



UNDERWATER COLORIMETRY

INTRODUCTION

COLOR
CAPTURE

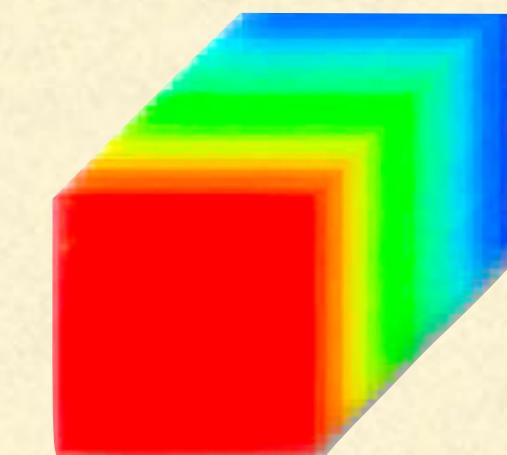
Dr. Derya Akkaynak | dakkaynak@univ.haifa.ac.il



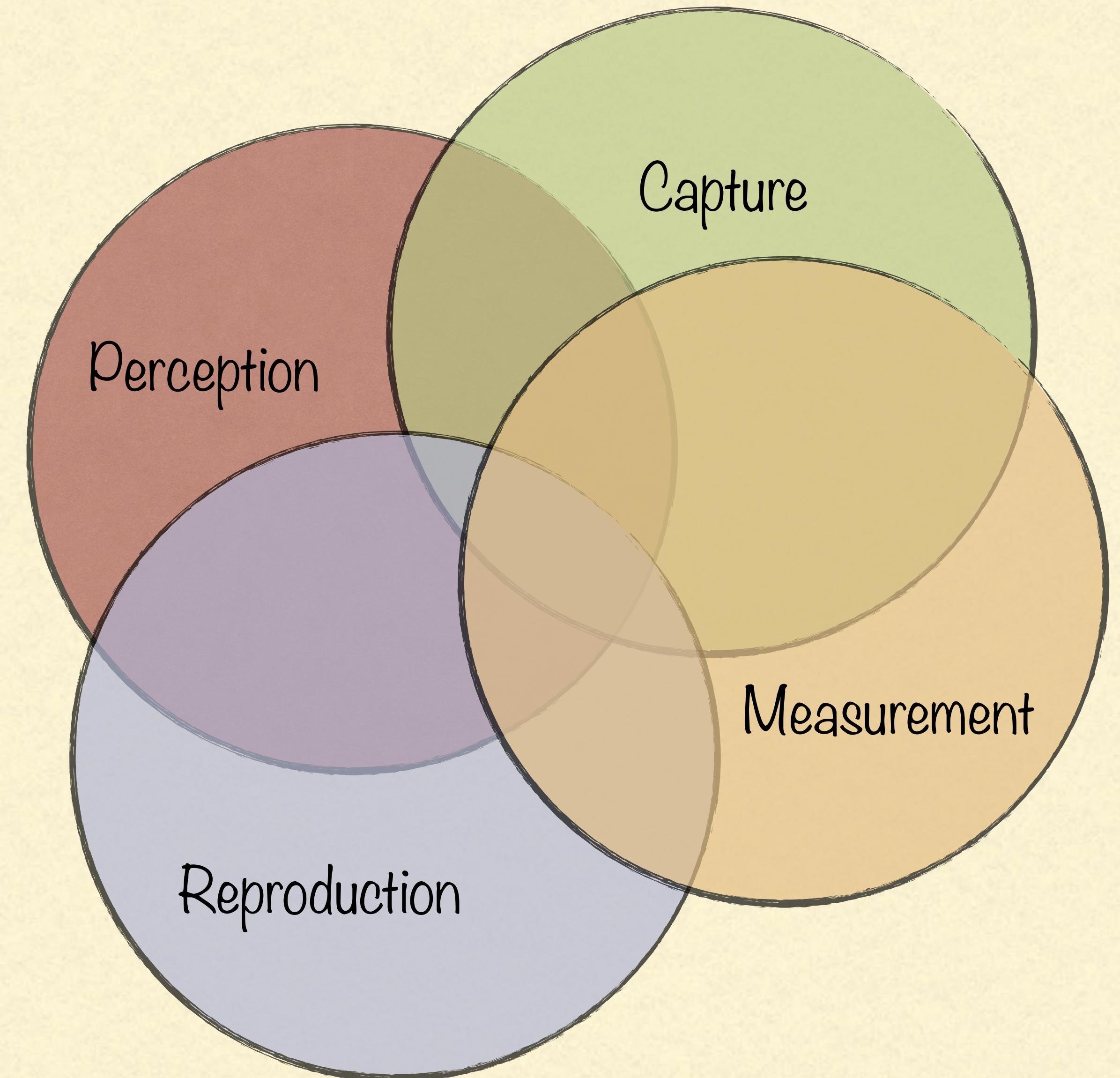
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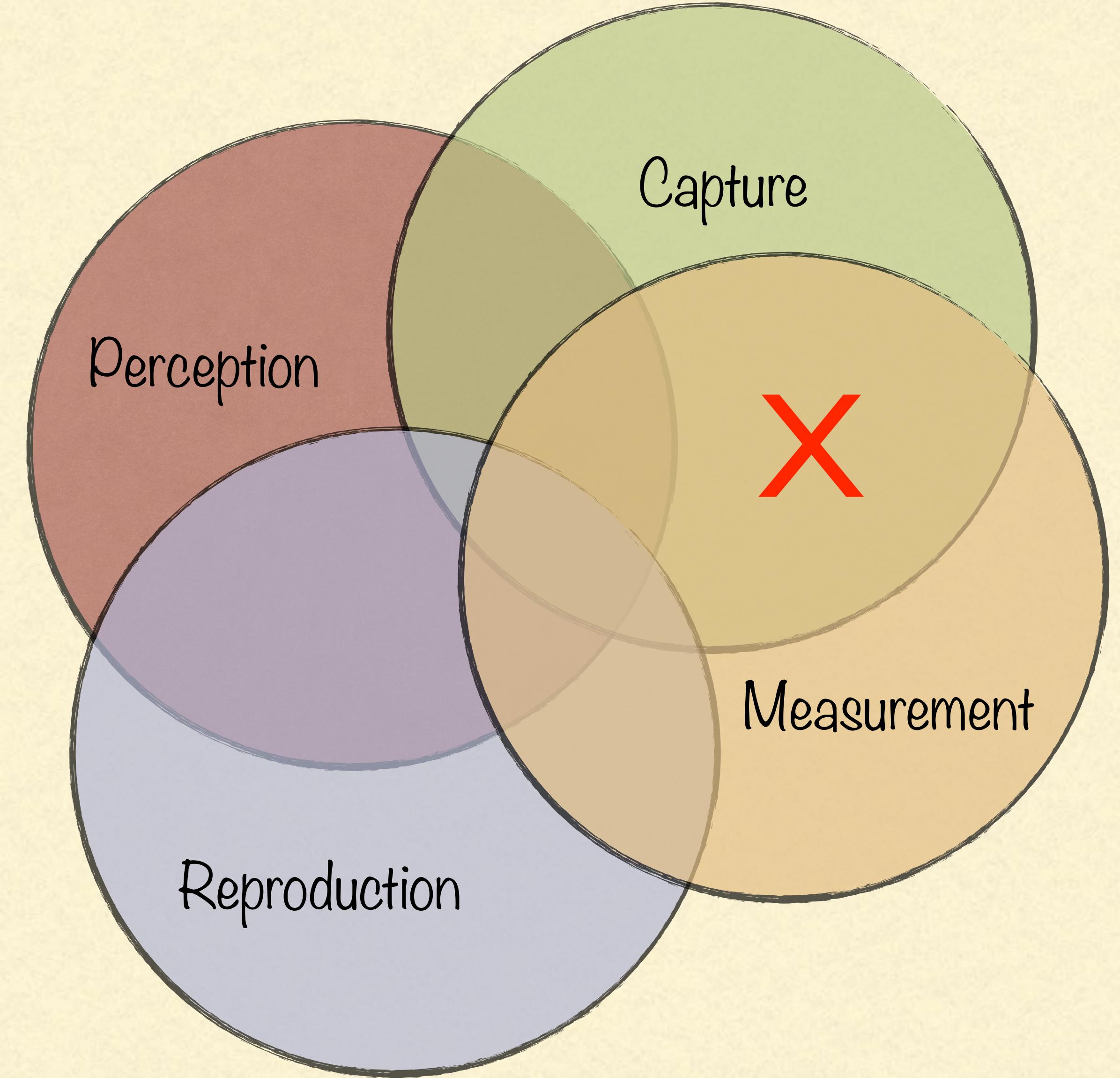


Color Is Complex

+ Subjective

HOW CAN WE MEASURE
A **SUBJECTIVE** QUANTITY
OBJECTIVELY?





Color Is Complex

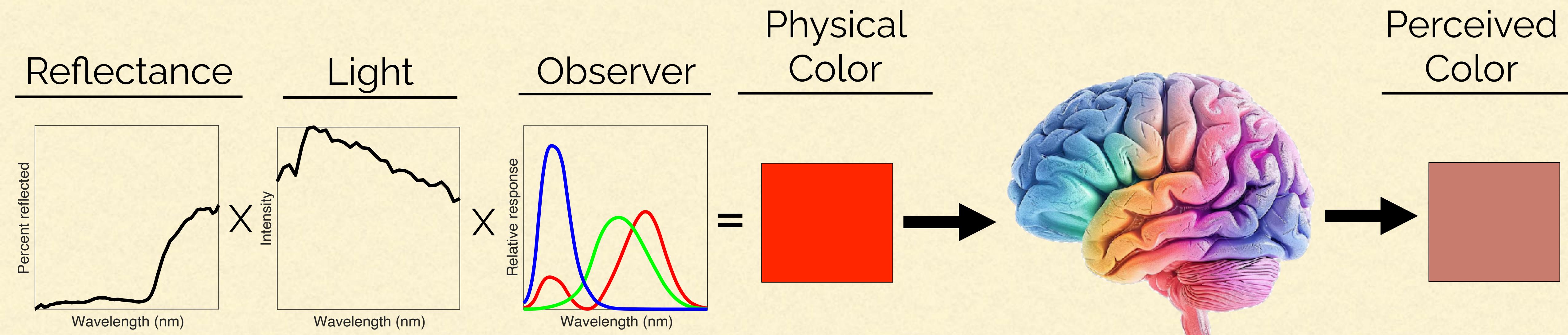
+ Subjective

HOW CAN WE MEASURE
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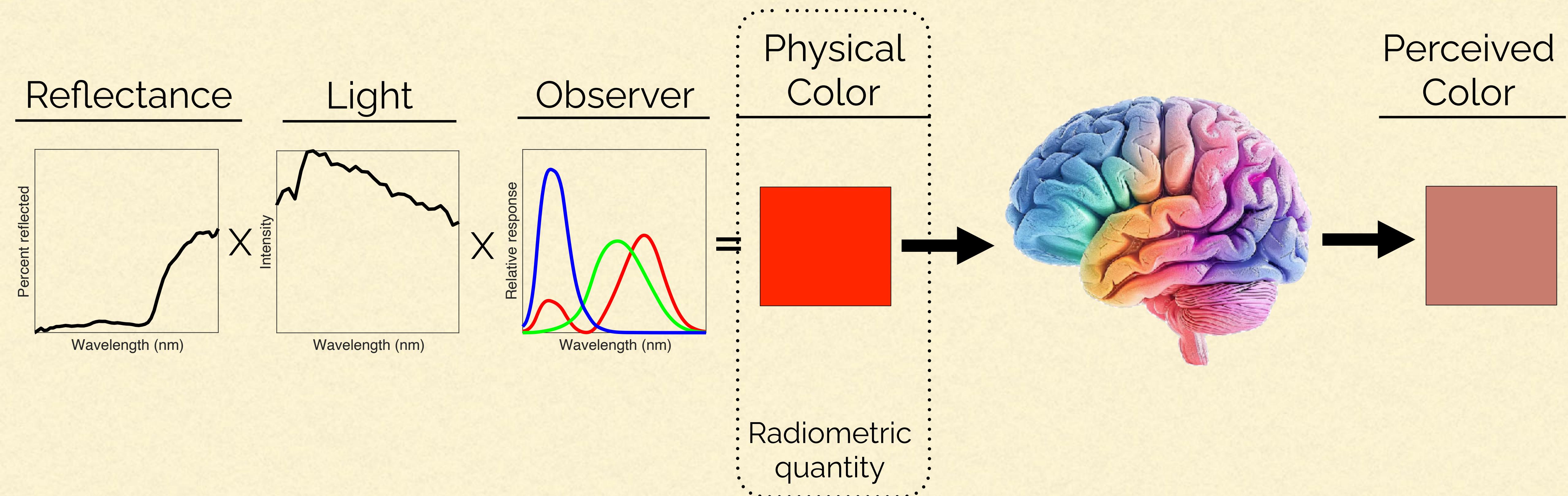
Color Capture

Color is a subjective phenomenon.



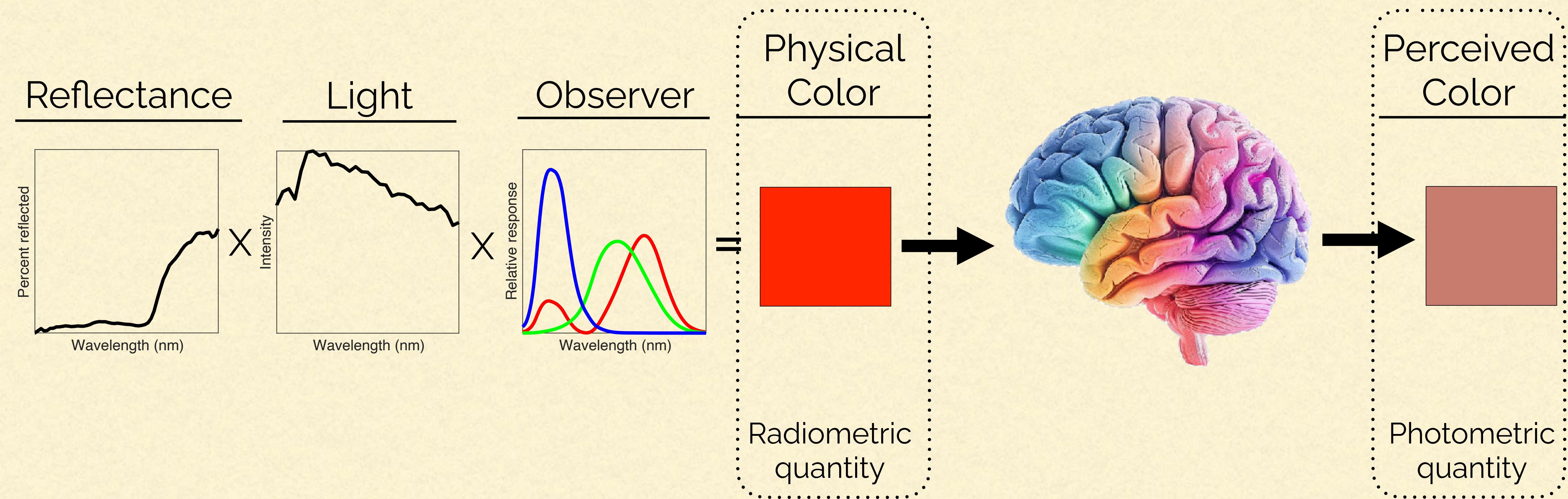
Color Capture

Color is a subjective phenomenon.

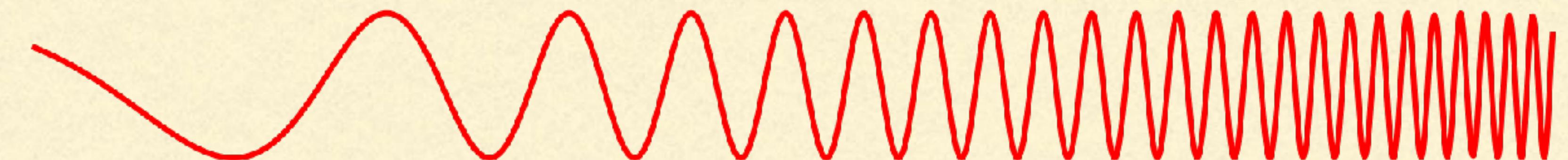


Color Capture

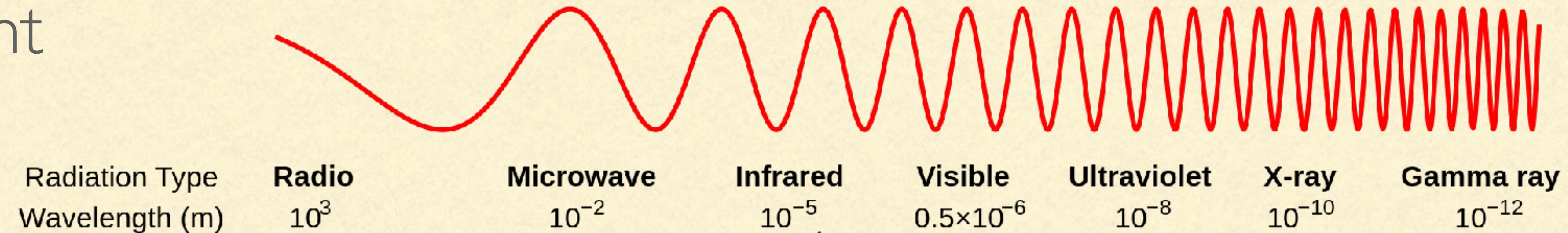
Color is a subjective phenomenon.



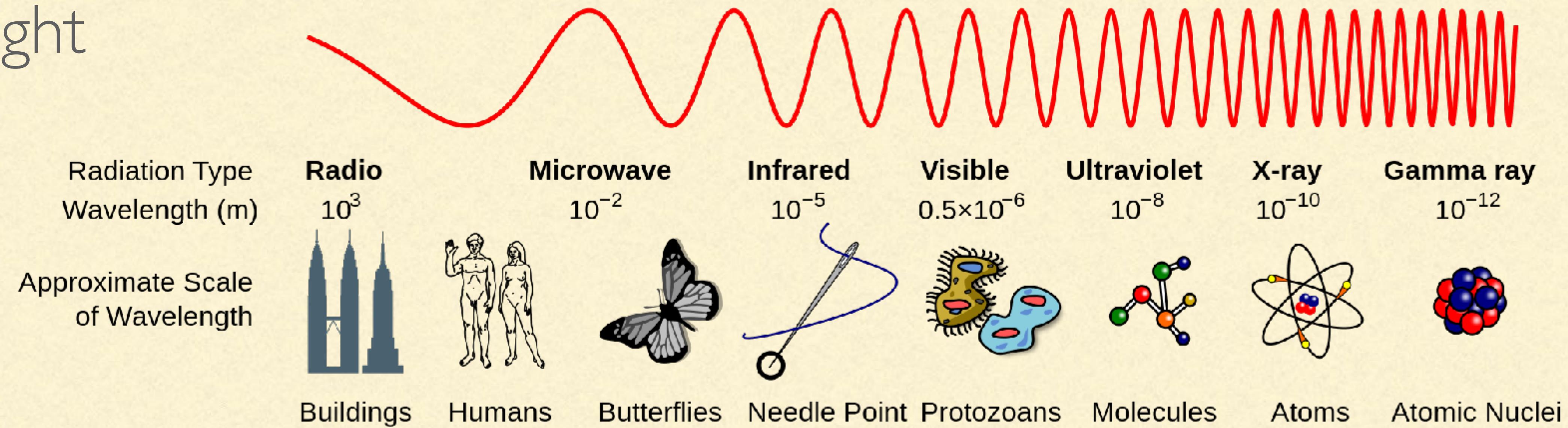
Light



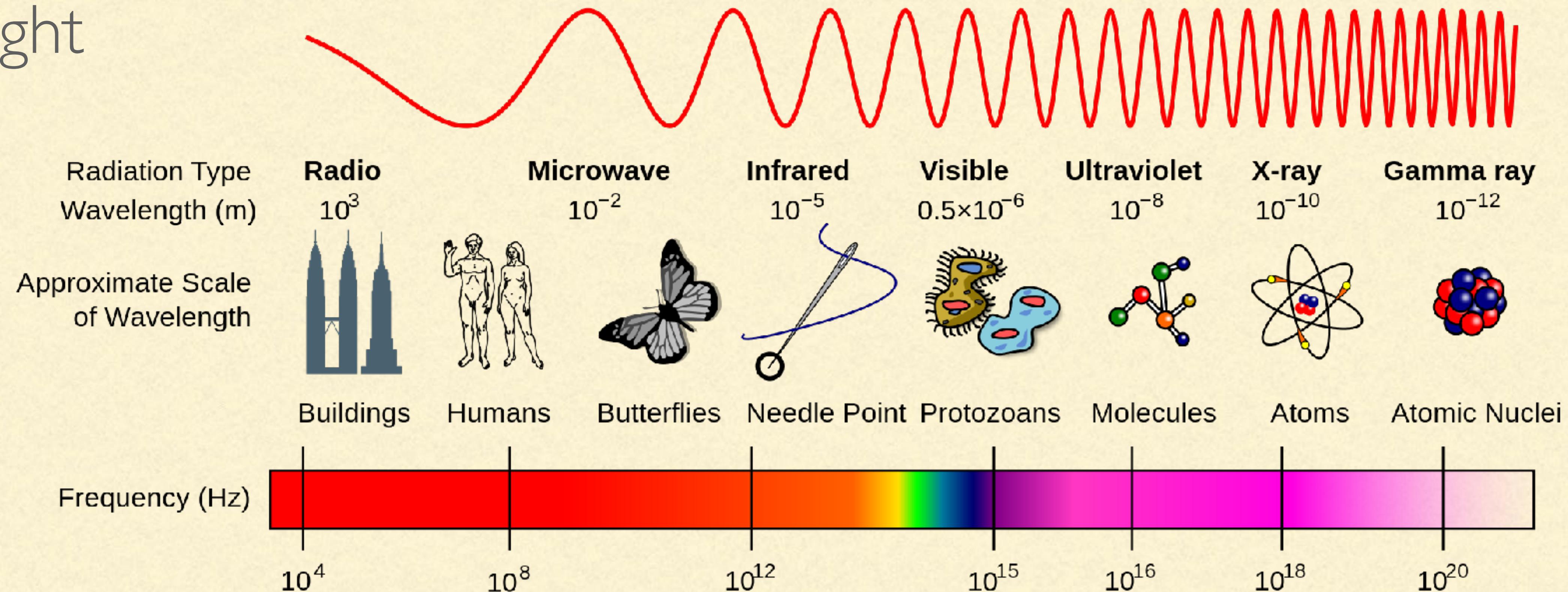
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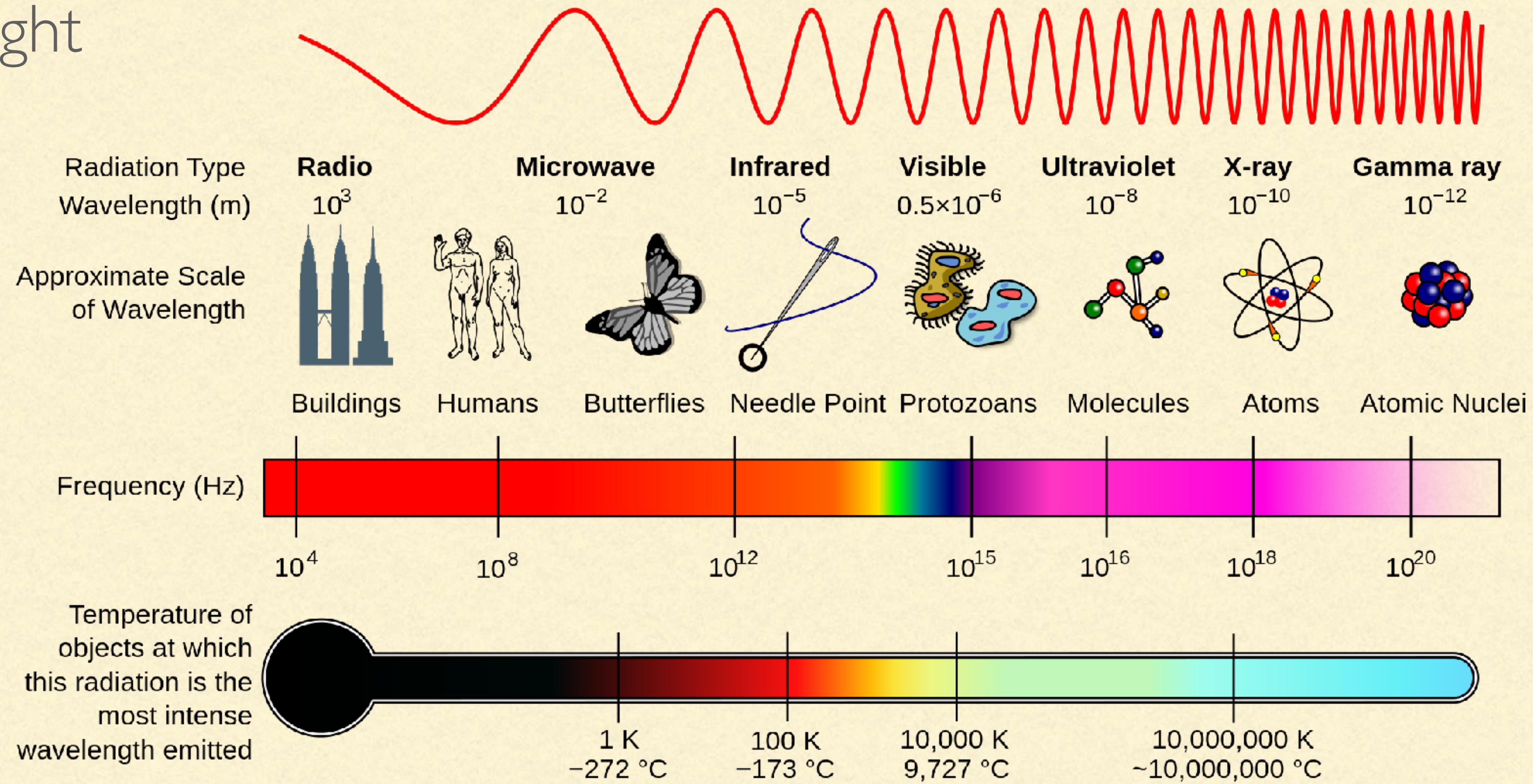
Light



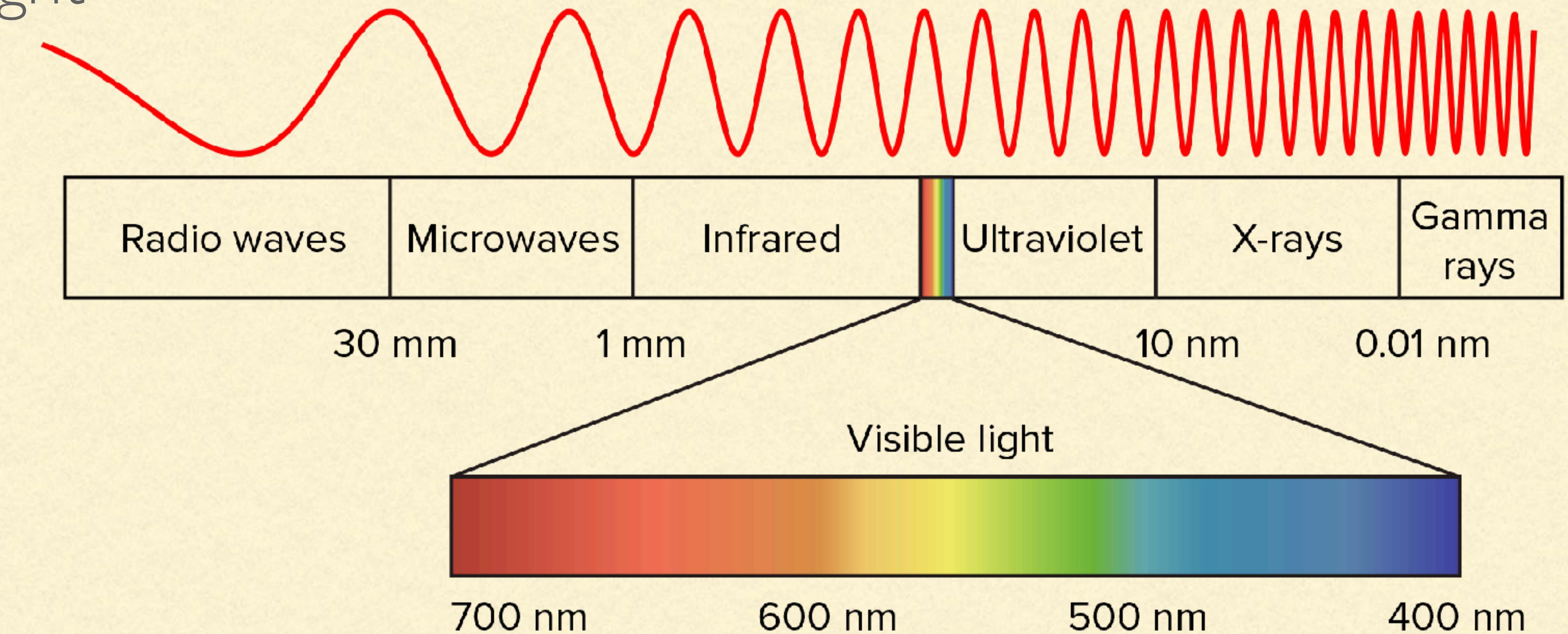
Light



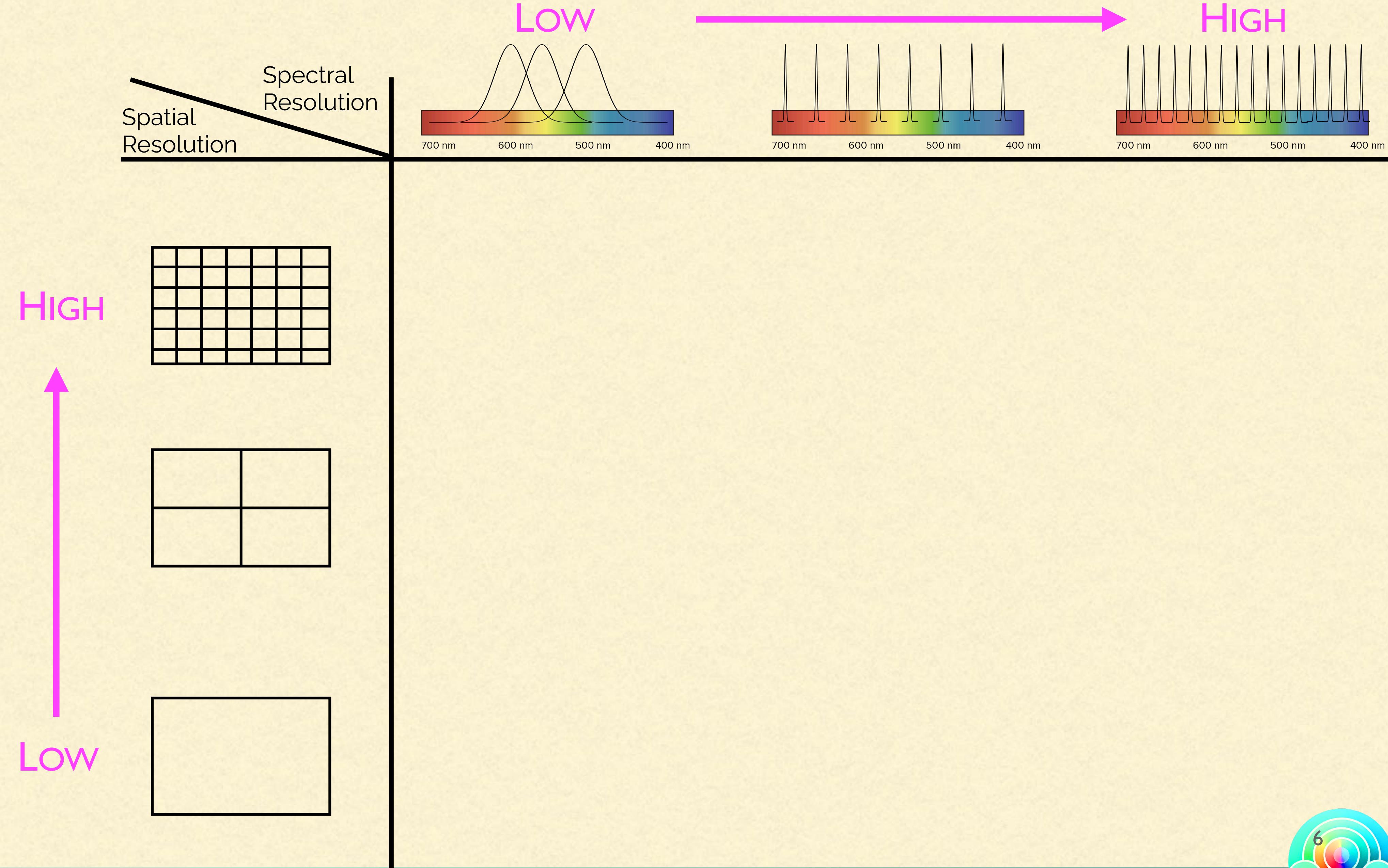
Light



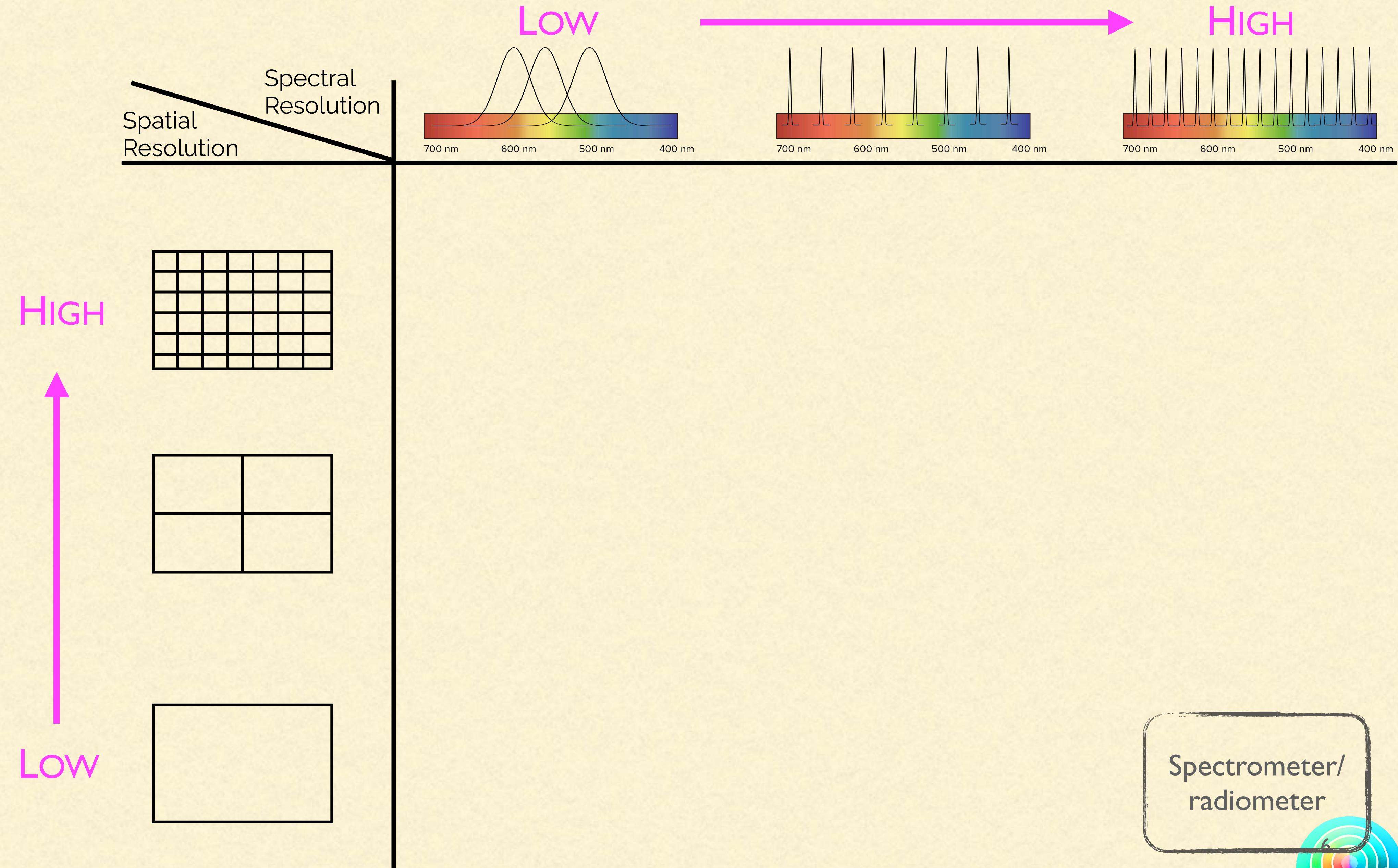
Visible Light



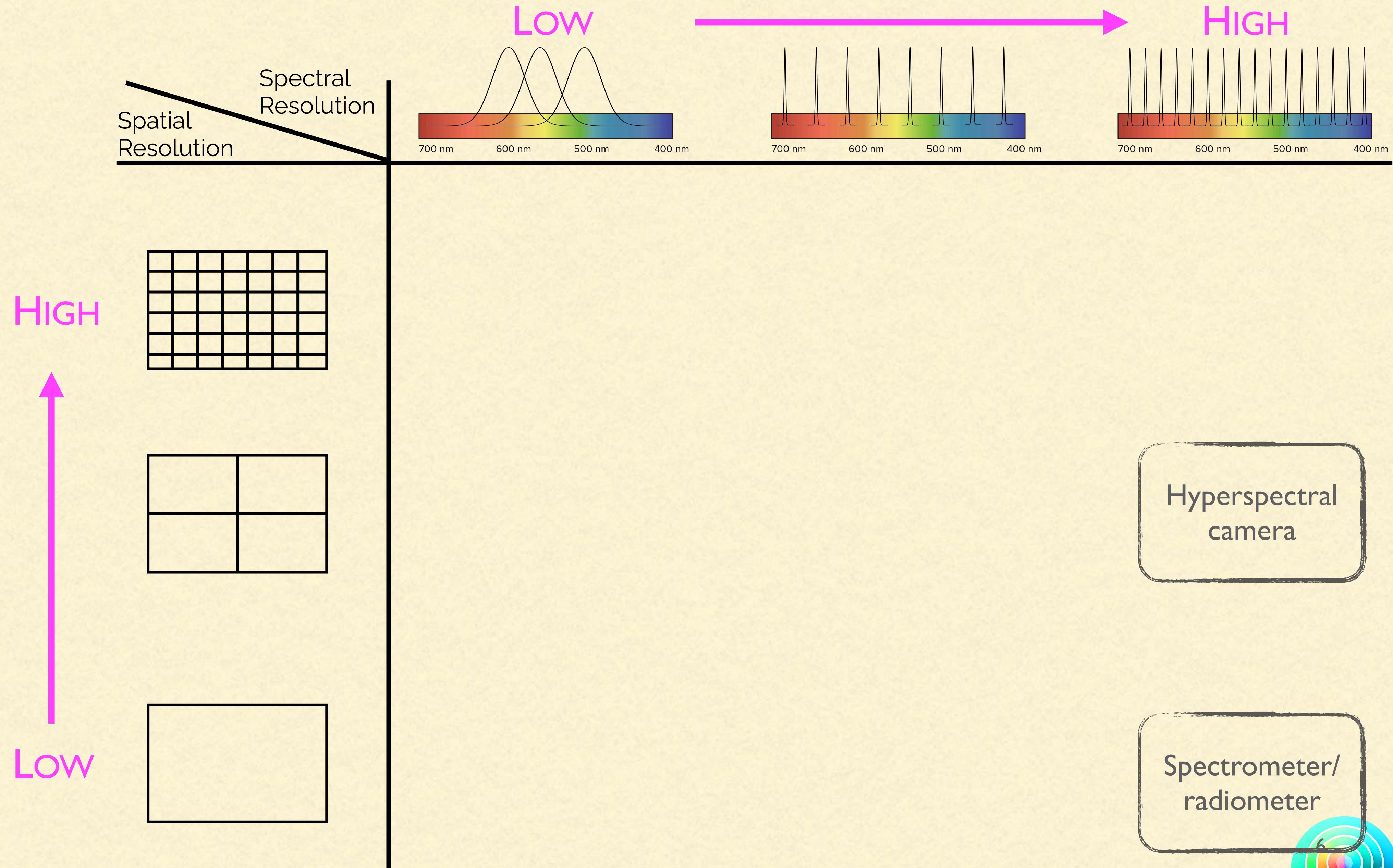
Light Measuring Devices



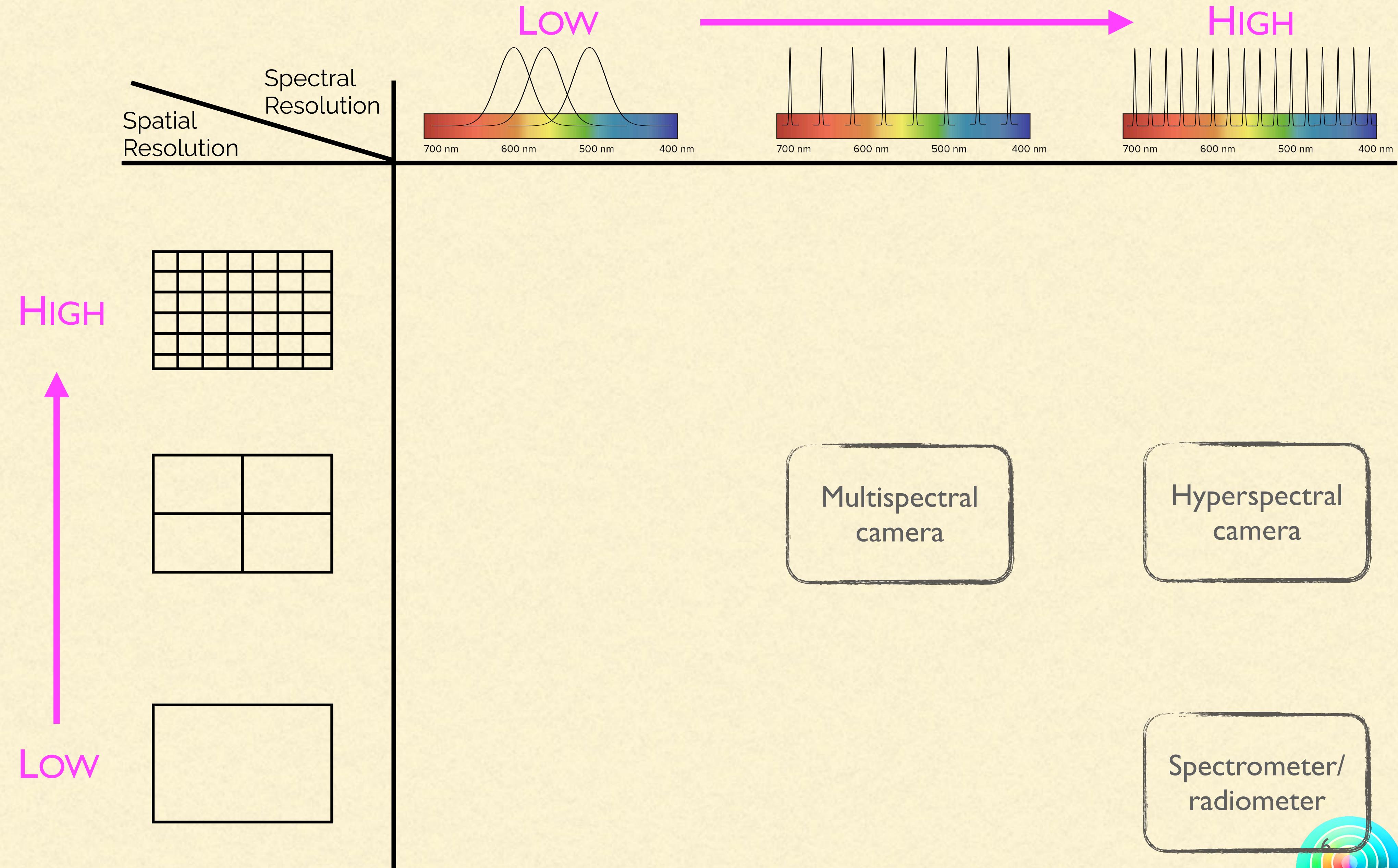
Light Measuring Devices



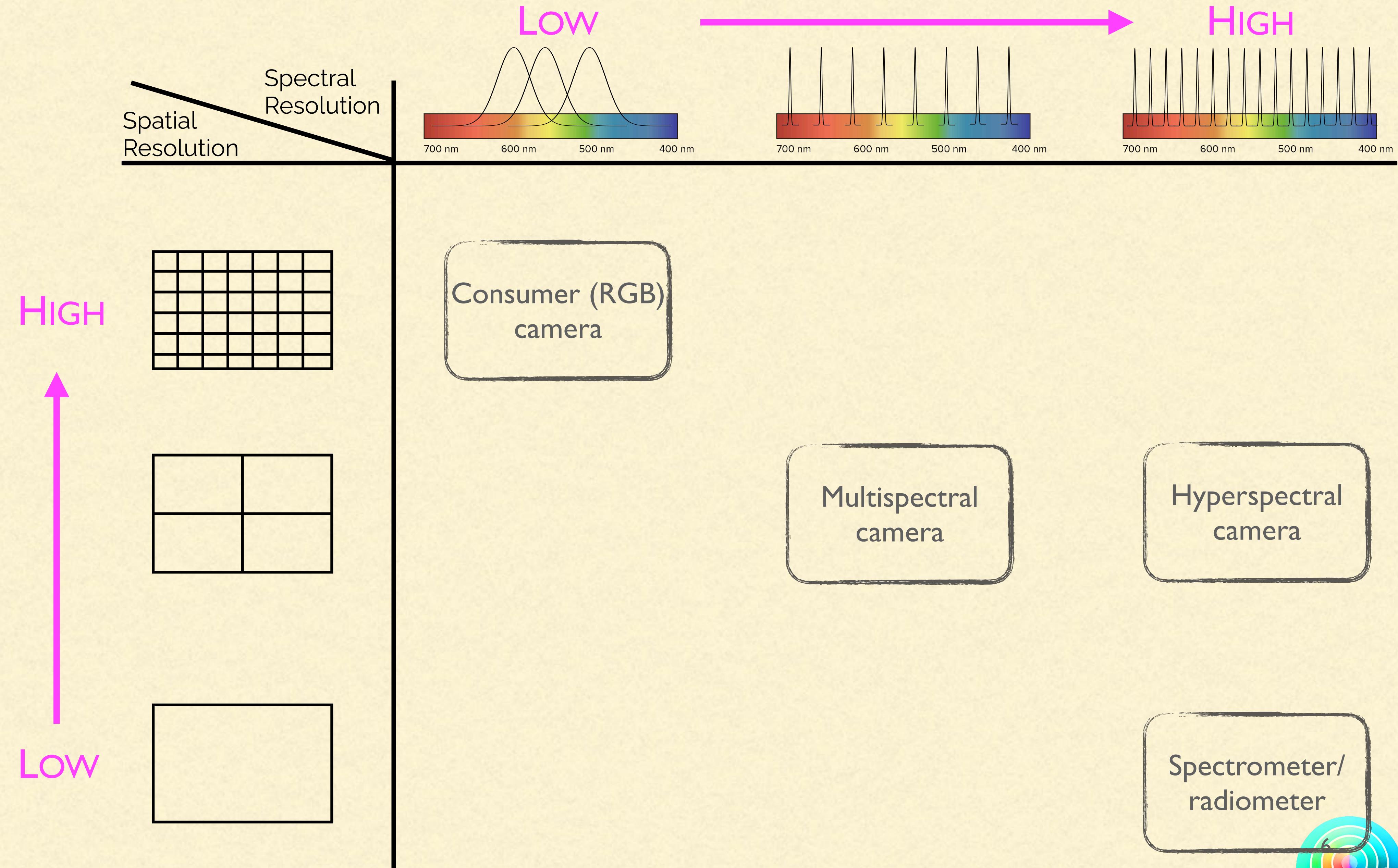
Light Measuring Devices



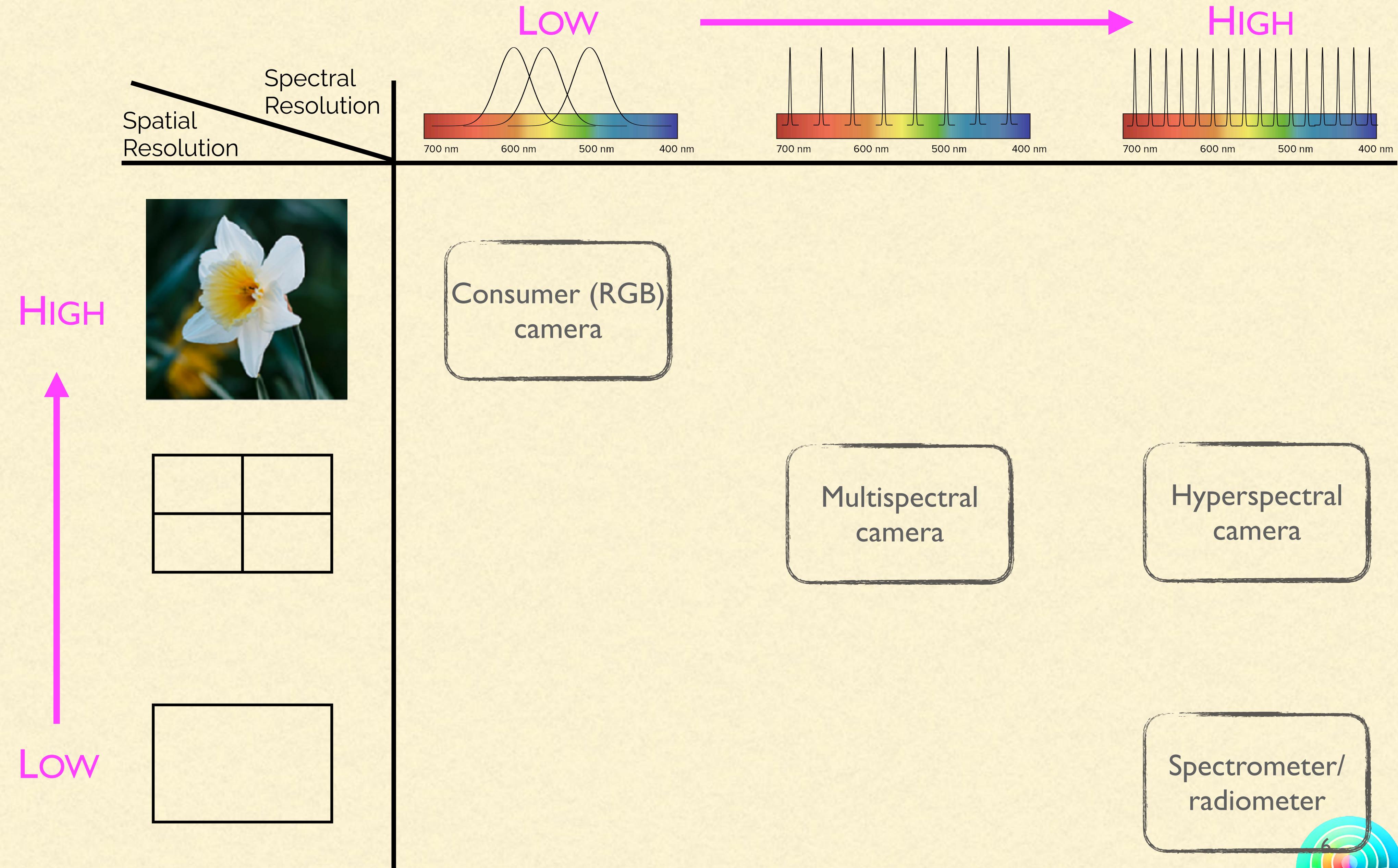
Light Measuring Devices



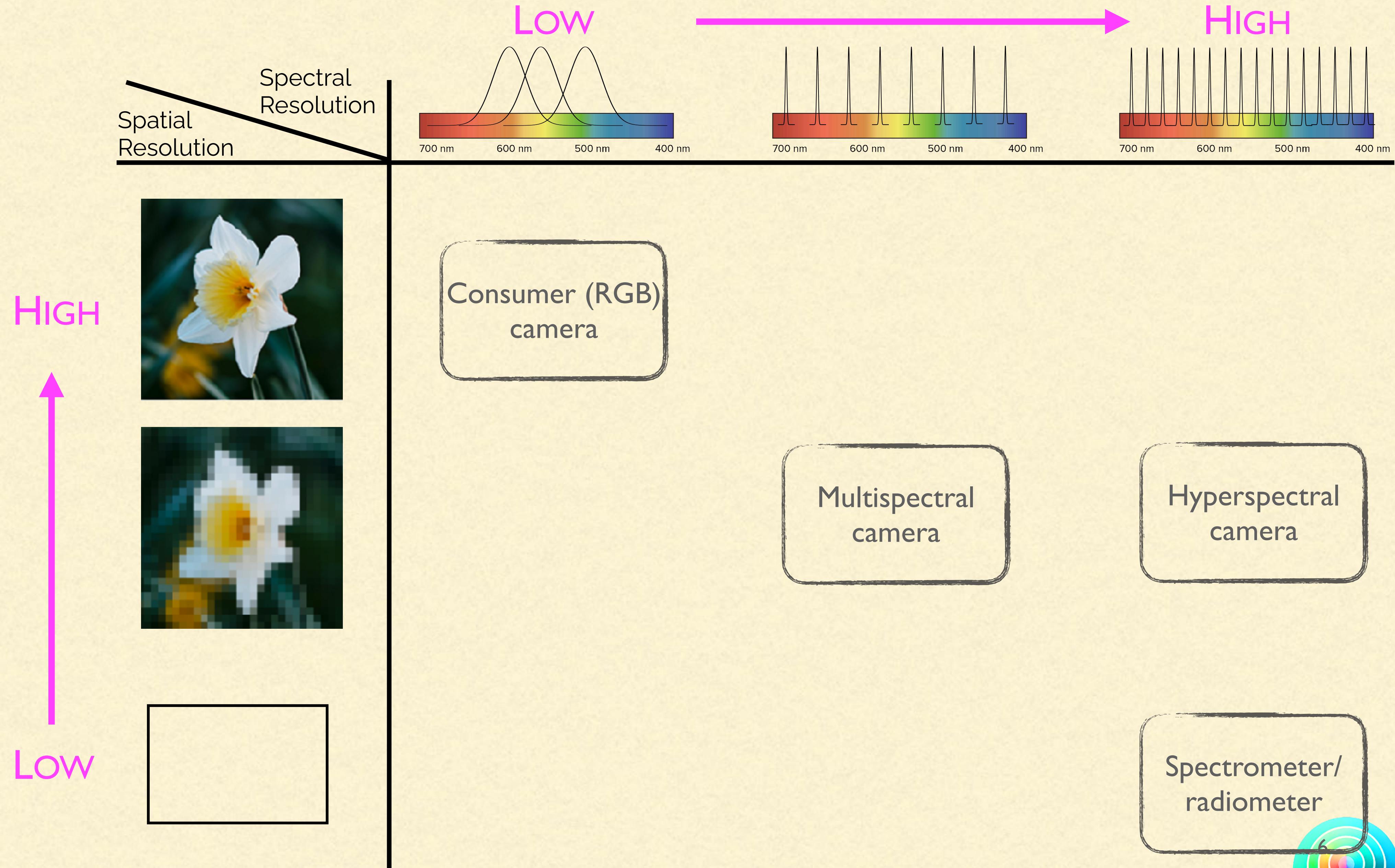
Light Measuring Devices



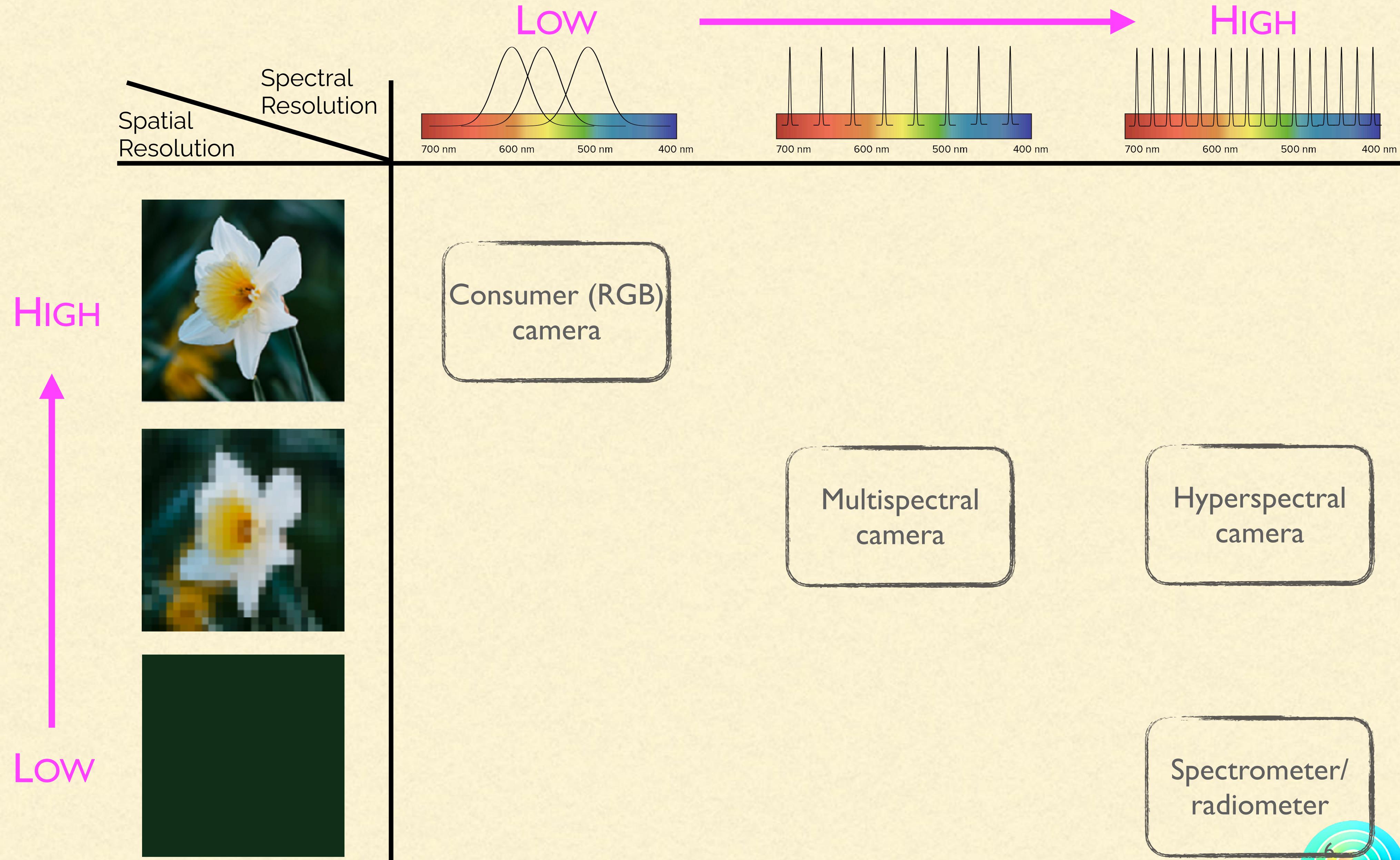
Light Measuring Devices



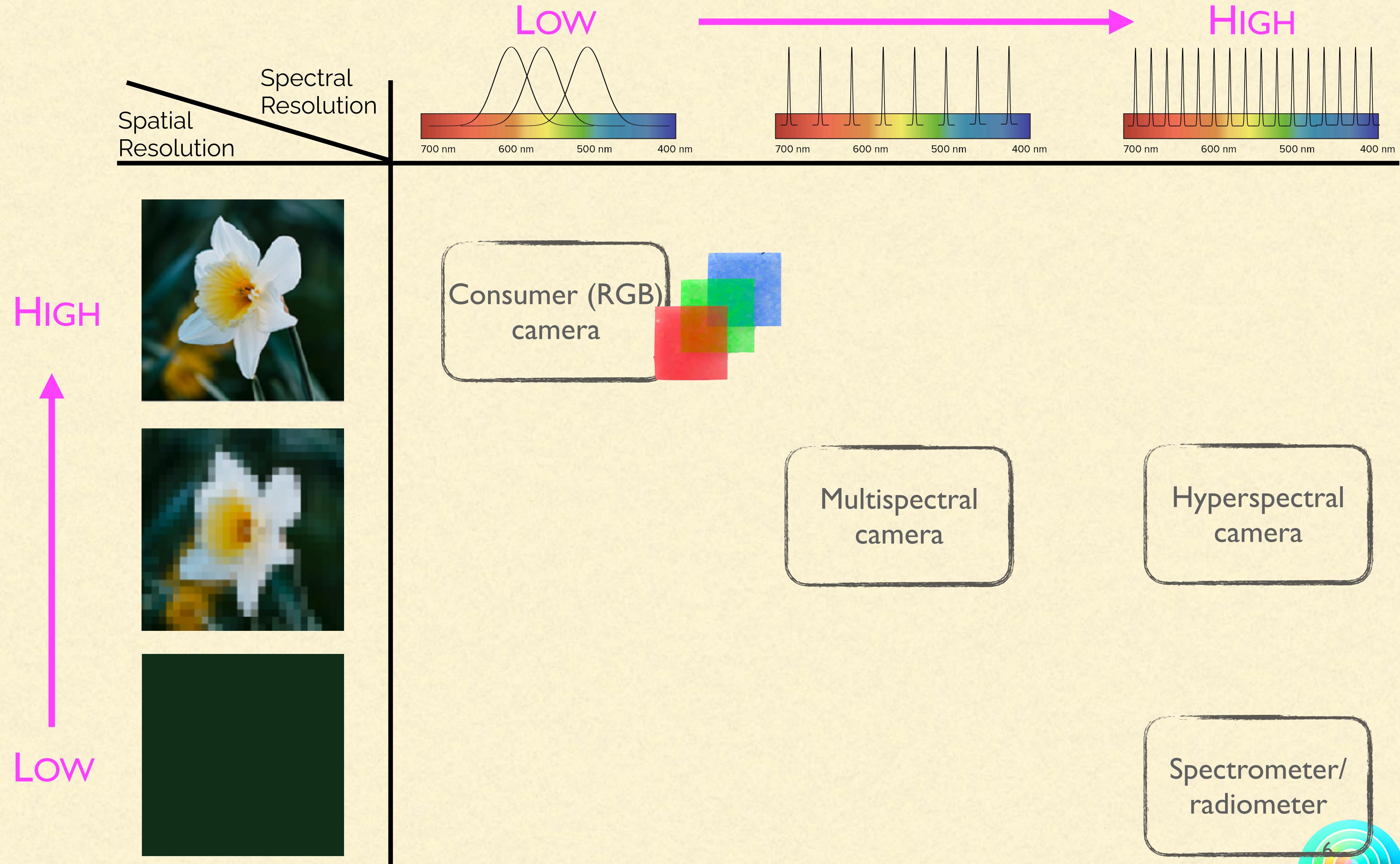
Light Measuring Devices



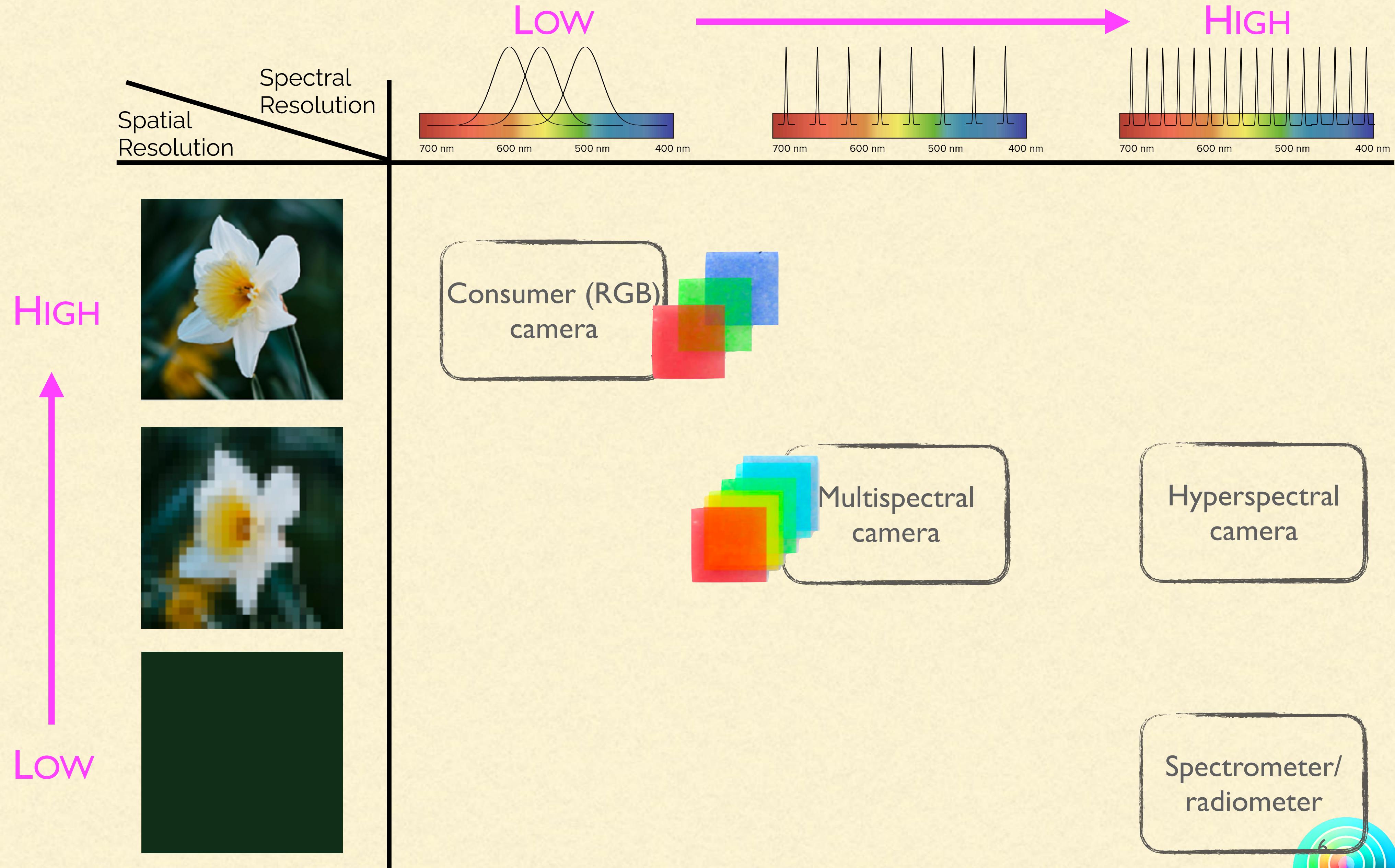
Light Measuring Devices



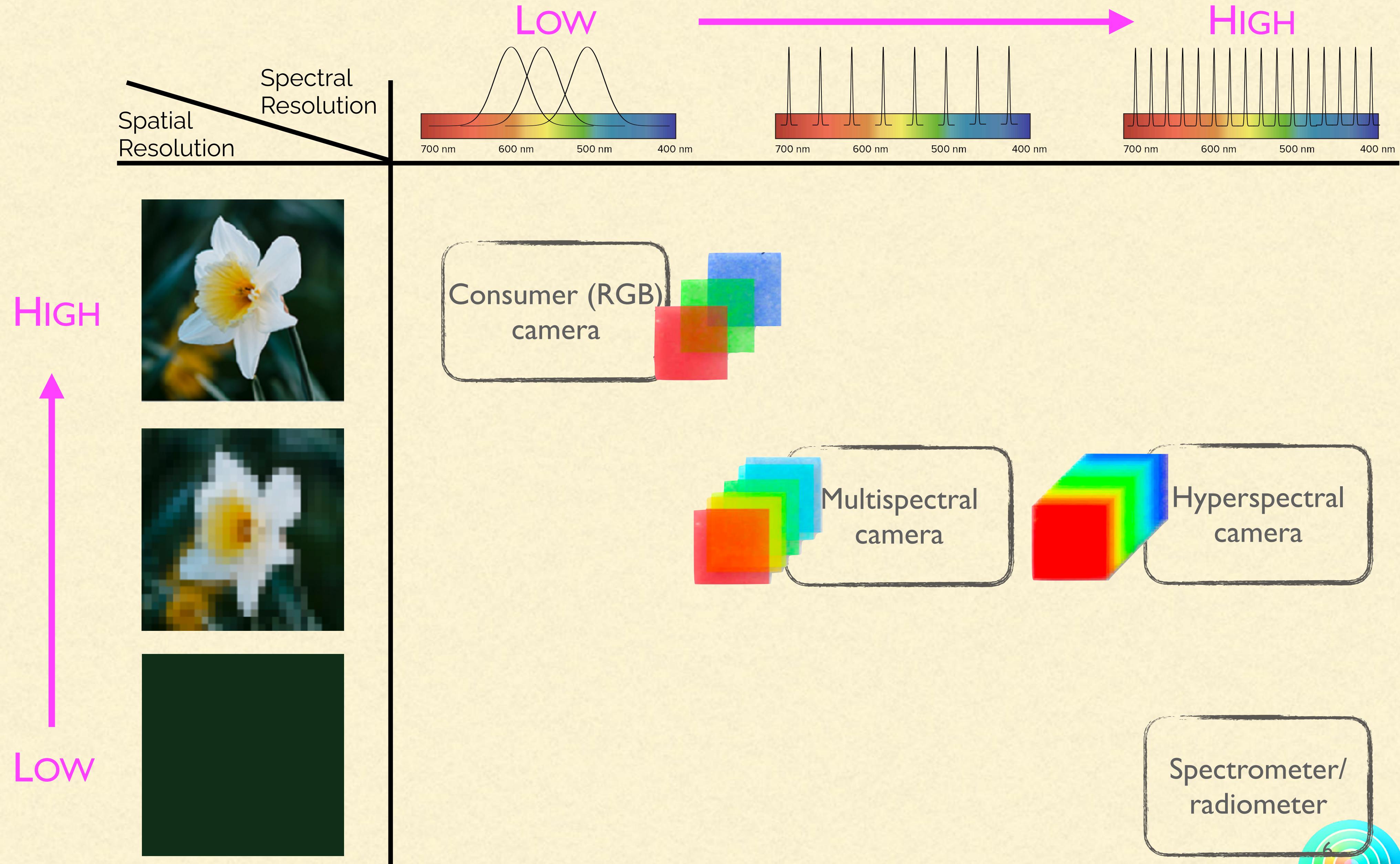
Light Measuring Devices



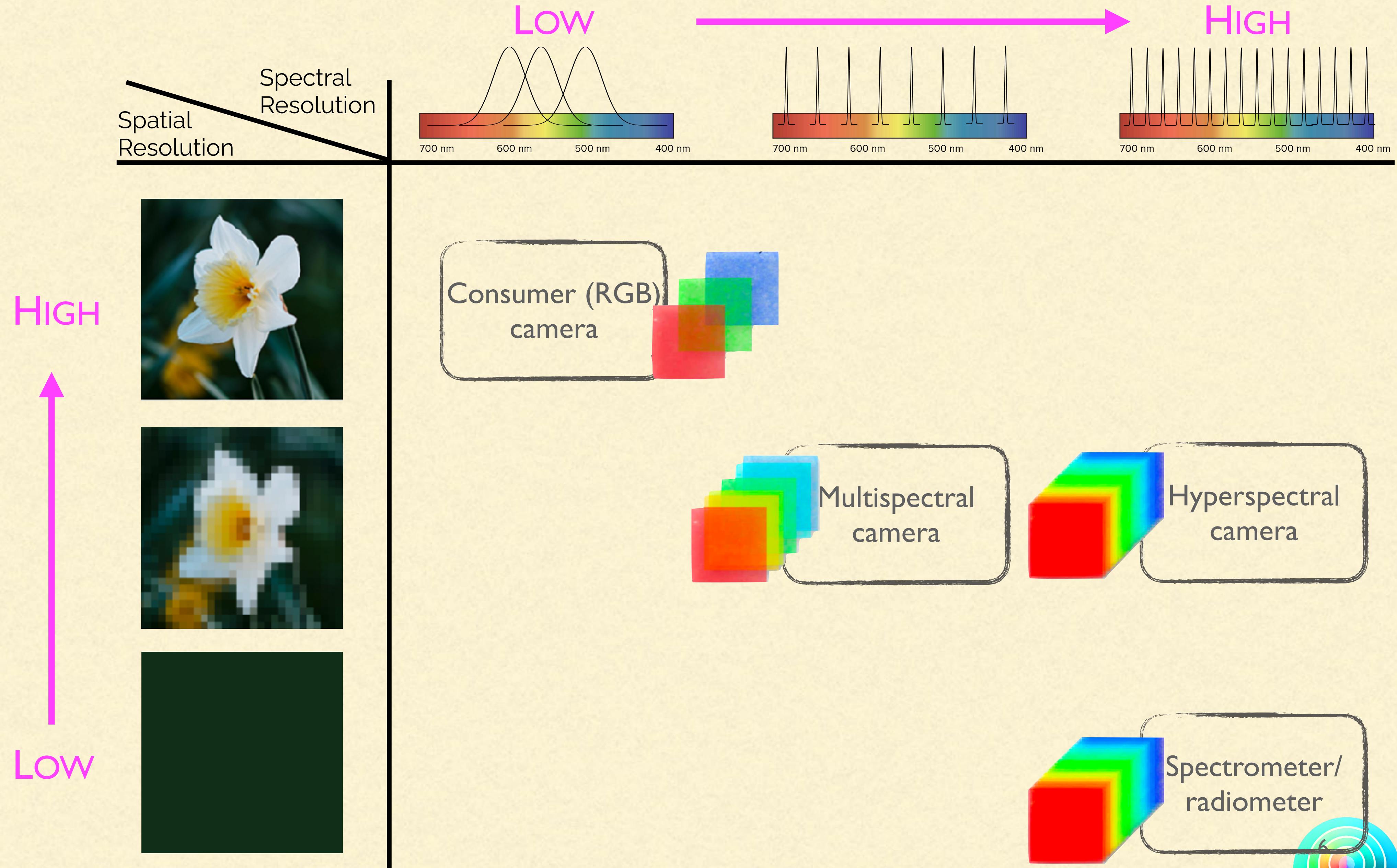
Light Measuring Devices



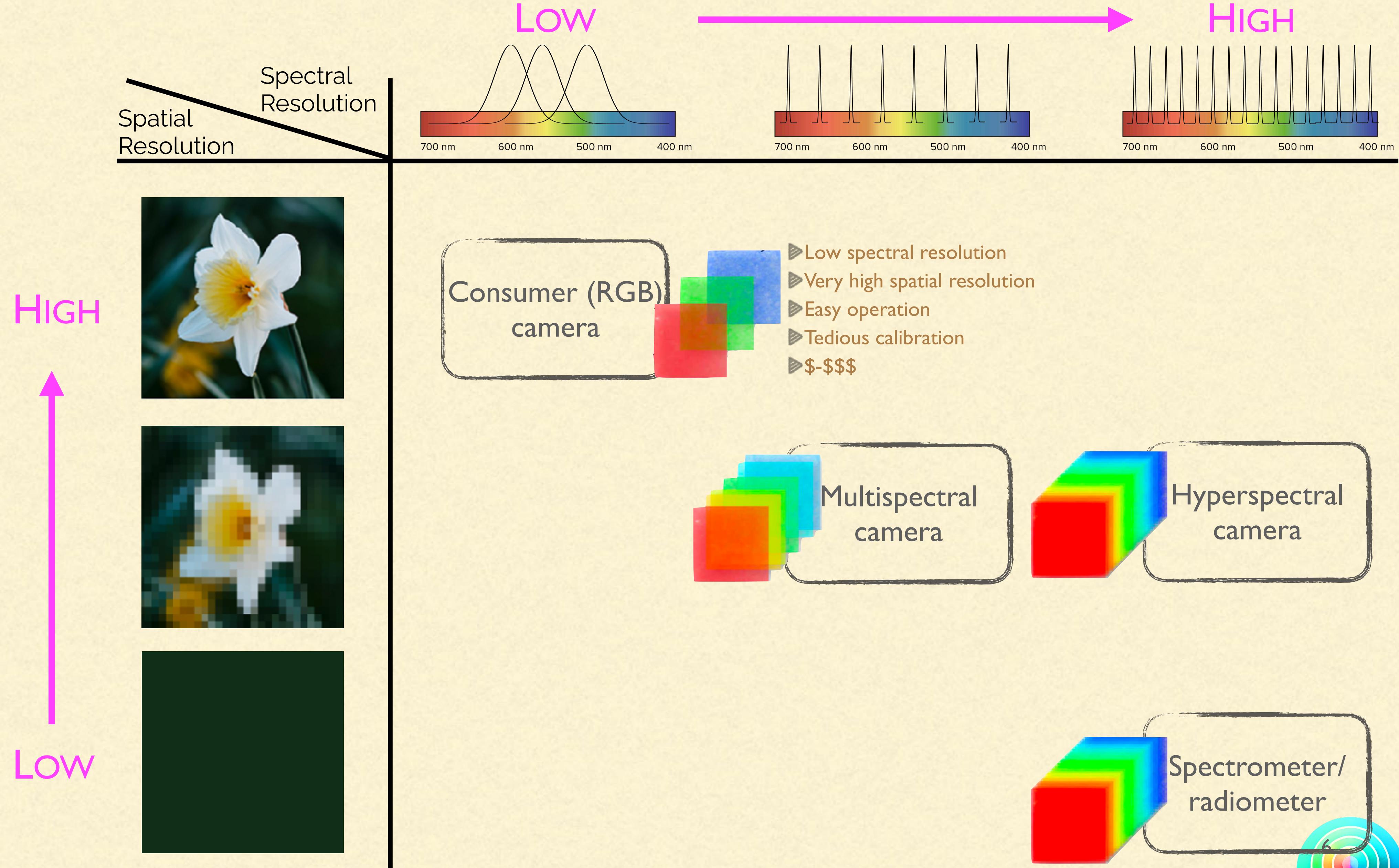
Light Measuring Devices



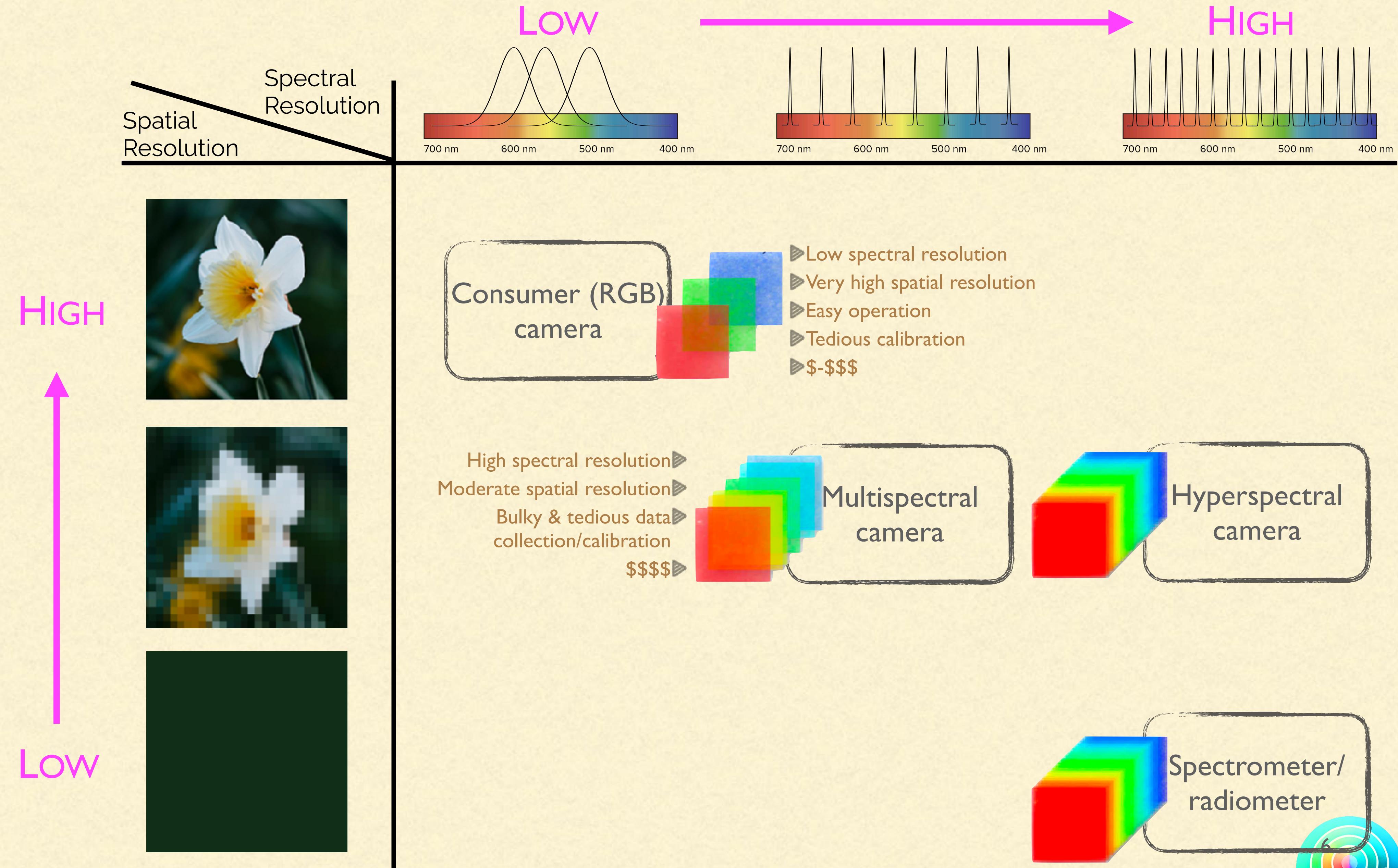
Light Measuring Devices



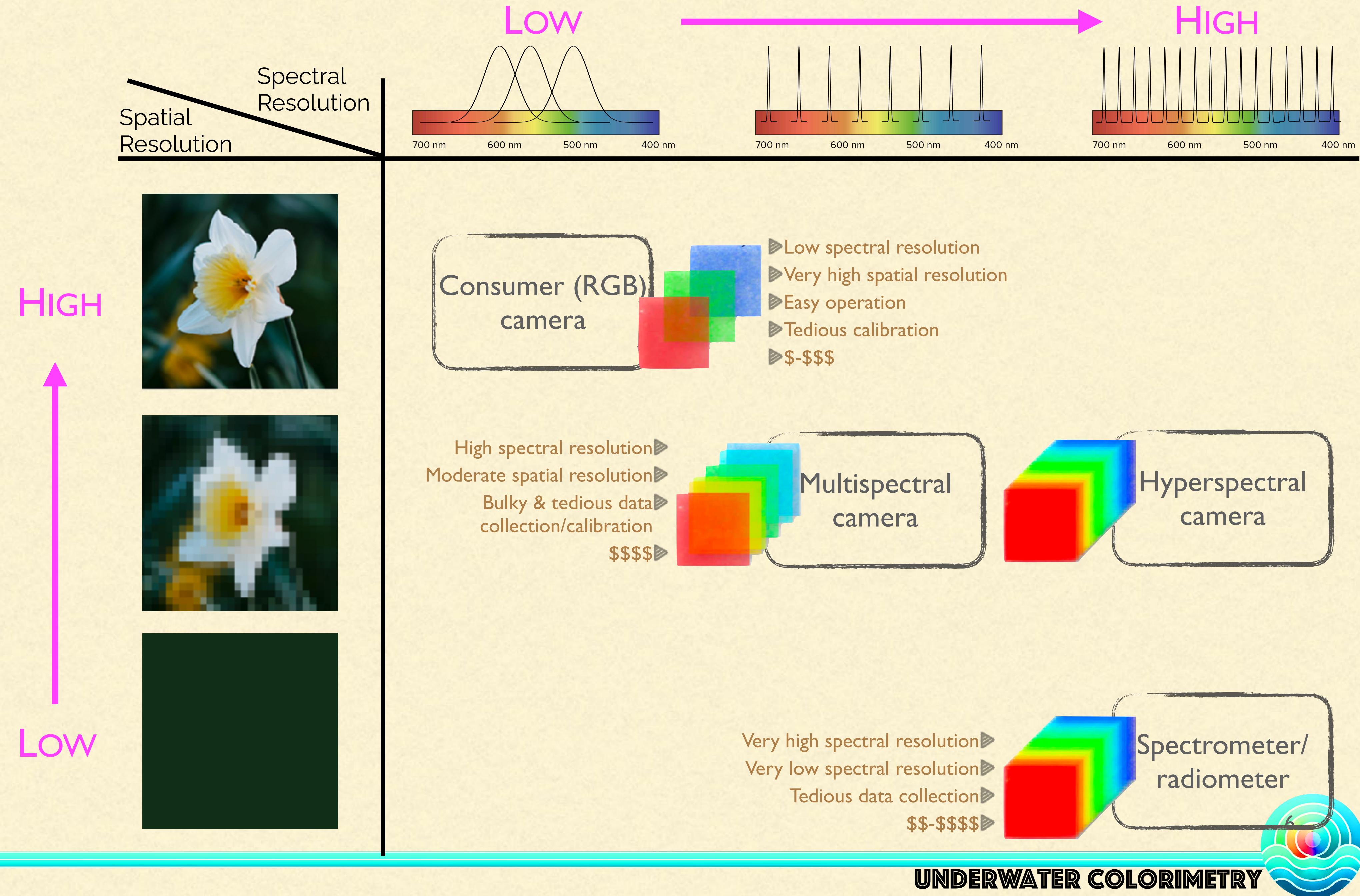
Light Measuring Devices



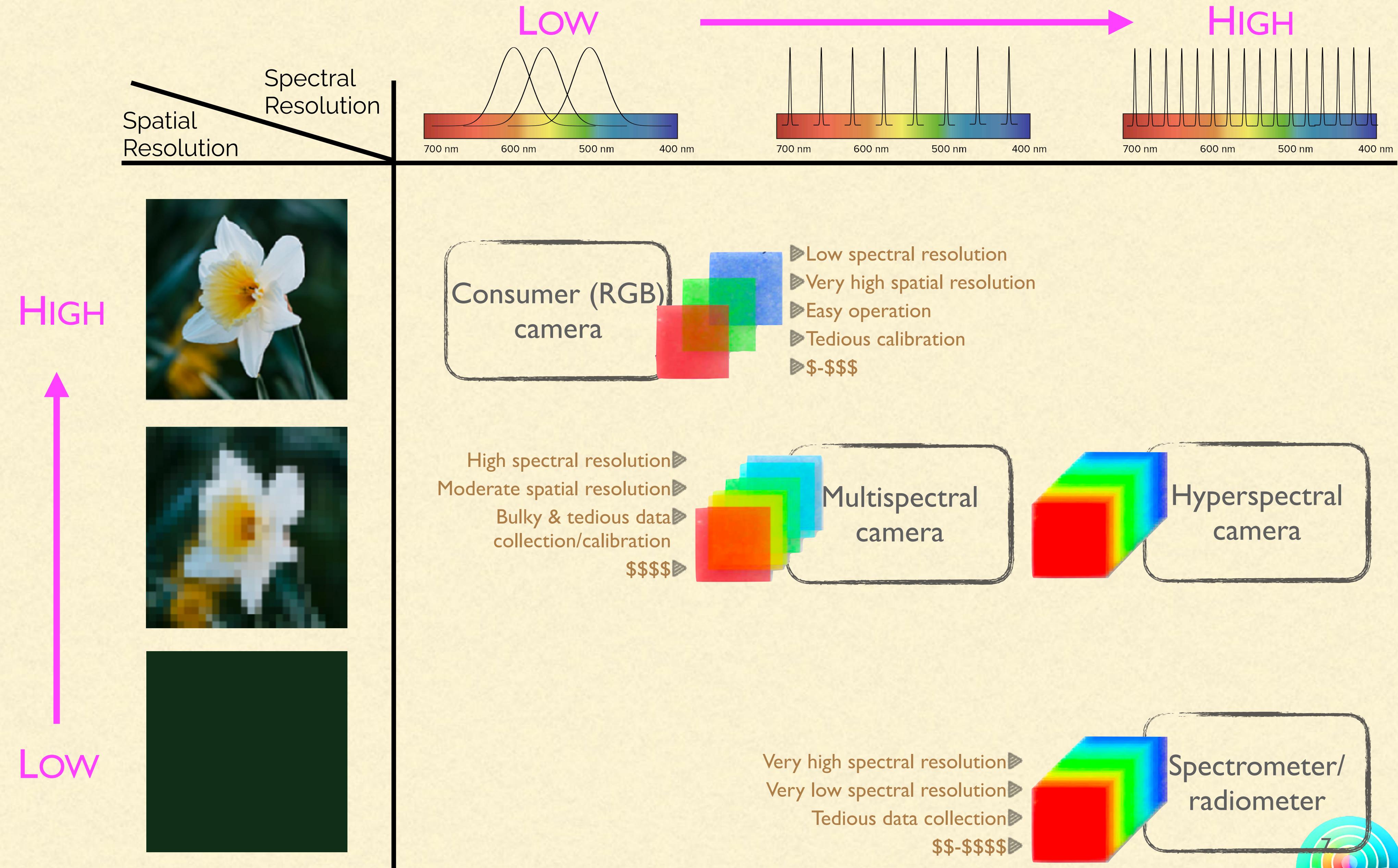
Light Measuring Devices



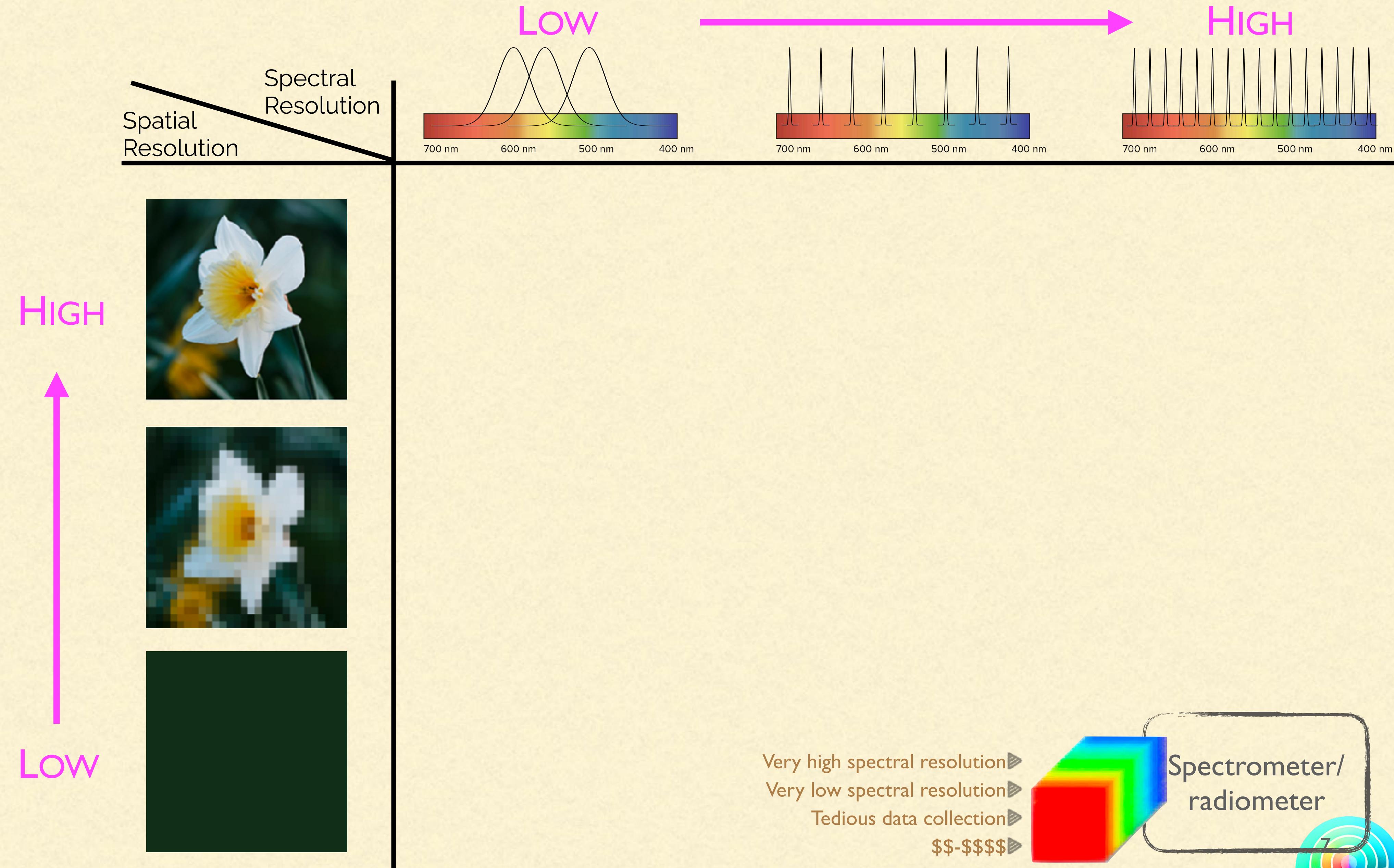
Light Measuring Devices



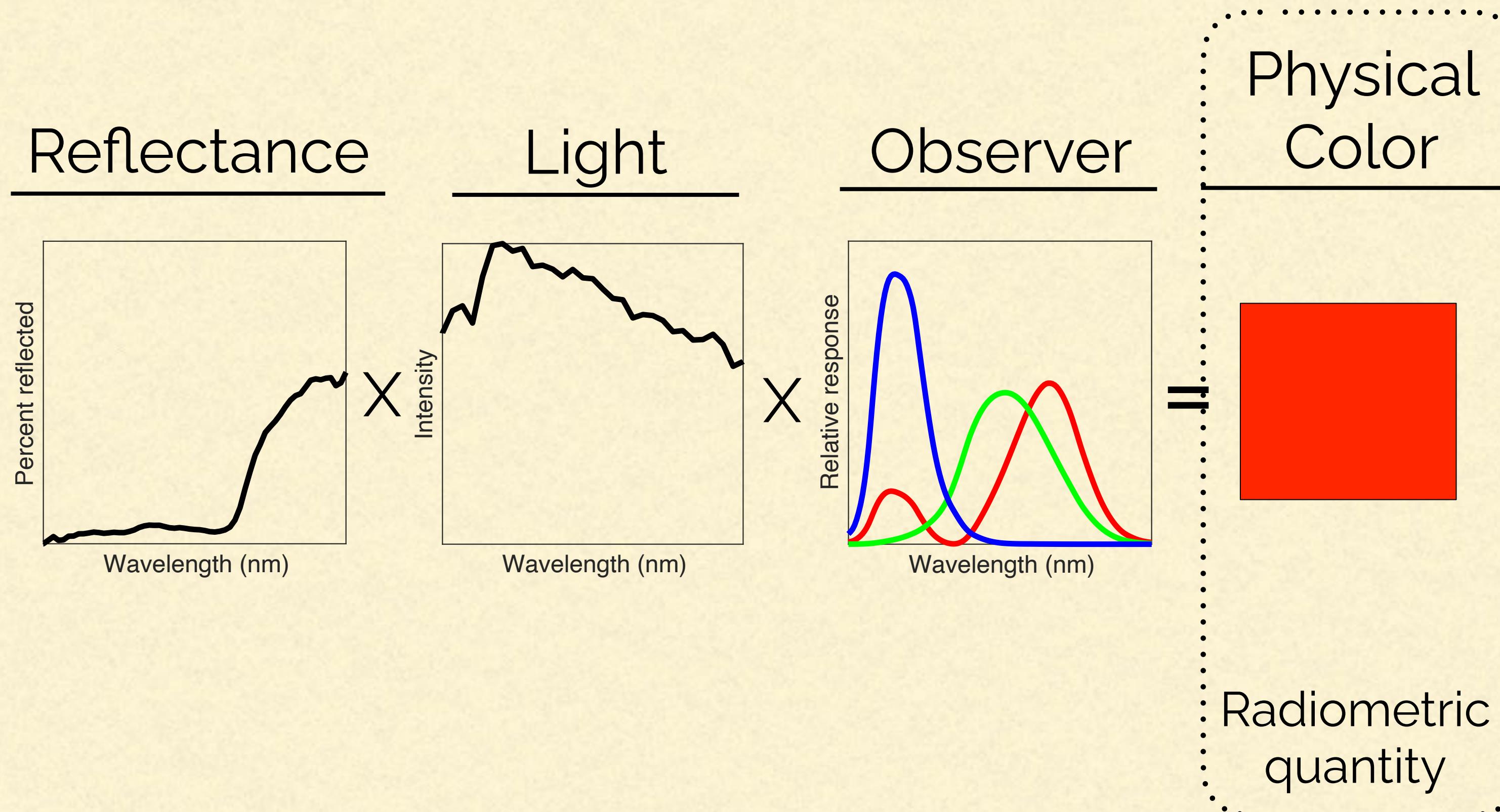
Light Measuring Devices



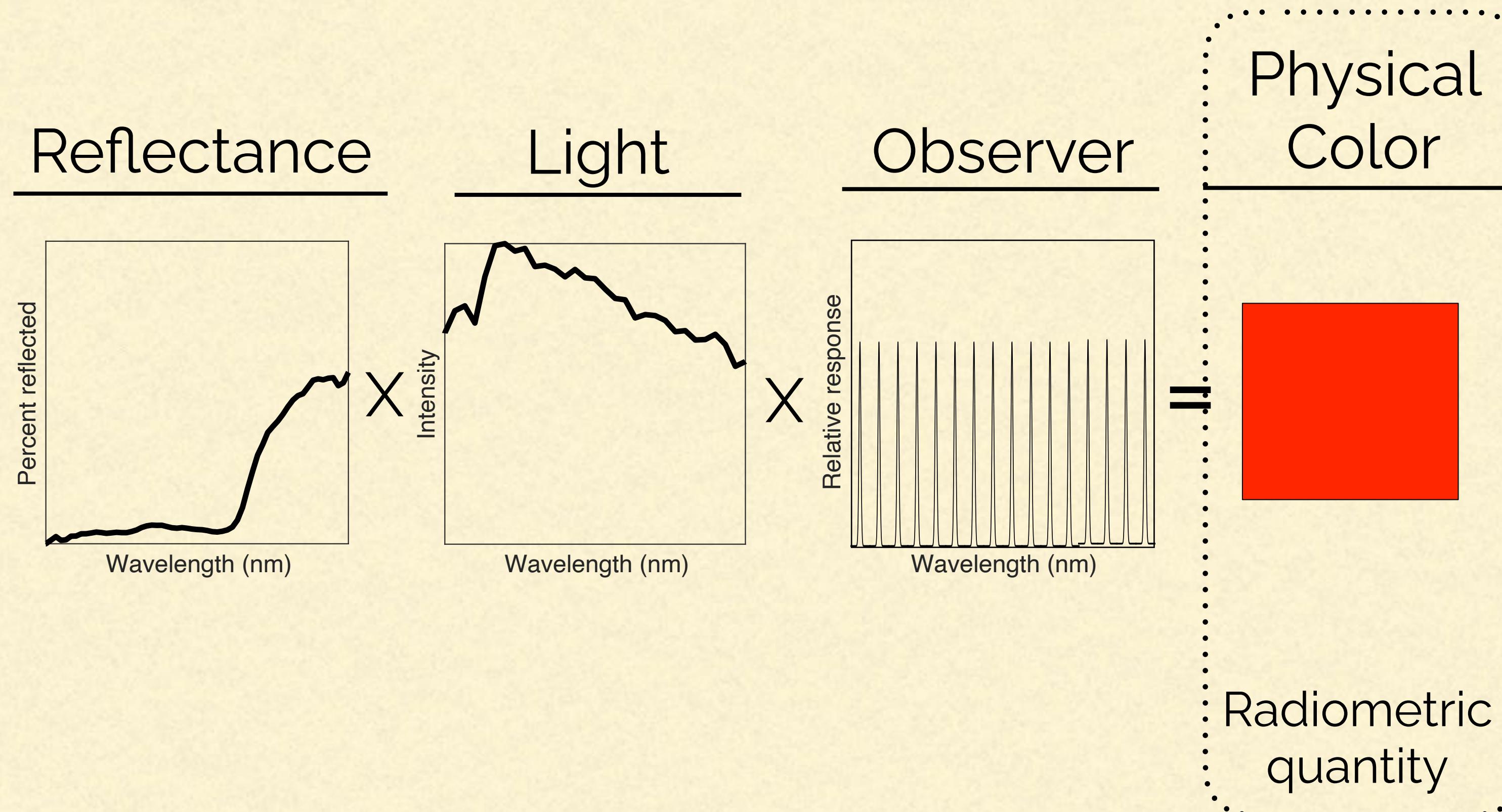
Light Measuring Devices



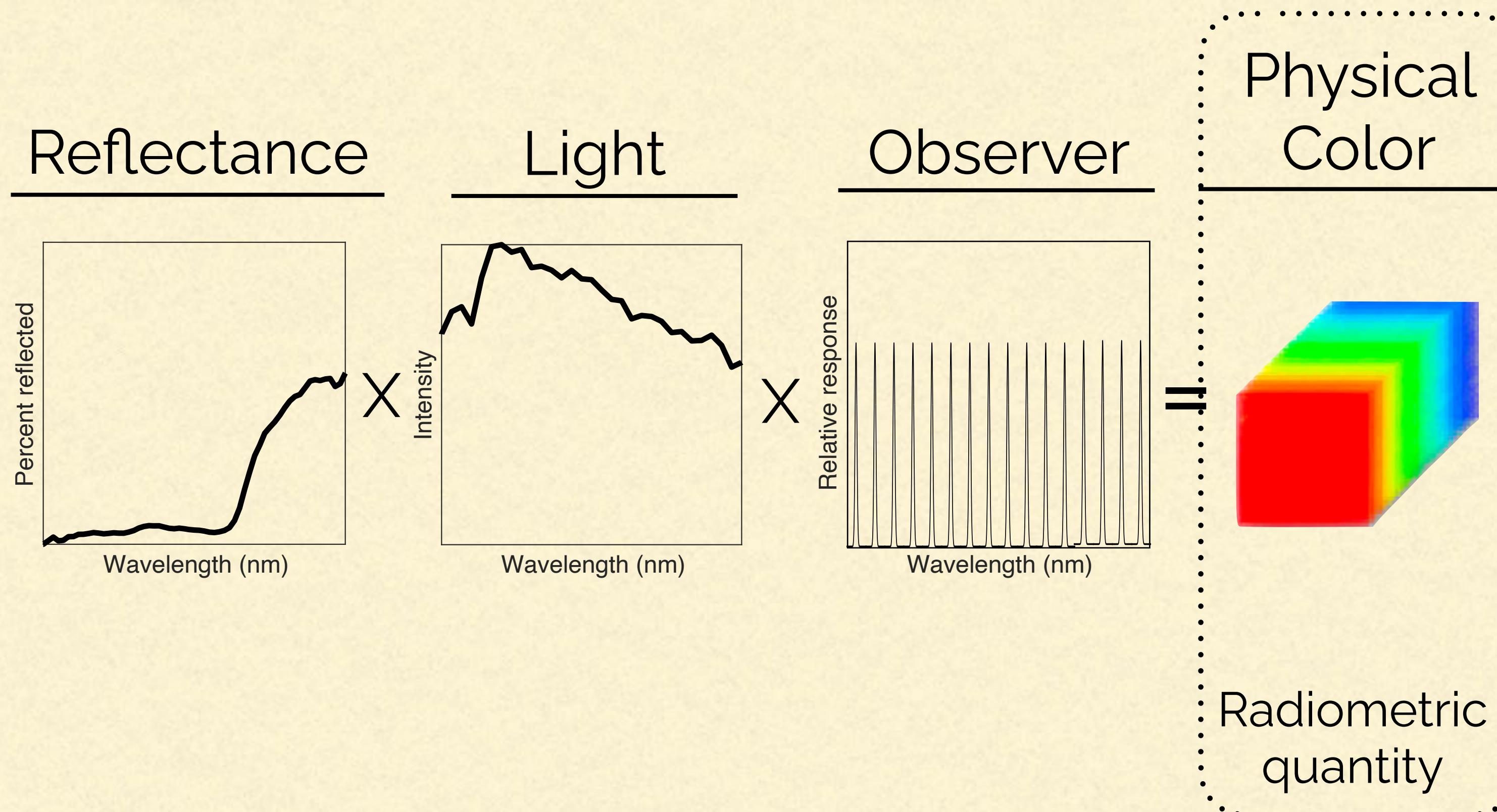
Spectrometer/Radiometer



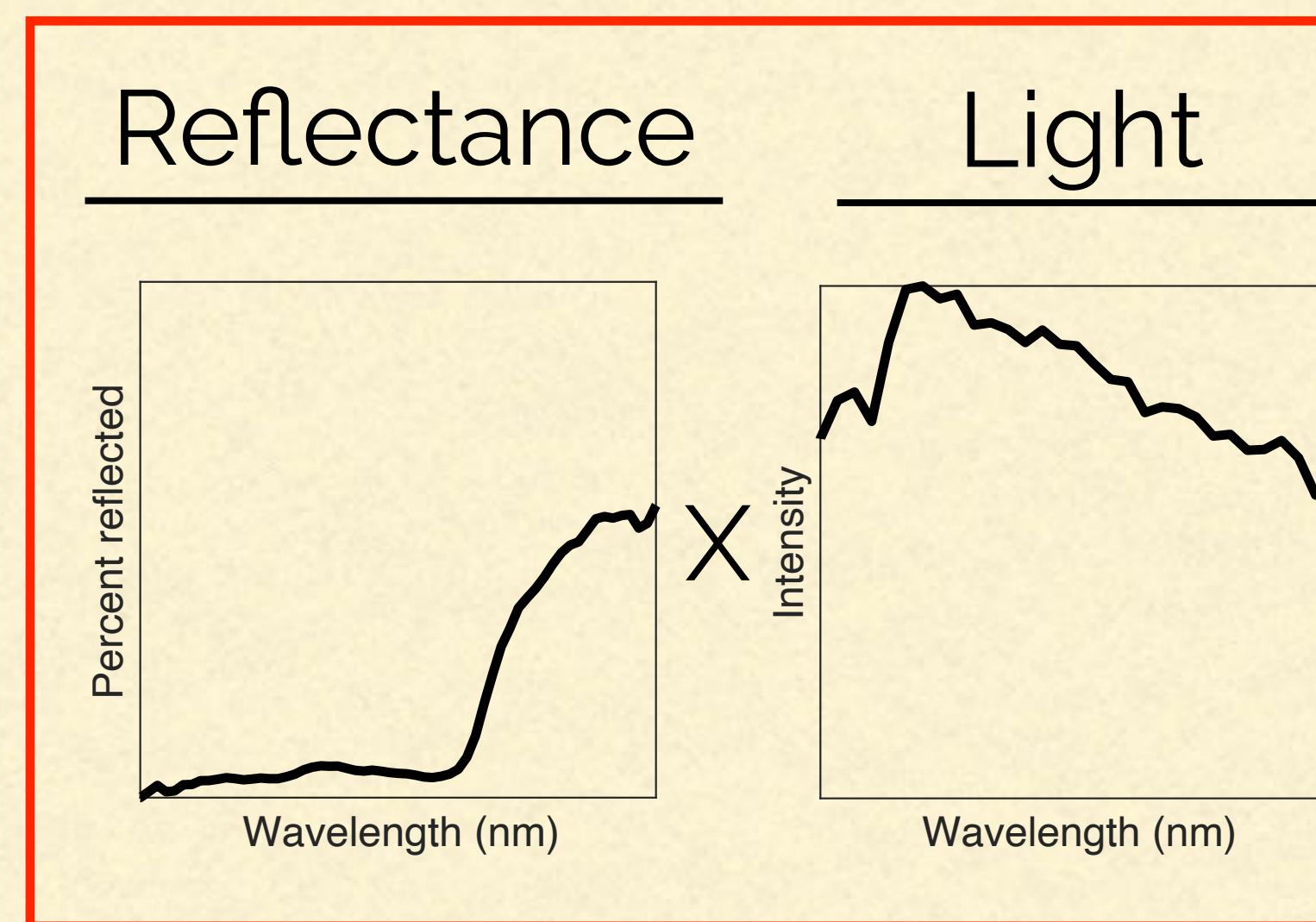
Spectrometer/Radiometer



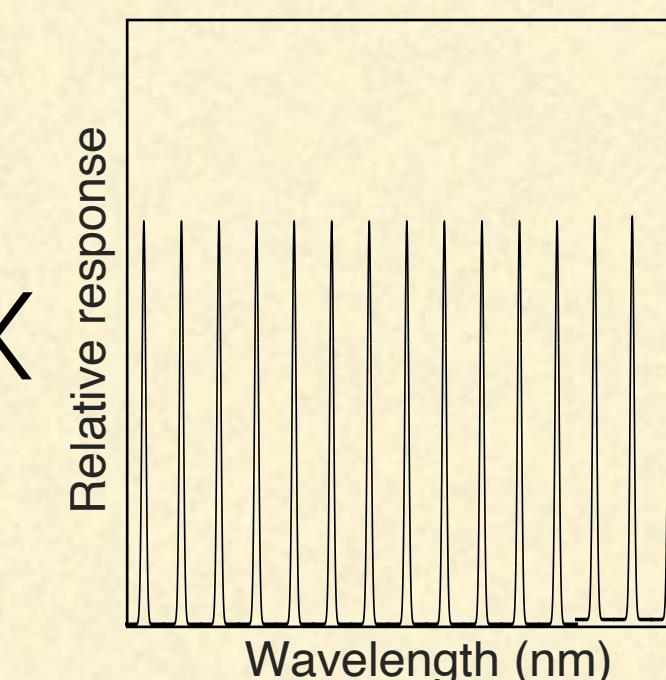
Spectrometer/Radiometer



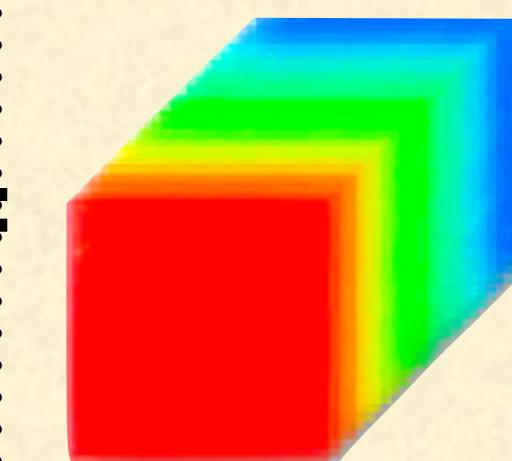
Spectrometer/Radiometer



Observer



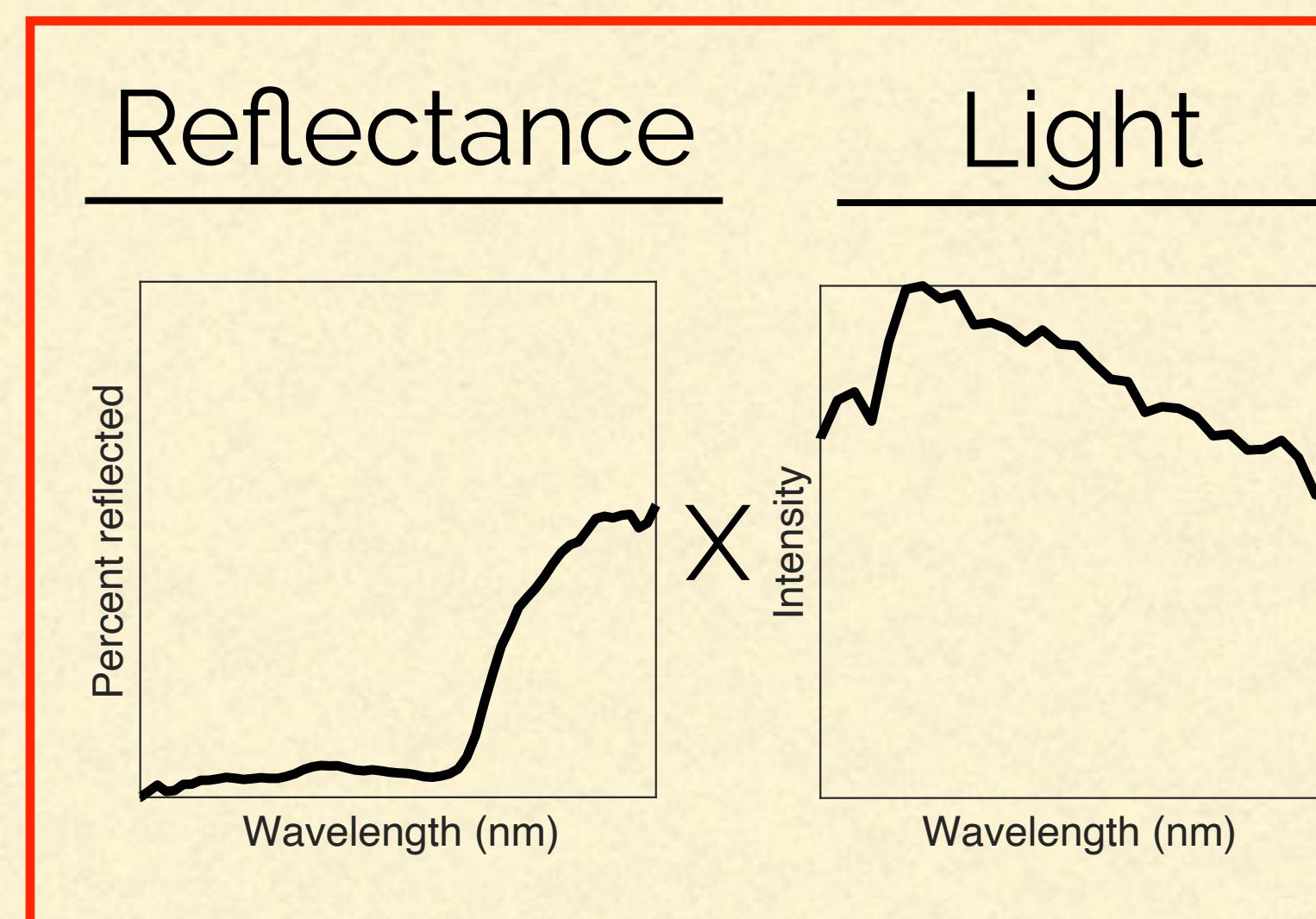
Physical
Color



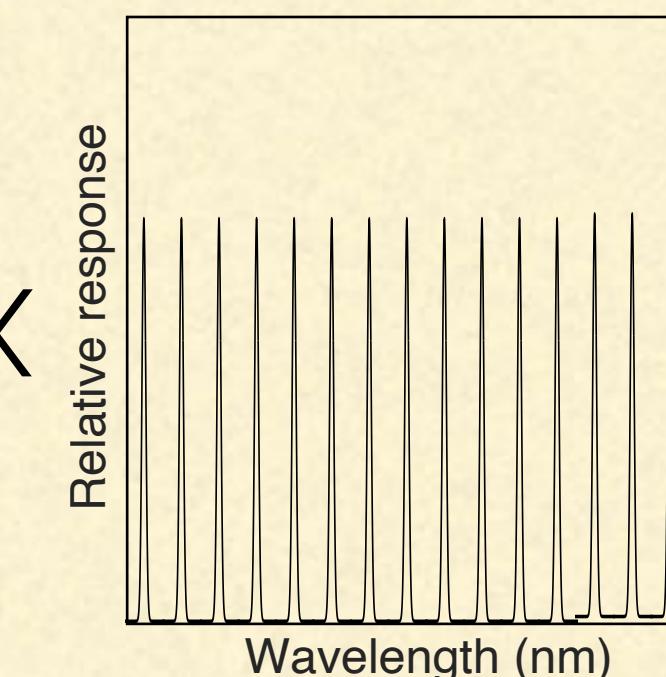
Radiometric
quantity

Radiance: measured with a radiometer

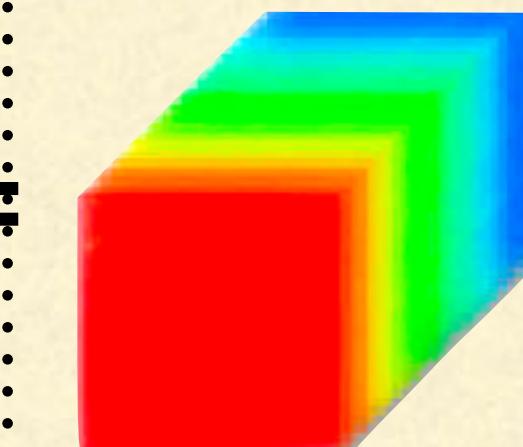
Spectrometer/Radiometer



Observer



Physical Color



Radiometric quantity

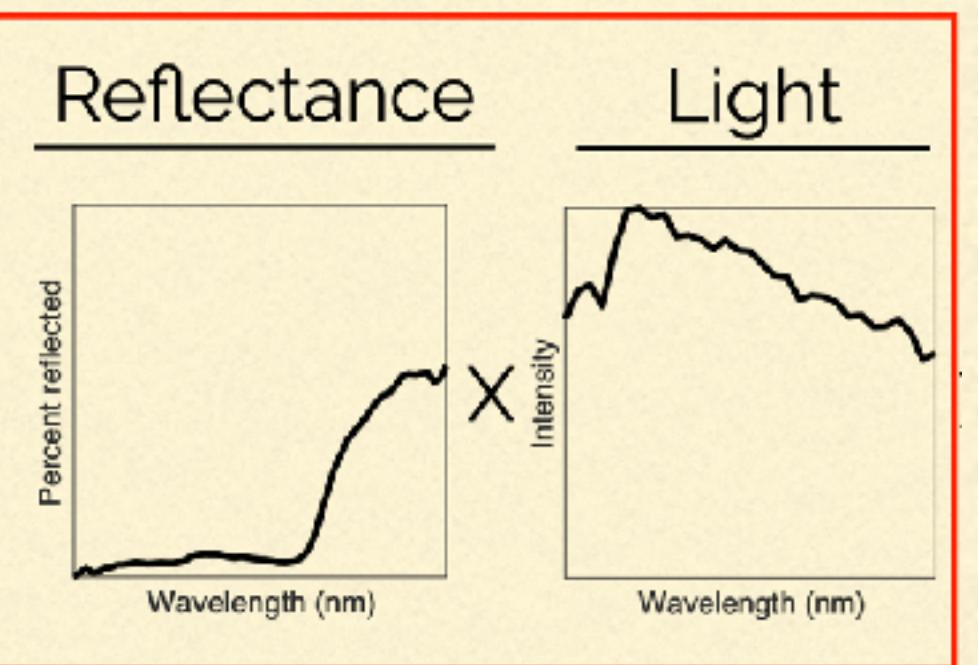
Radiance: measured with a radiometer

Spectrometer: measures reflectance. How?

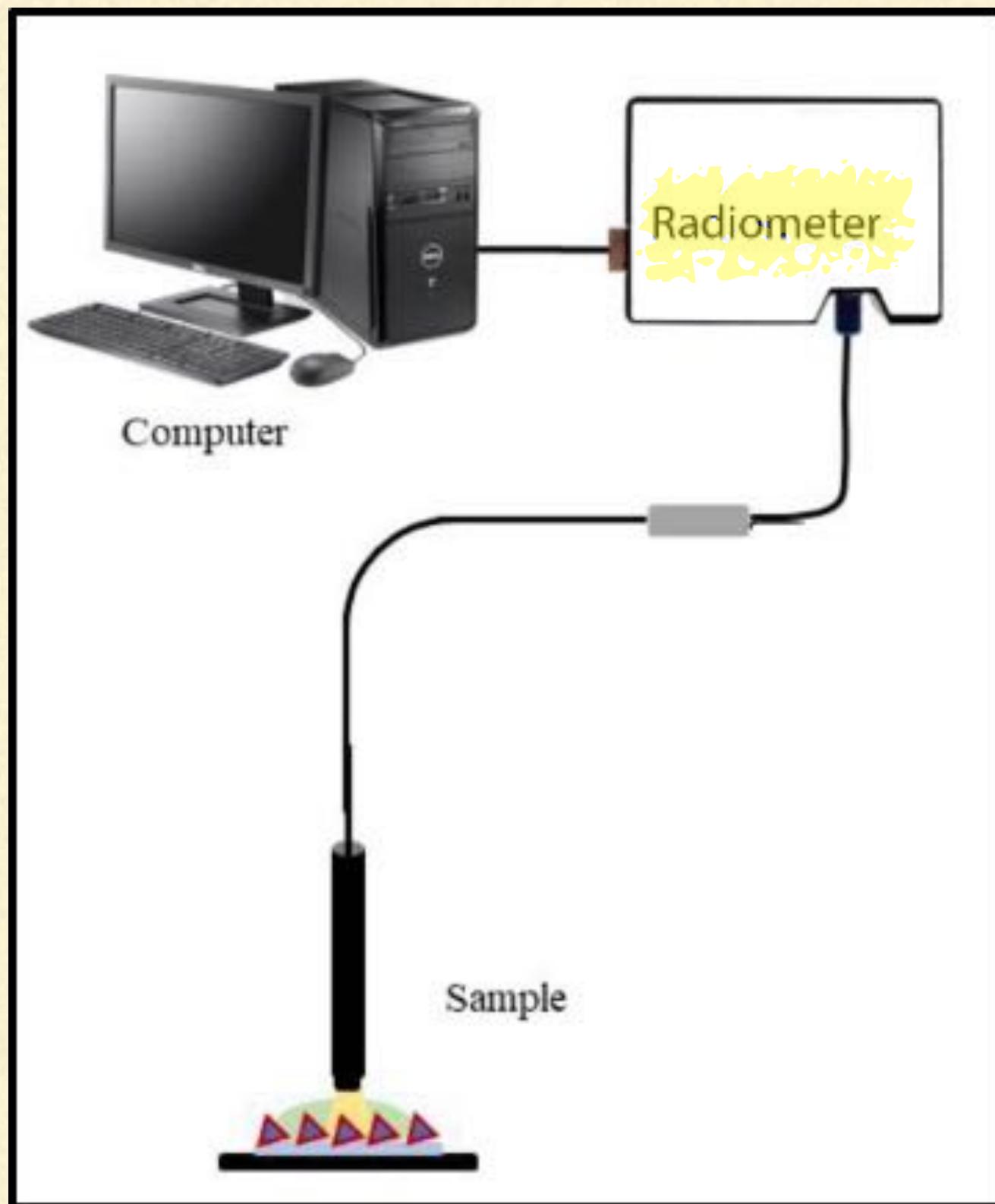
Spectrometer/Radiometer



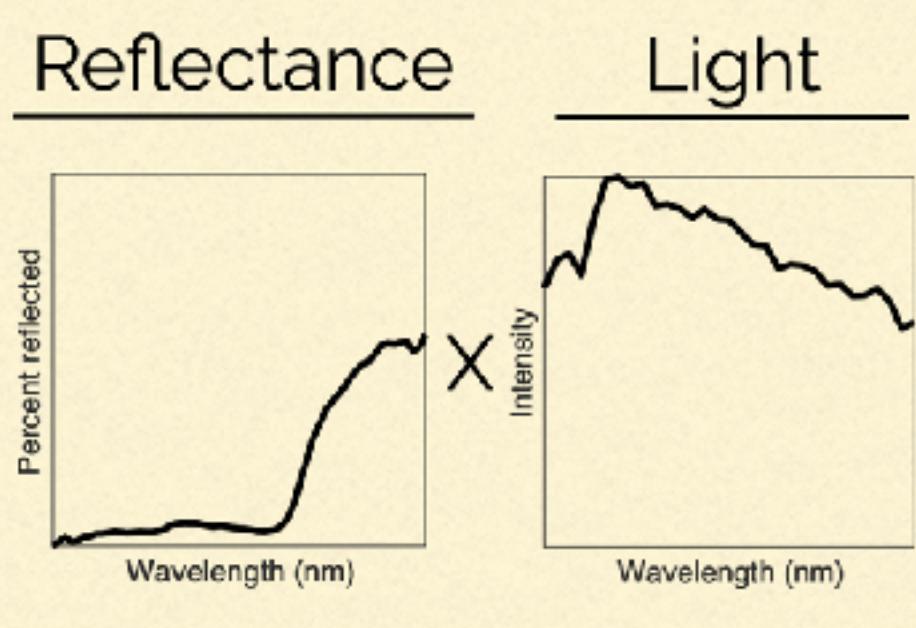
Spectrometer/Radiometer



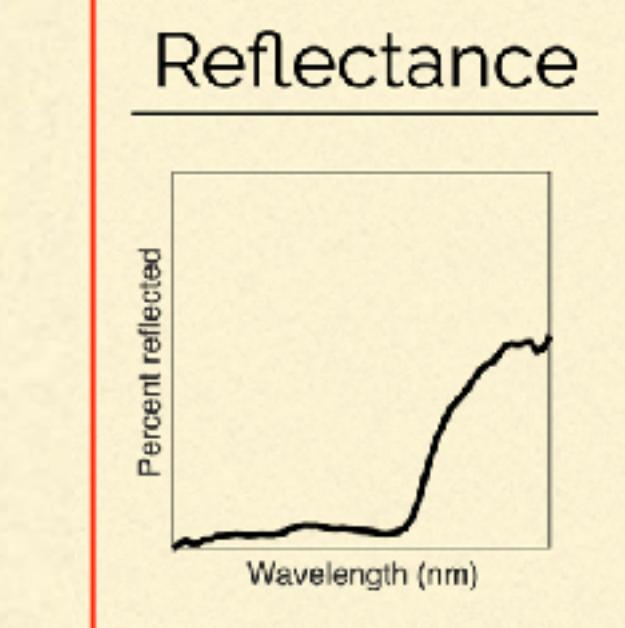
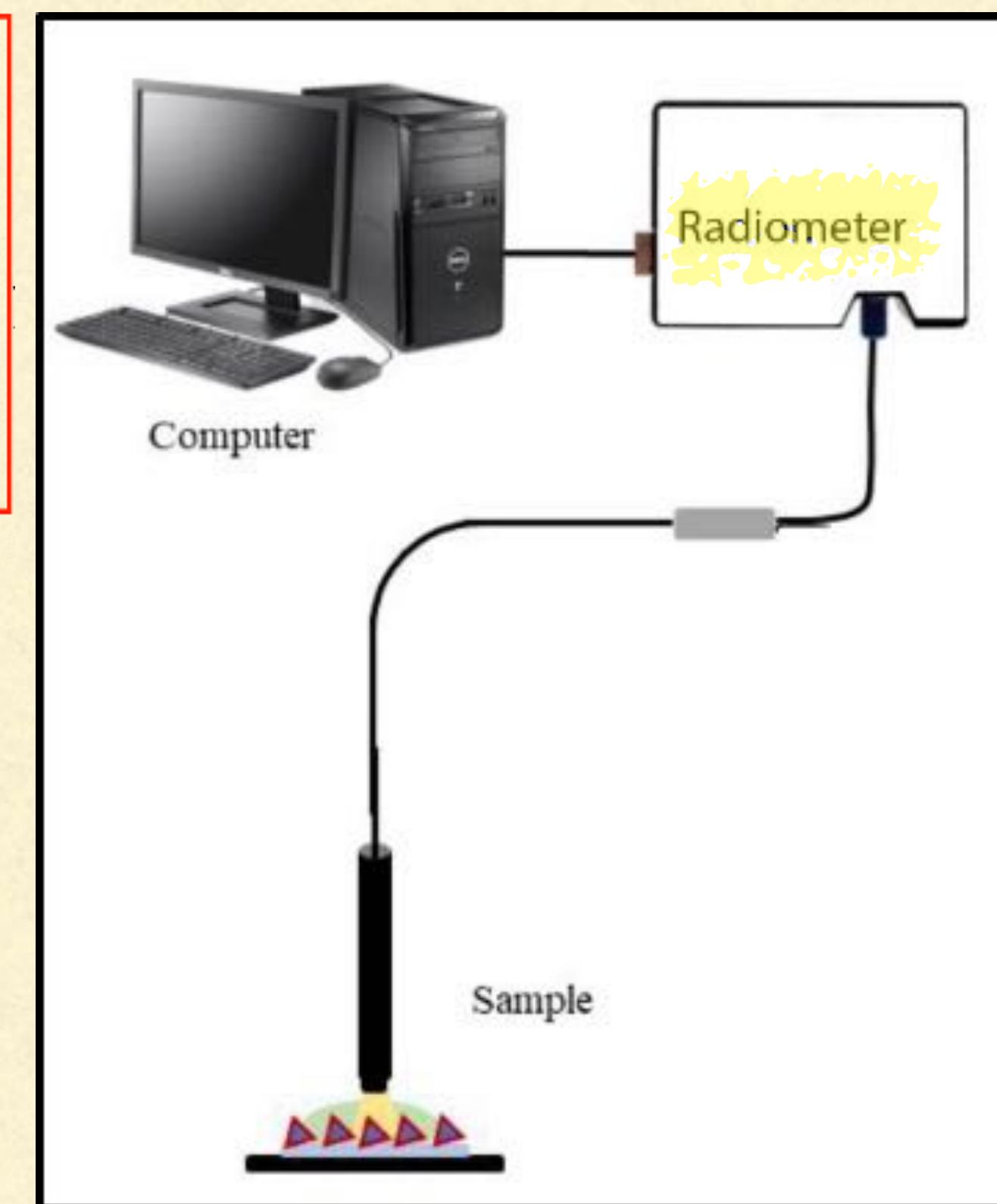
Radiance: measured with a radiometer



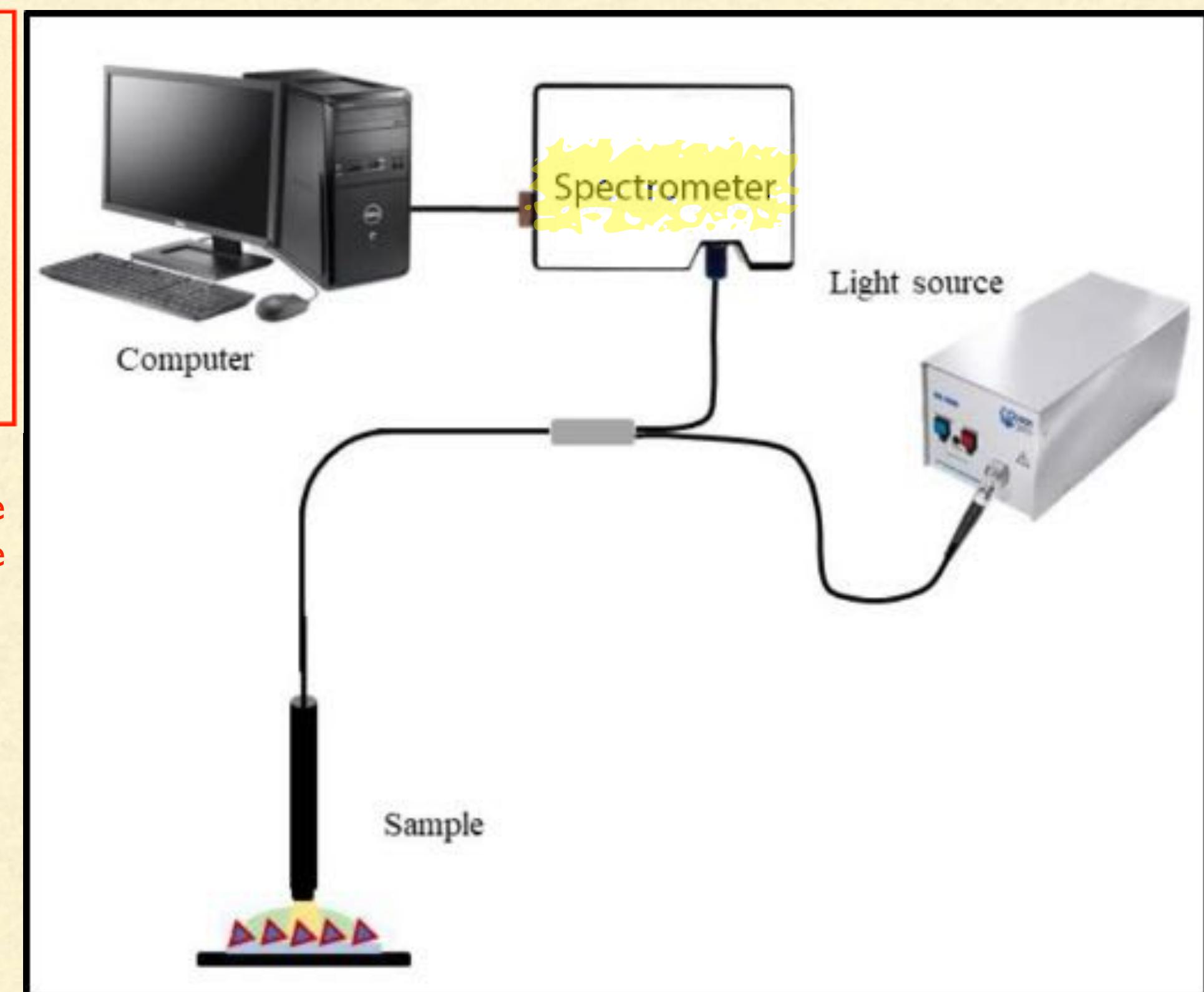
Spectrometer/Radiometer



Radiance: measured with a radiometer



Spectrometer:
measures reflectance
because it knows the
light shone on the
sample.

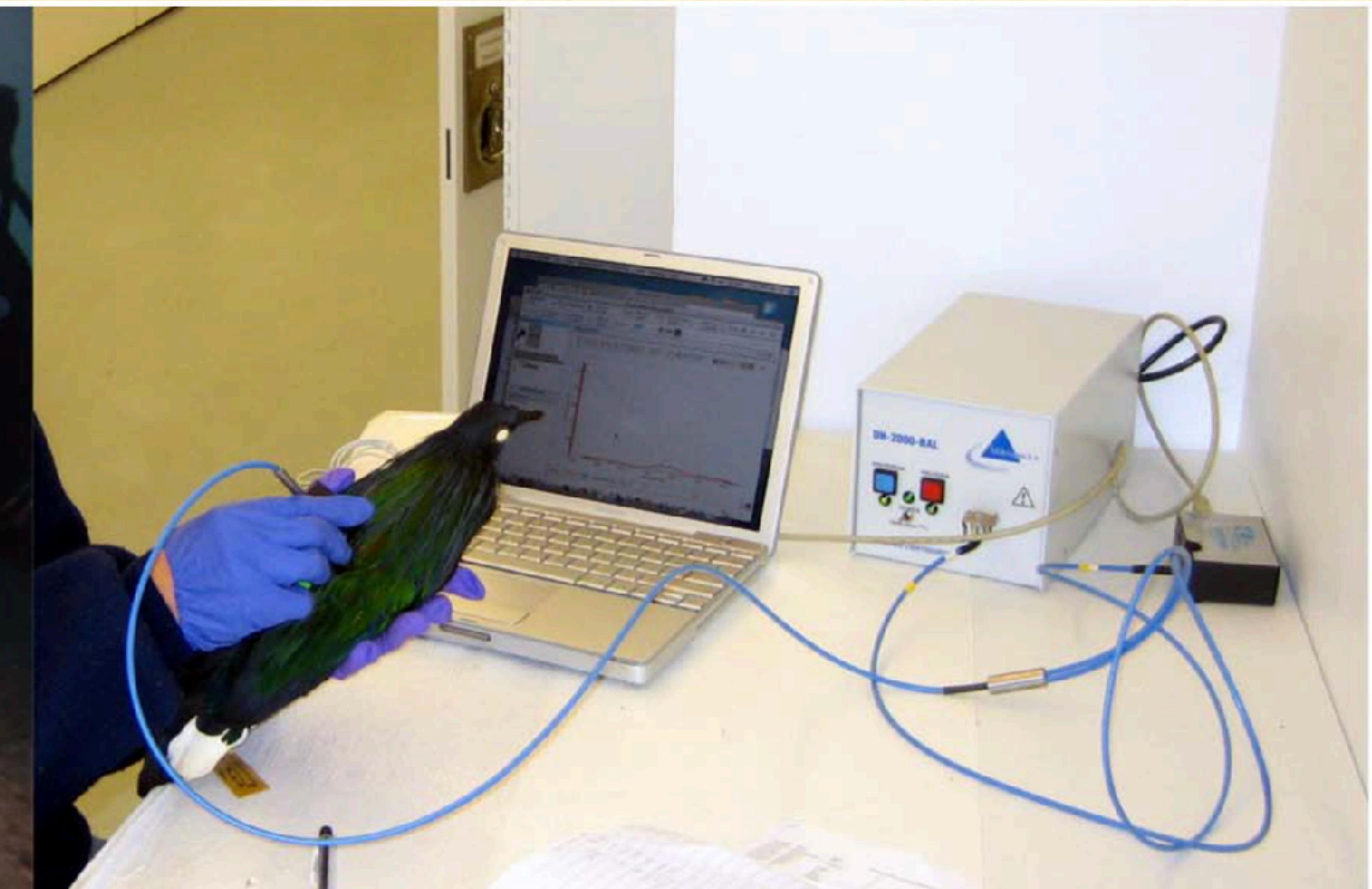


Spectrometer/Radiometer

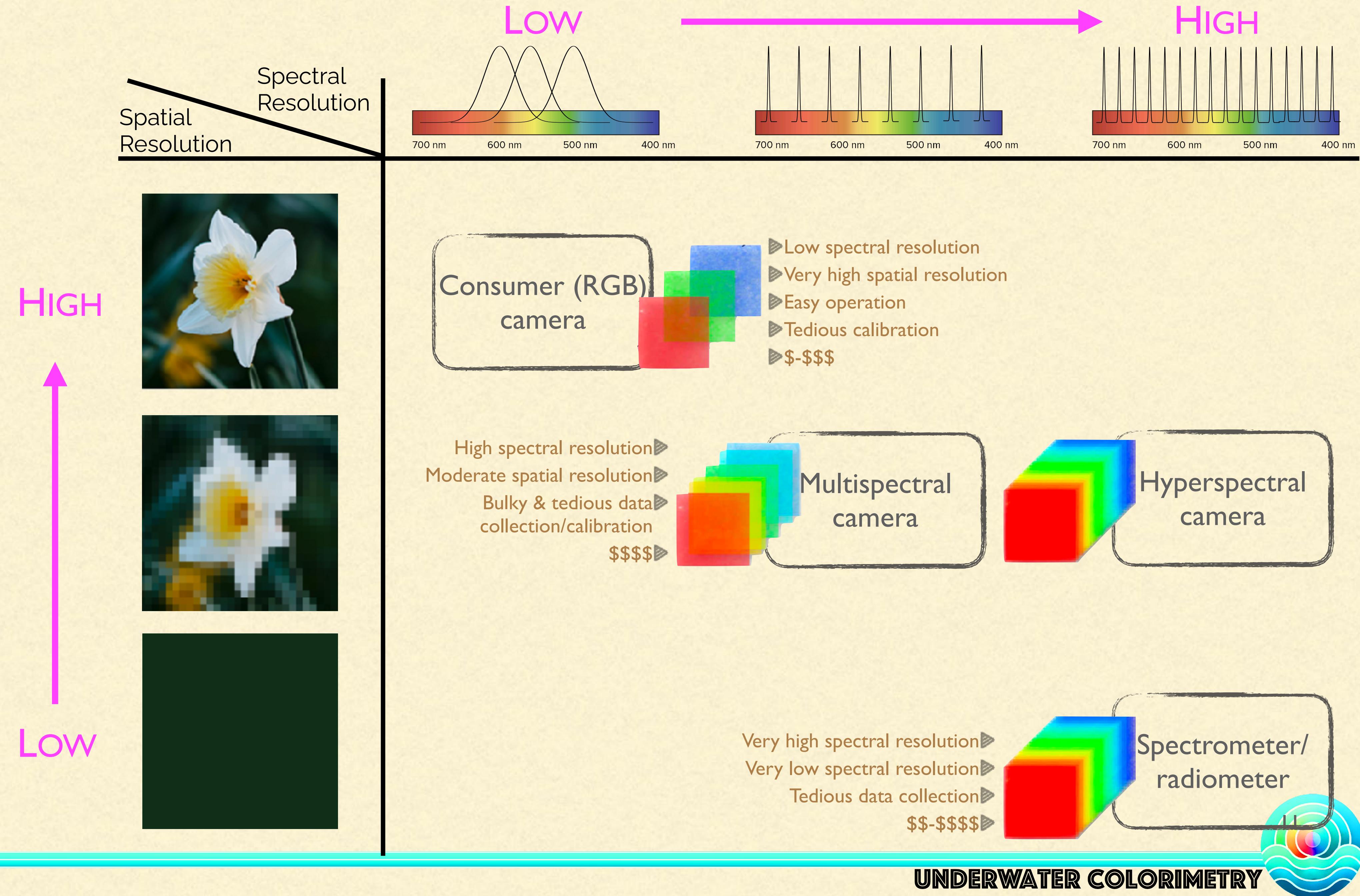
Underwater radiometer



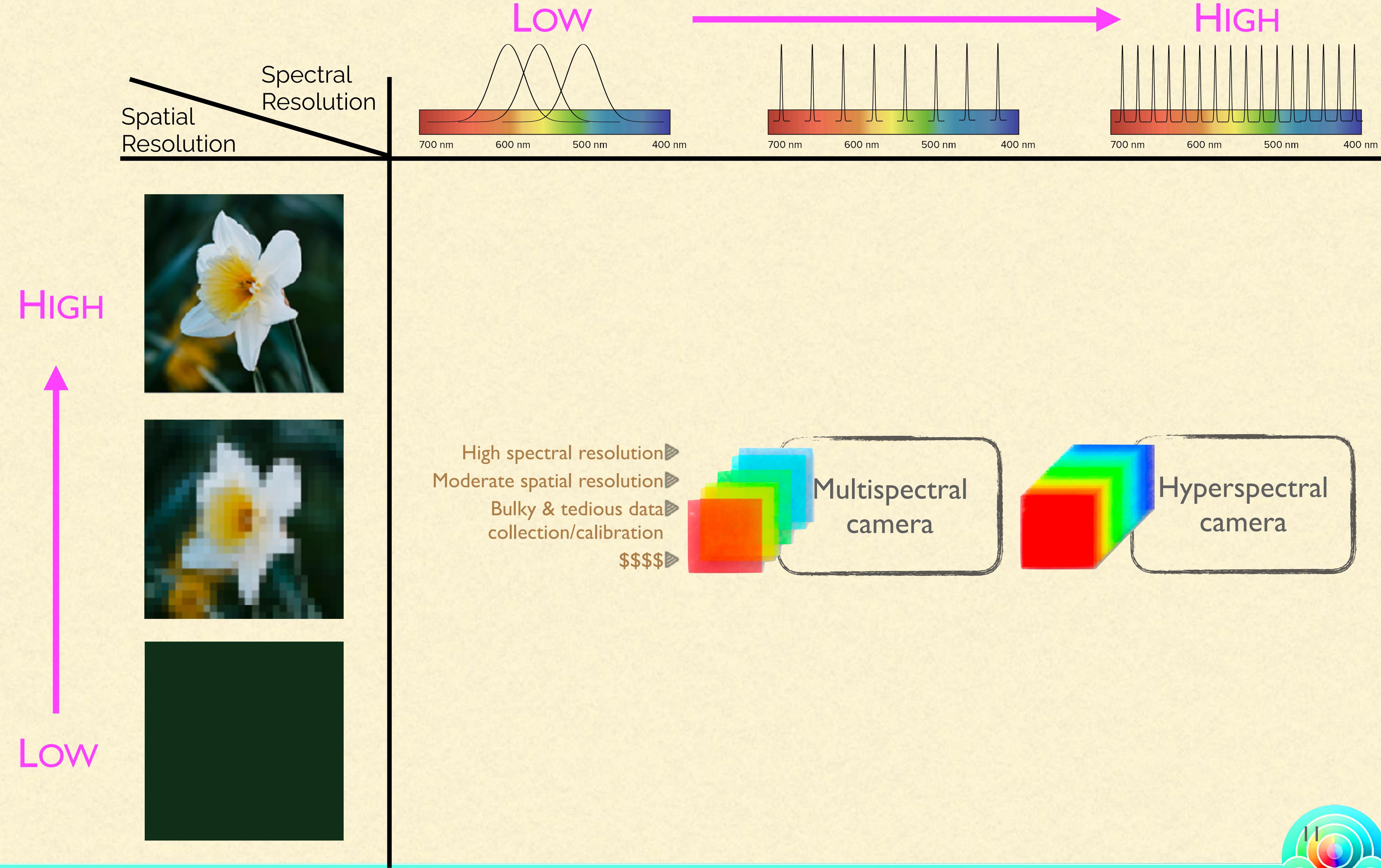
Benchtop spectrometer



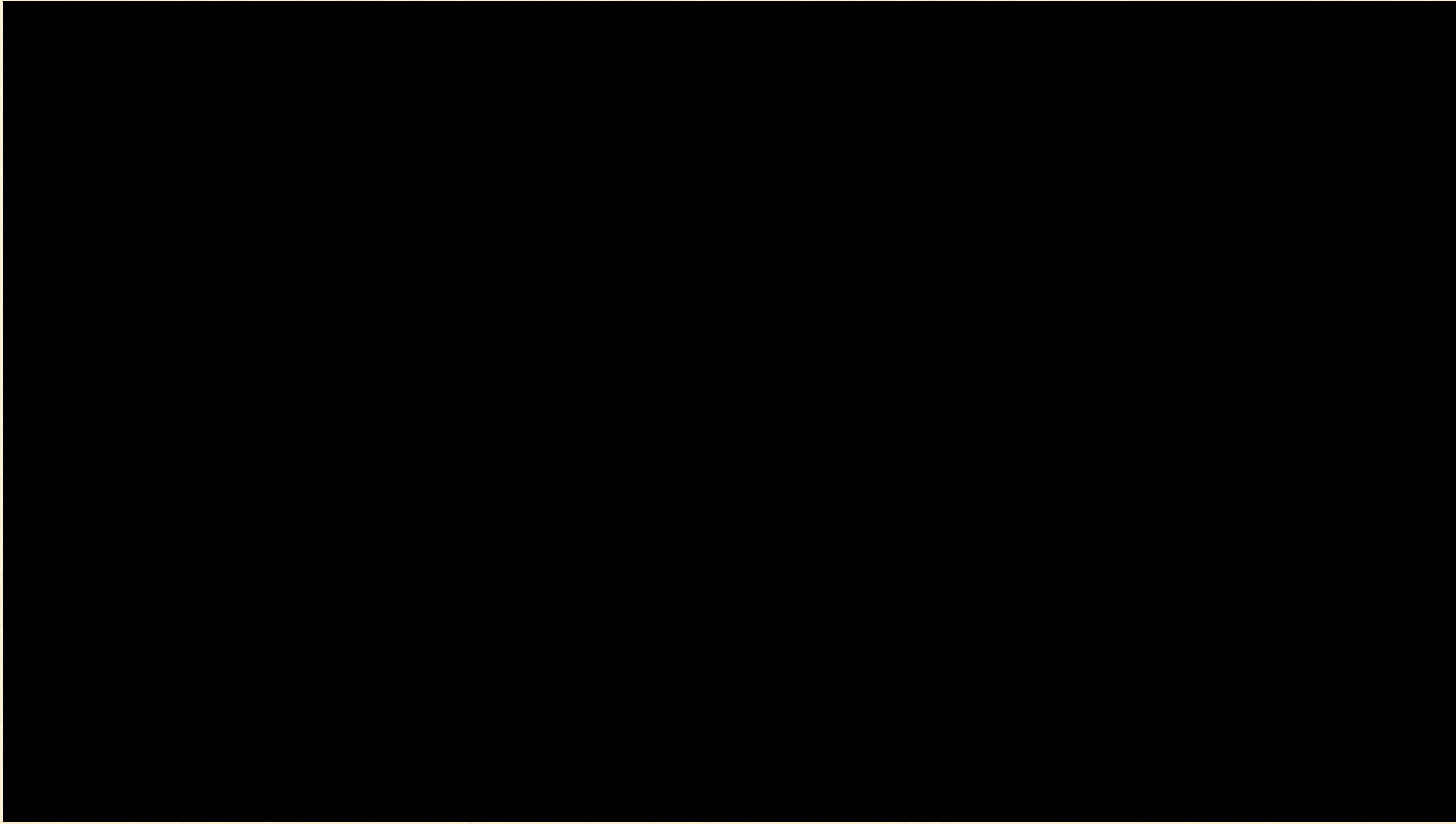
Light Measuring Devices



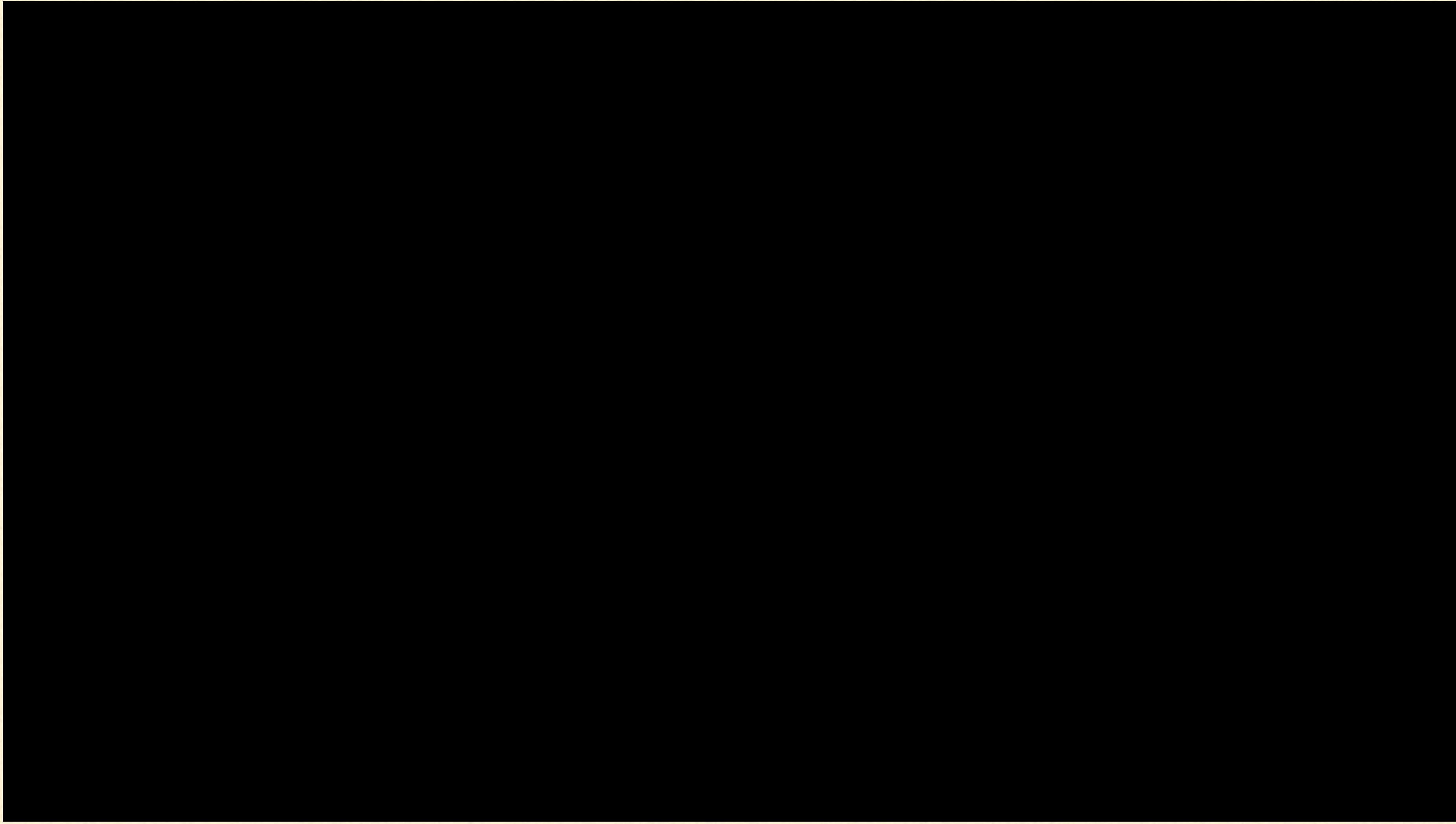
Light Measuring Devices



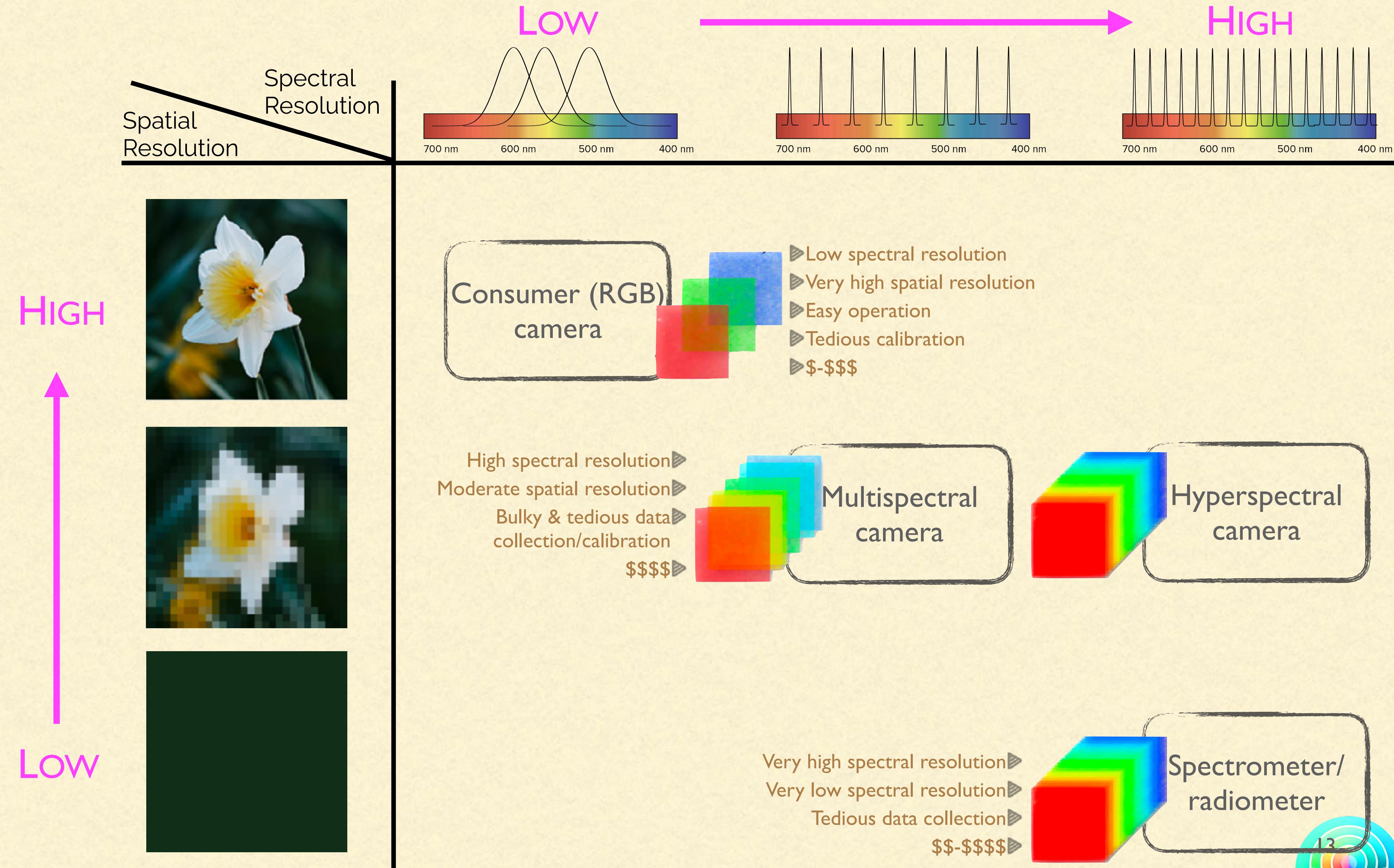
Multi-/Hyper-Spectral Camera



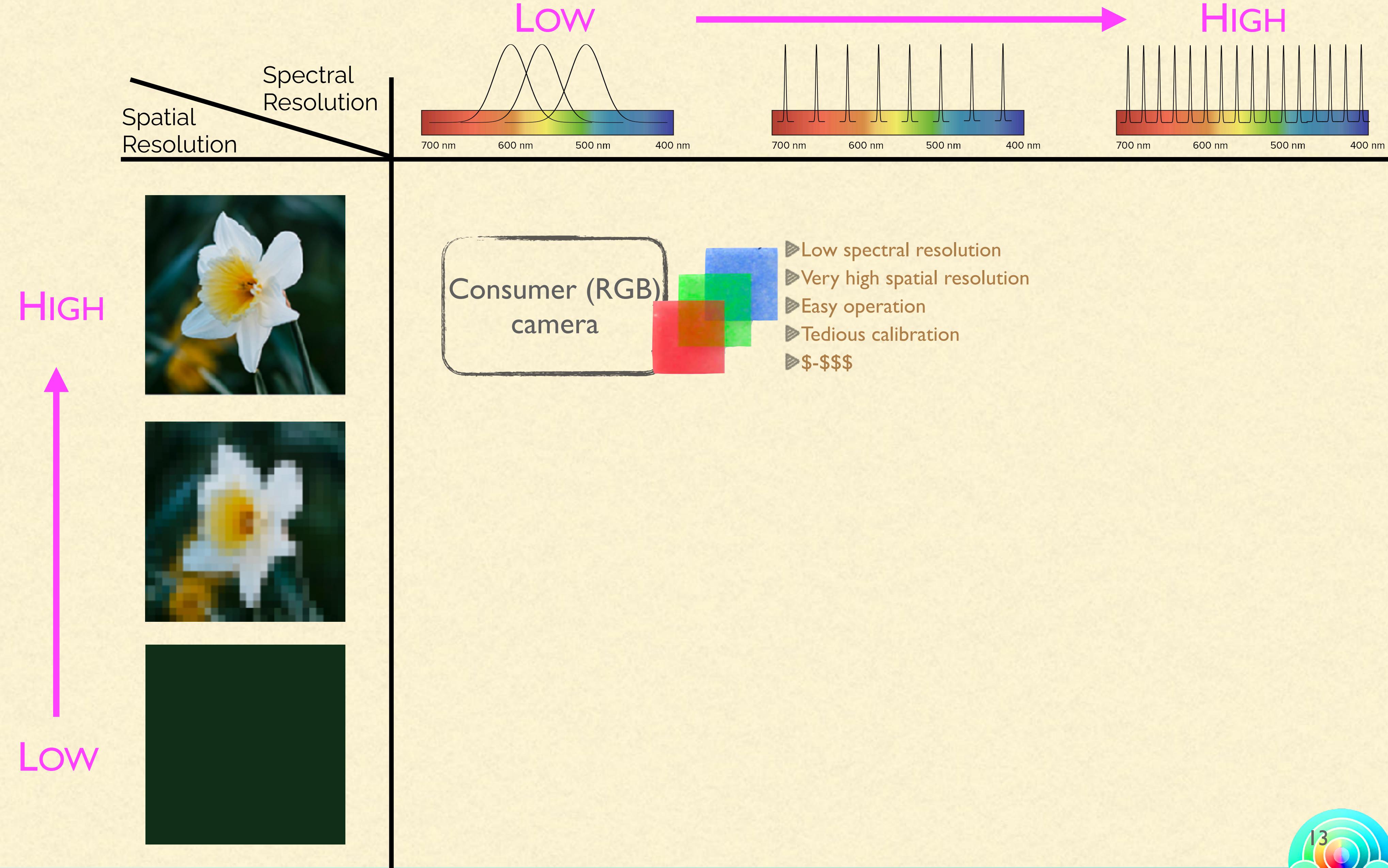
Multi-/Hyper-Spectral Camera



Light Measuring Devices

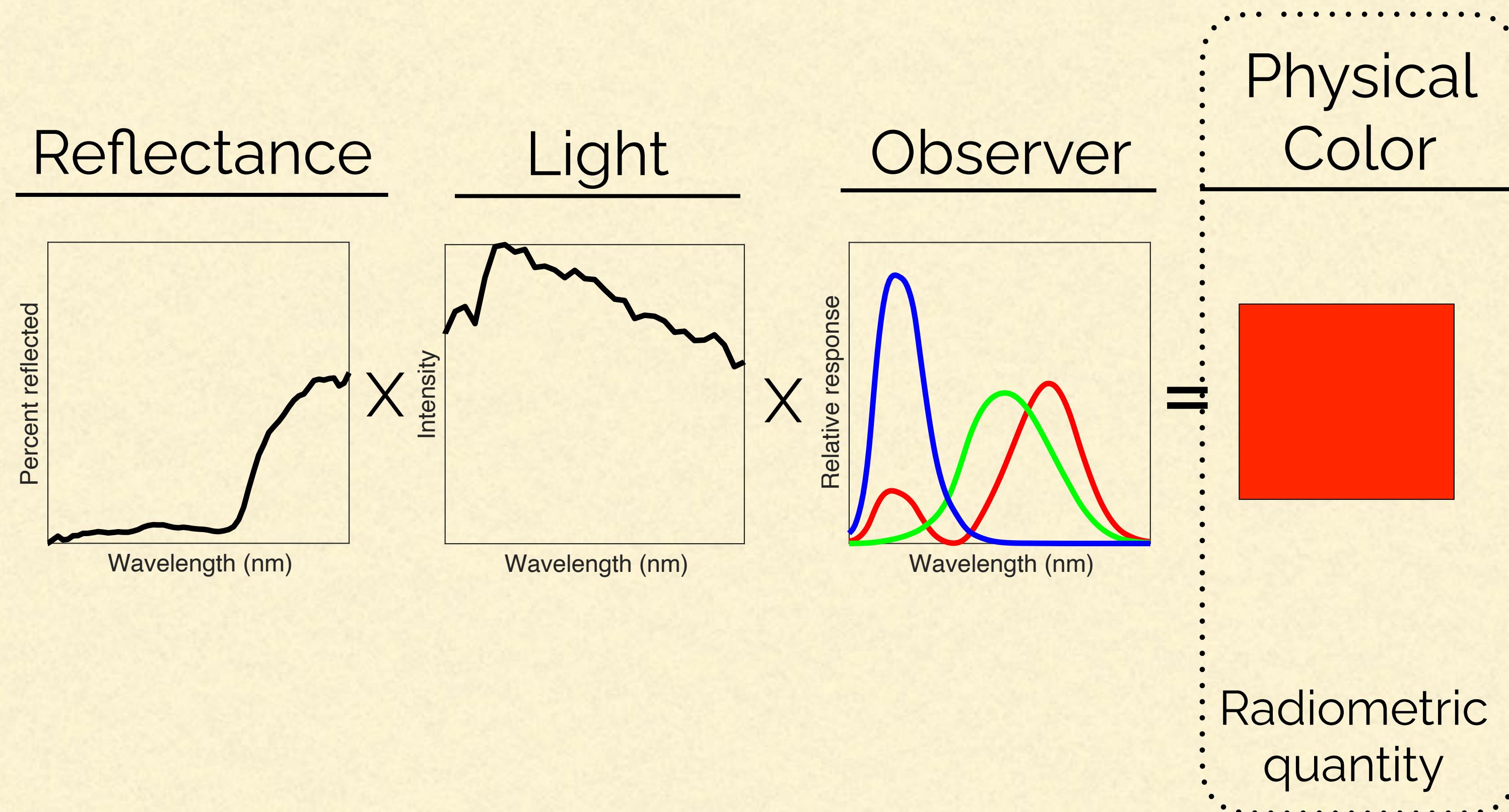


Light Measuring Devices

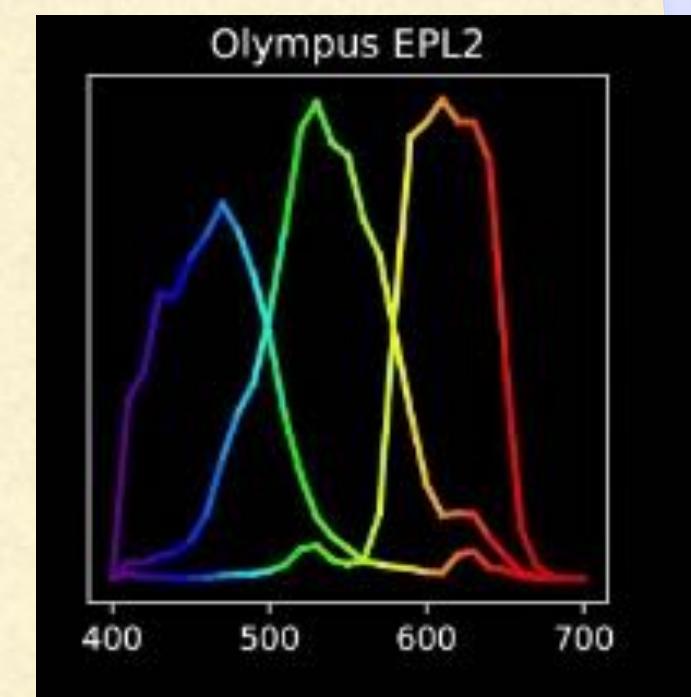
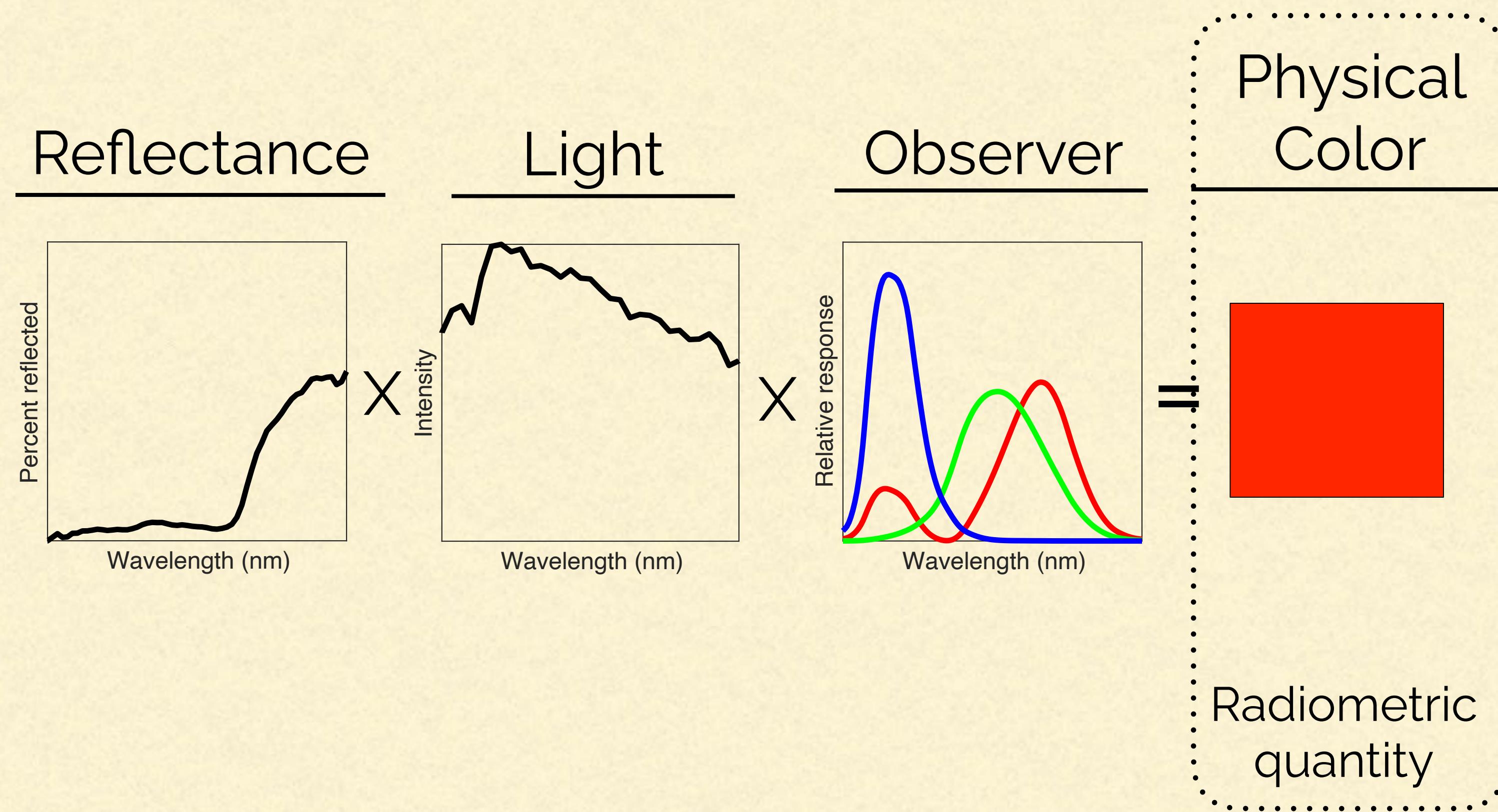


RGB Camera

Every camera records colors differently.

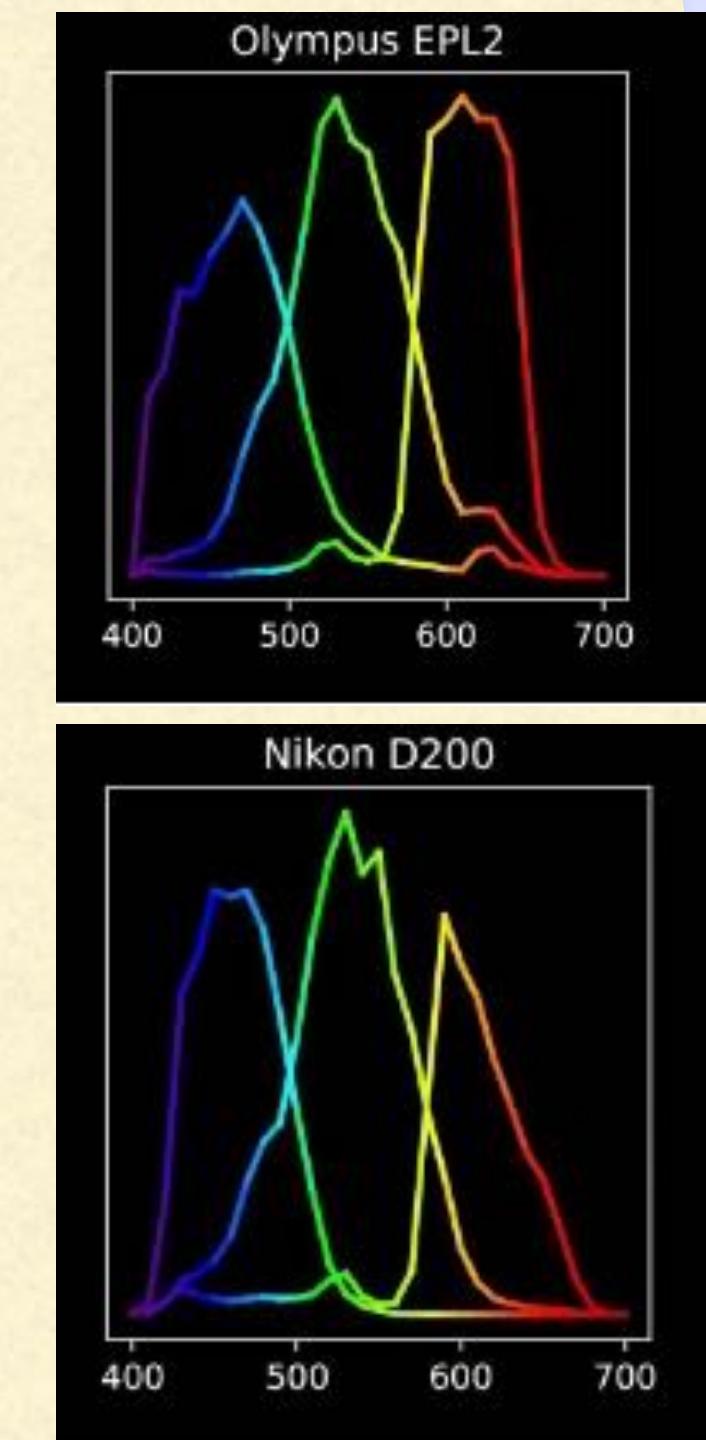
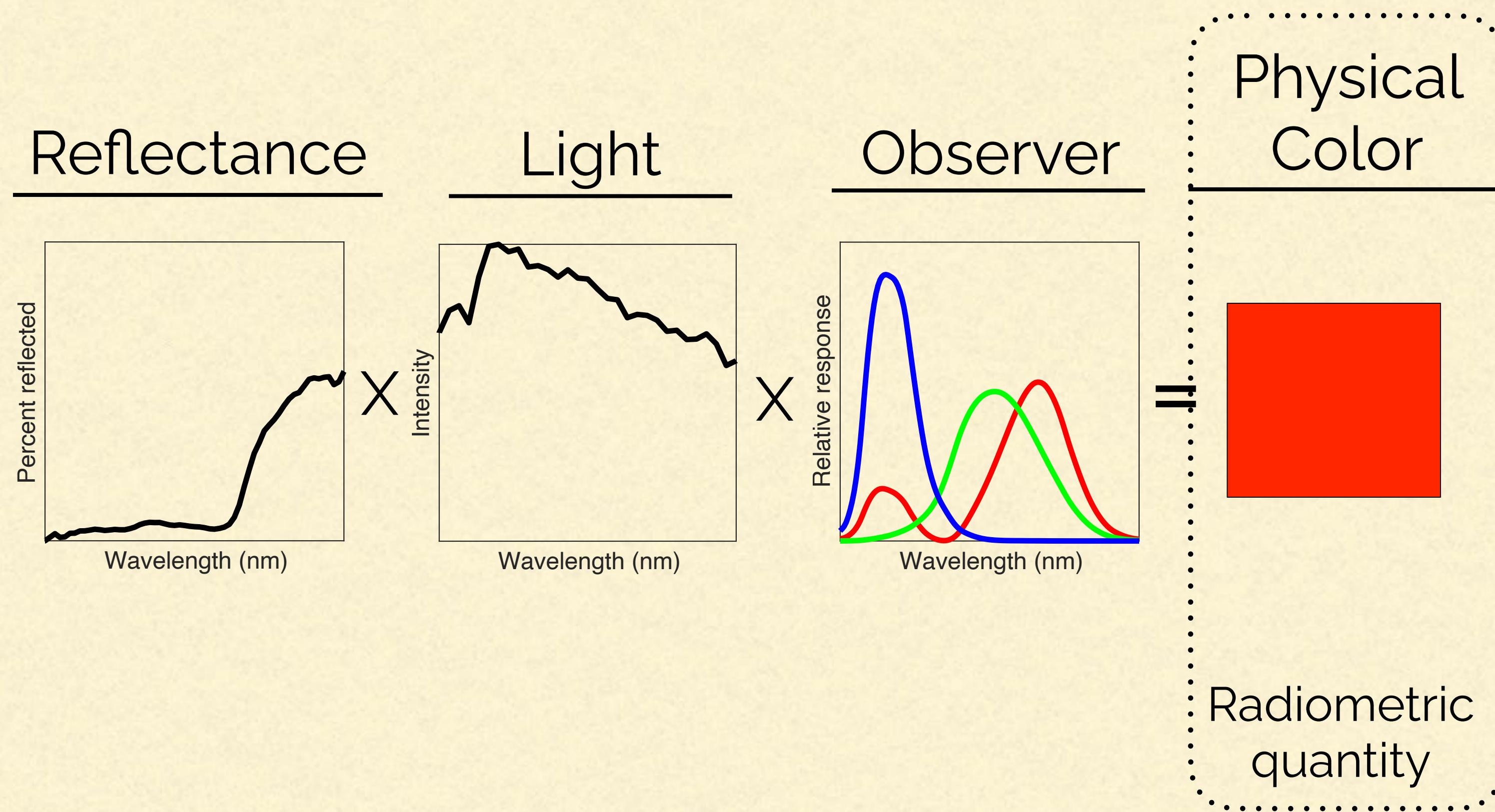


RGB Camera



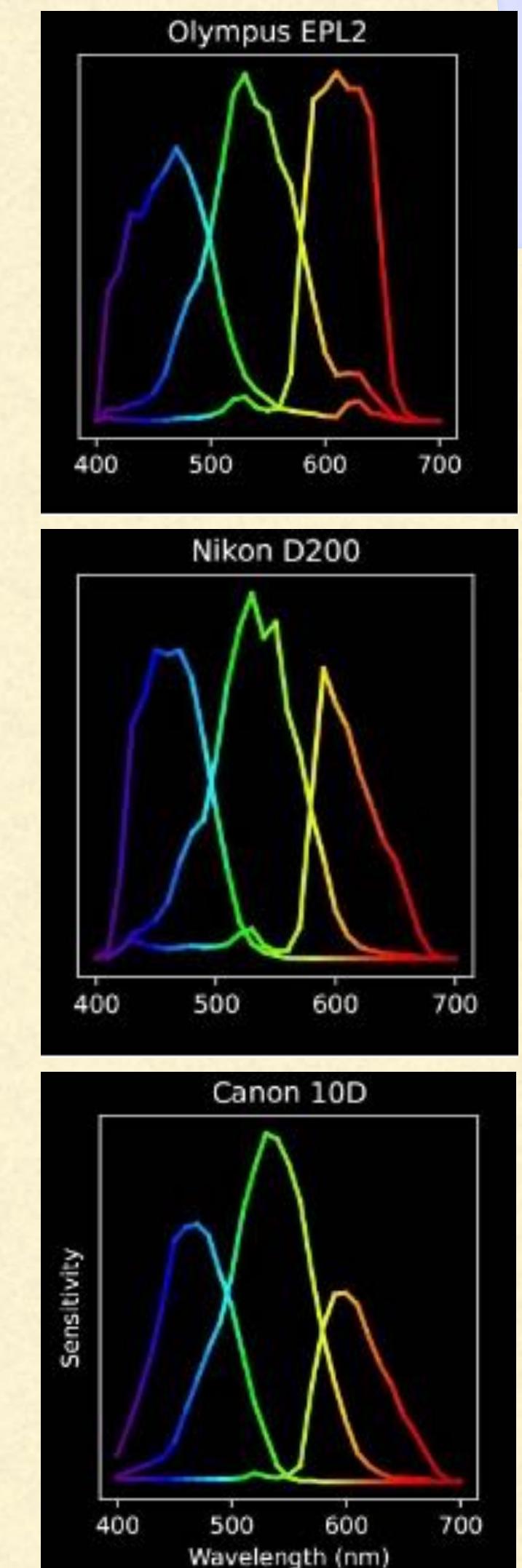
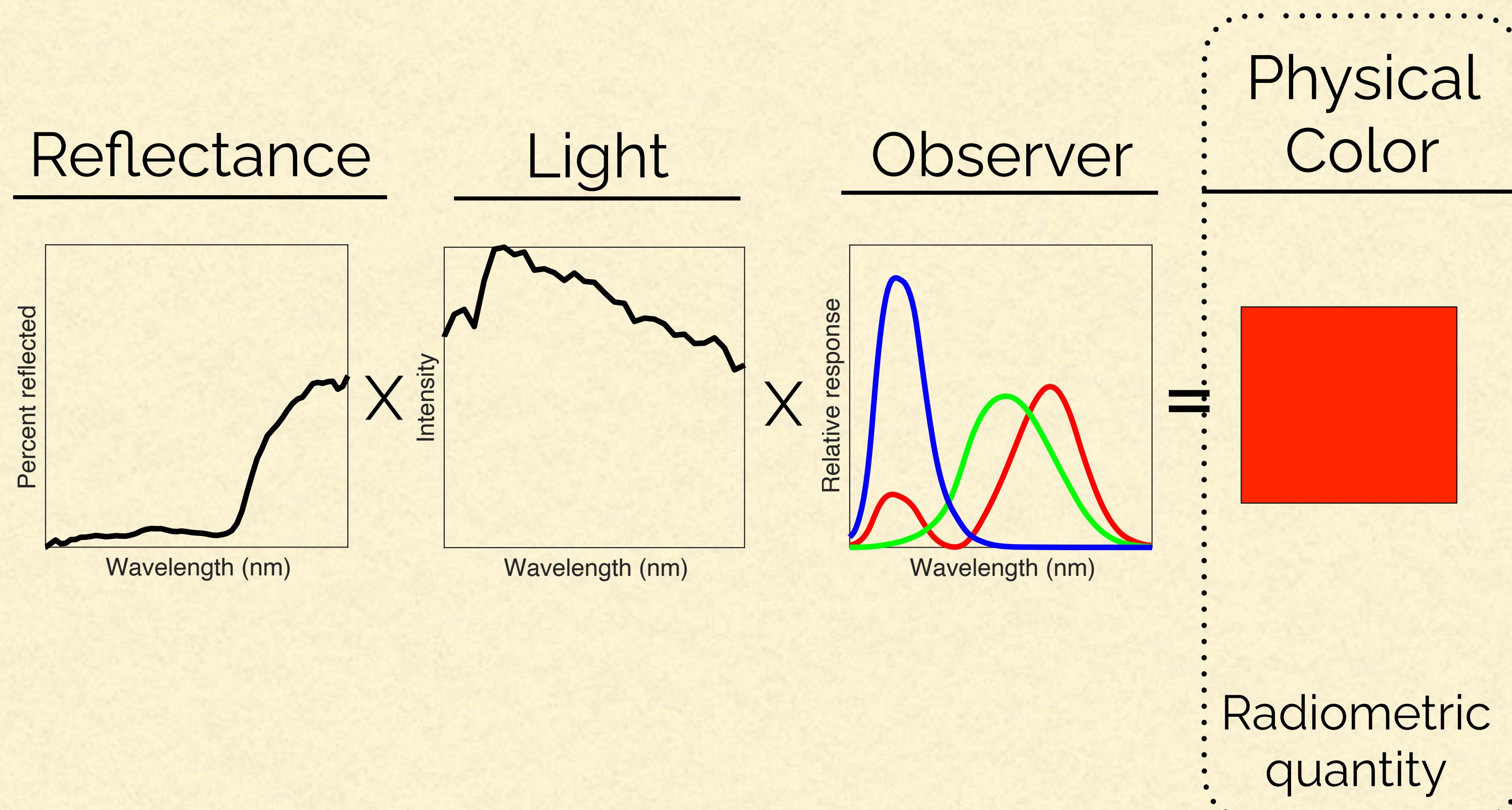
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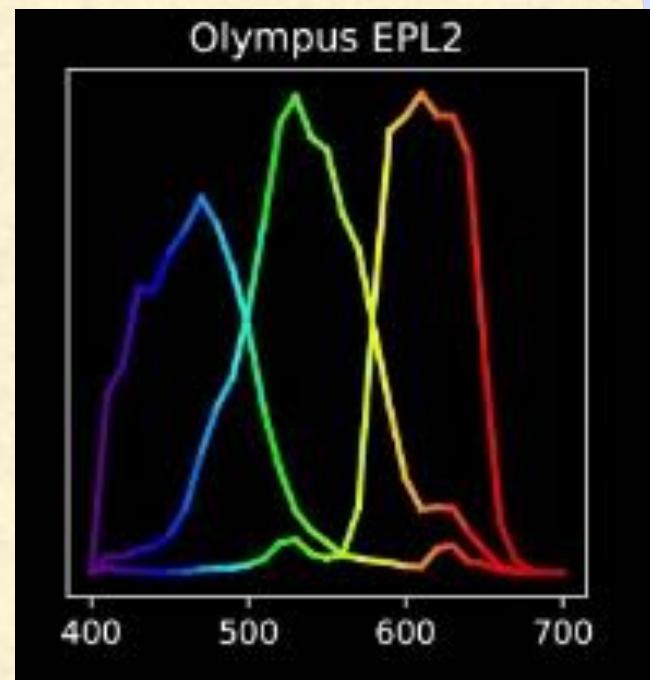
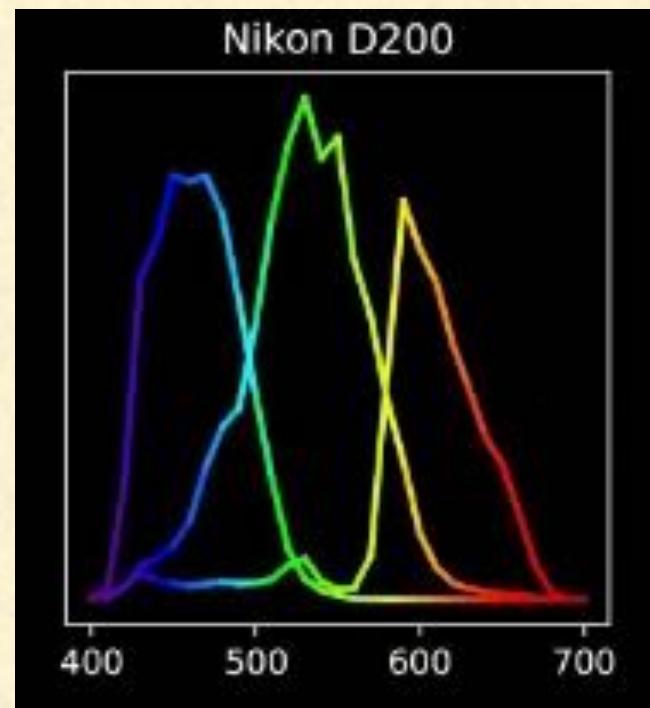
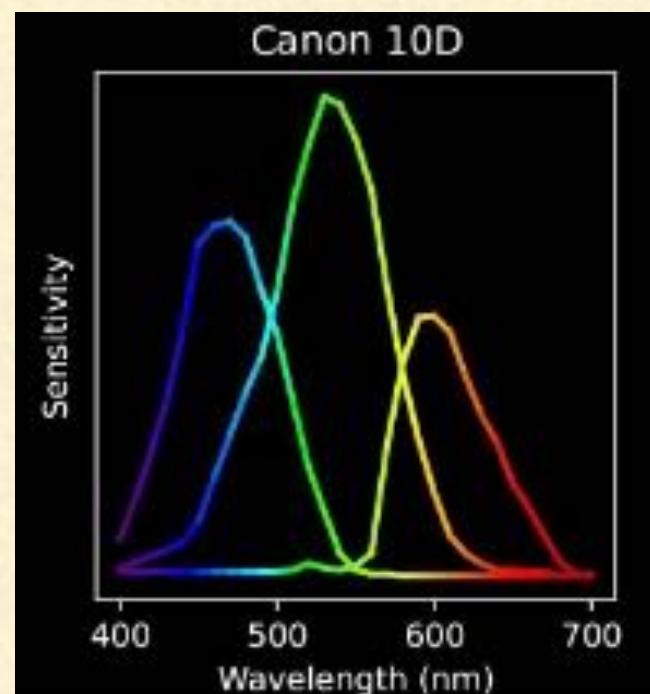
Every camera records colors differently.

RGB Camera



Every camera records colors differently.

Olympus EPL2
Nikon D200
Canon 10D



RGB Camera



Every camera records colors differently.

Every camera
records colors
differently.

More Resources

- [US man sentenced for selling DuPont secrets to China](#)
- [In Search of Forgotten Colours - Sachio Yoshioka and the Art of Natural Dyeing](#)
- [Tyrian Purple: The Color of Royalty](#)
- [A Brief History of Prehistoric Art and Why Israel Doesn't Have Any](#)
- [Why you may have been eating insects your whole life](#)
- [Making Manuscripts: Oak Gall Ink](#)
- [A Dye for Kings: What Is Tyrian Purple?](#)
- ['Regal' purple dye is found in Israeli artefacts dating 3,000 years to the reigns of kings Solomon and David](#)
- [Into the Void: Anish Kapoor Reveals His First Works Using Vantablack, the World's Darkest Color, in Venice](#)
- [10 Pigments With Colorful Histories](#)
- [This Man Protects the World's Rarest Colors](#)
- [The library of rare colors](#)
- [The surprising pattern behind color names around the world](#)
- Webster, Michael A., and John D. Mollon. "Adaptation and the color statistics of natural images." *Vision research* 37.23 (1997): 3283-3298.
- Welbourne, Lauren E., Antony B. Morland, and Alex R. Wade. "Human colour perception changes between seasons." *Current Biology* 25.15 (2015): R646-R647.
- Webster, Michael A., Yoko Mizokami, and Shernaaz M. Webster. "Seasonal variations in the color statistics of natural images." *Network: Computation in neural systems* 18.3 (2007): 213-233.

