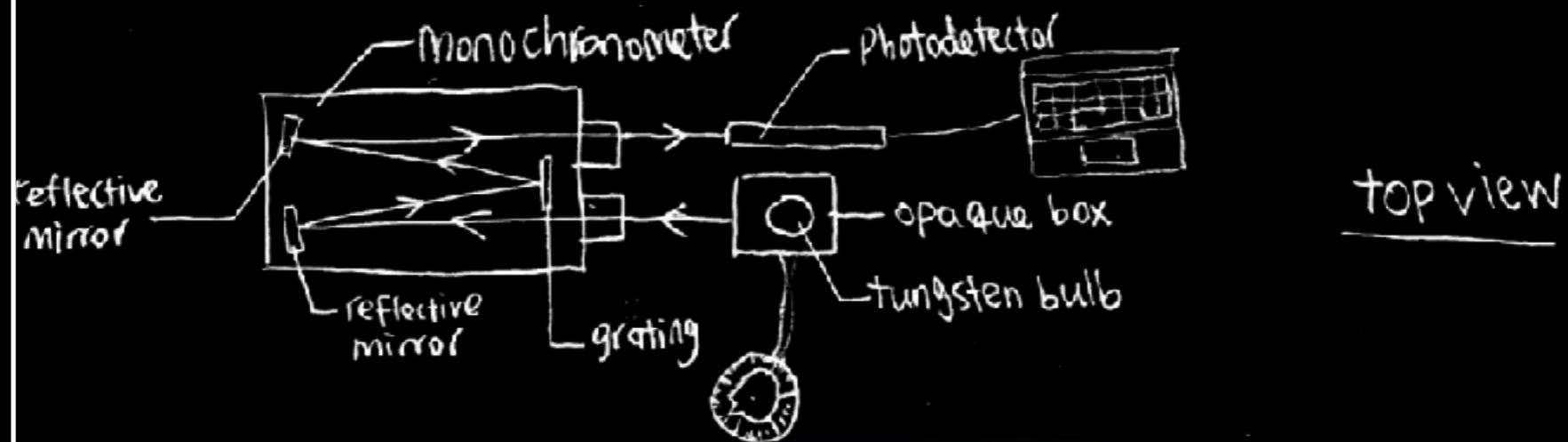
- 💡 Tungsten Bulb & Power Supply
- 💡 Vernier Photodetector
- 💡 Monochromator
- 💡 Three Lasers with Known Wavelengths
- 💡 Cardboard Box
- 💡 Thermocouple

# Procedure – Calibration

- 💡 1. Shine the first of the three lasers through the opening to the monochromator.
- 💡 2. Adjust the wavelength dial on the monochromator until the laser light is emitted from the device.
- 💡 3. Record the monochromator's wavelength reading and the actual wavelength of the laser.
- 💡 4. Repeat steps 1-3 with the other two lasers.
- 💡 5. Use the data collected to determine the offset between the monochromator's wavelength reading and the wavelength of light actually being emitted from the device.



sideview



top view

# Procedure

- 💡 2. Turn on the Tungsten bulb to a low setting.
- 💡 3. Align the bulb so that the light emitted into the monochromator is incident on both mirrors and the grating inside the monochromator.
- 💡 4. Align the photodetector so that the light emitted from the monochromator is incident on the aperture of the detector.
- 💡 5. Adjust the wavelength dial on the monochromator until the photodetector reads a value just above 2.0 Lux.

# Procedure

- 💡 6. By turning the wavelength dial on the monochromator, record the photodetector reading over the range of wavelengths for which the photodetector reads a value greater than 2.0 Lux.
- 💡 In our case, we started at the smallest wavelength for which the photodetector read a value greater than 2.0 Lux, and we increased the wavelength by about 100 Angstrom between subsequent data points.
- 💡 7. Repeat steps 5 and 6 four times, but each time change the power supplied to the Tungsten bulb to change its temperature.

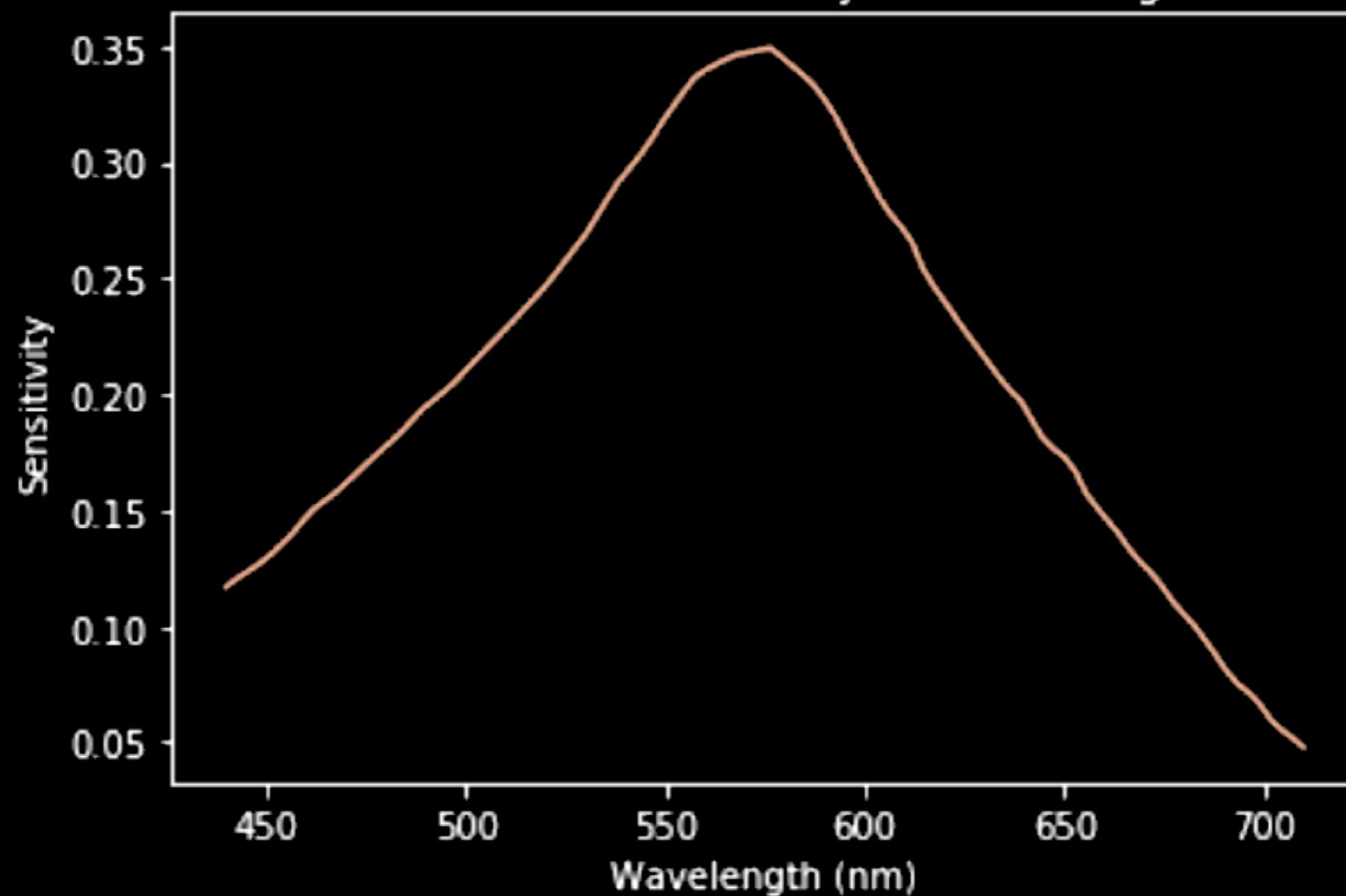
# Procedure

💡 #Determining Temperature

# Data - Calibration

	<b>Wavelength Reading</b>	<b>Actual Wavelength</b>
0	3816	6328
1	3332	5320
2	2727	4050

## Photodetector Sensitivity vs. Wavelength



# Data

# Data

# Analysis

# Conclusion