Computer Graphics: Rendering

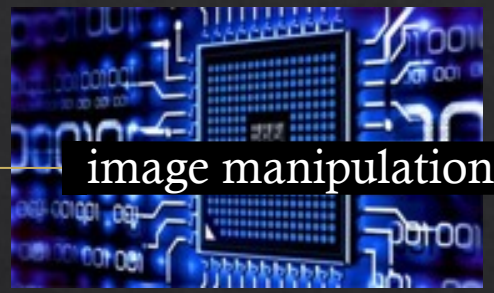
Lecture 3: Imaging, Radiometry, Photometry

Kartic Subr

The big picture!

Real

photography



Human
visual system

rendering

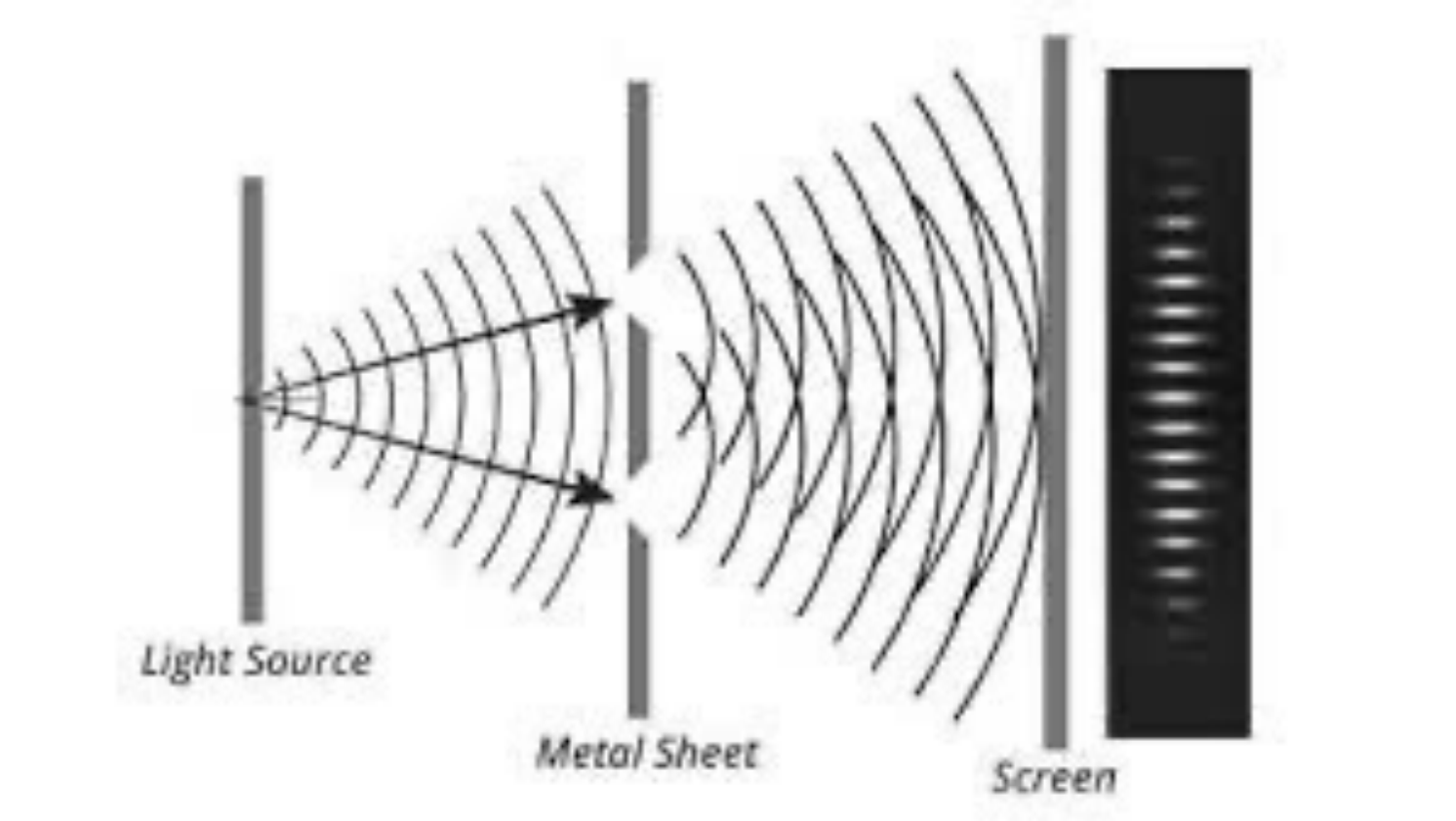
Virtual

Energy in the scene

What is light?

What is light?

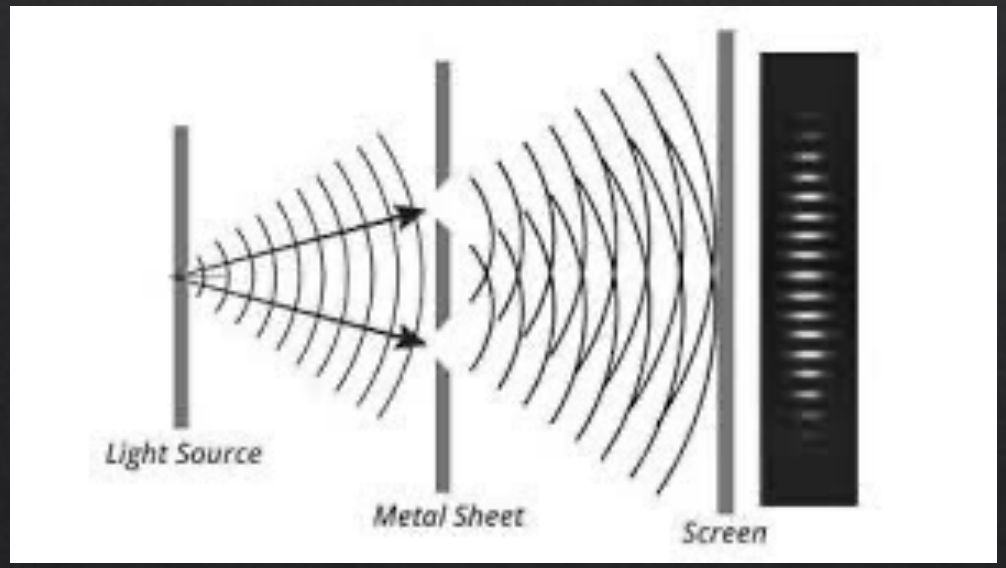
Wave?



Thomas Young 1801

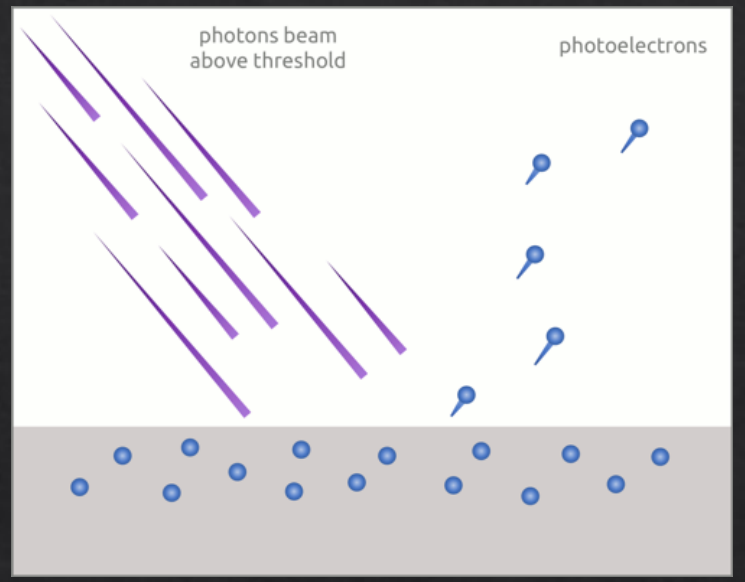
What is light?

Wave?



Thomas Young 1801

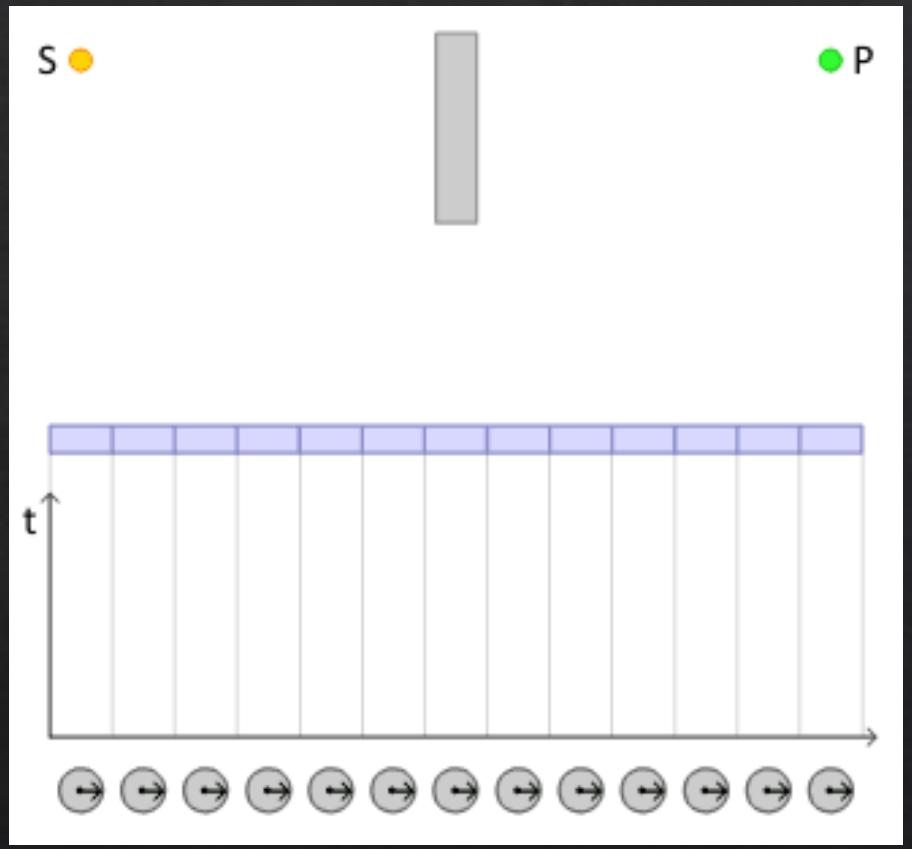
Particle?



1887 Hertz,
1902 Lenard,
1905 Einstein

Straight lines?

Straight lines?



Feynman 1985

https://en.wikipedia.org/wiki/Quantum_electrodynamics

Light Energy

Energy

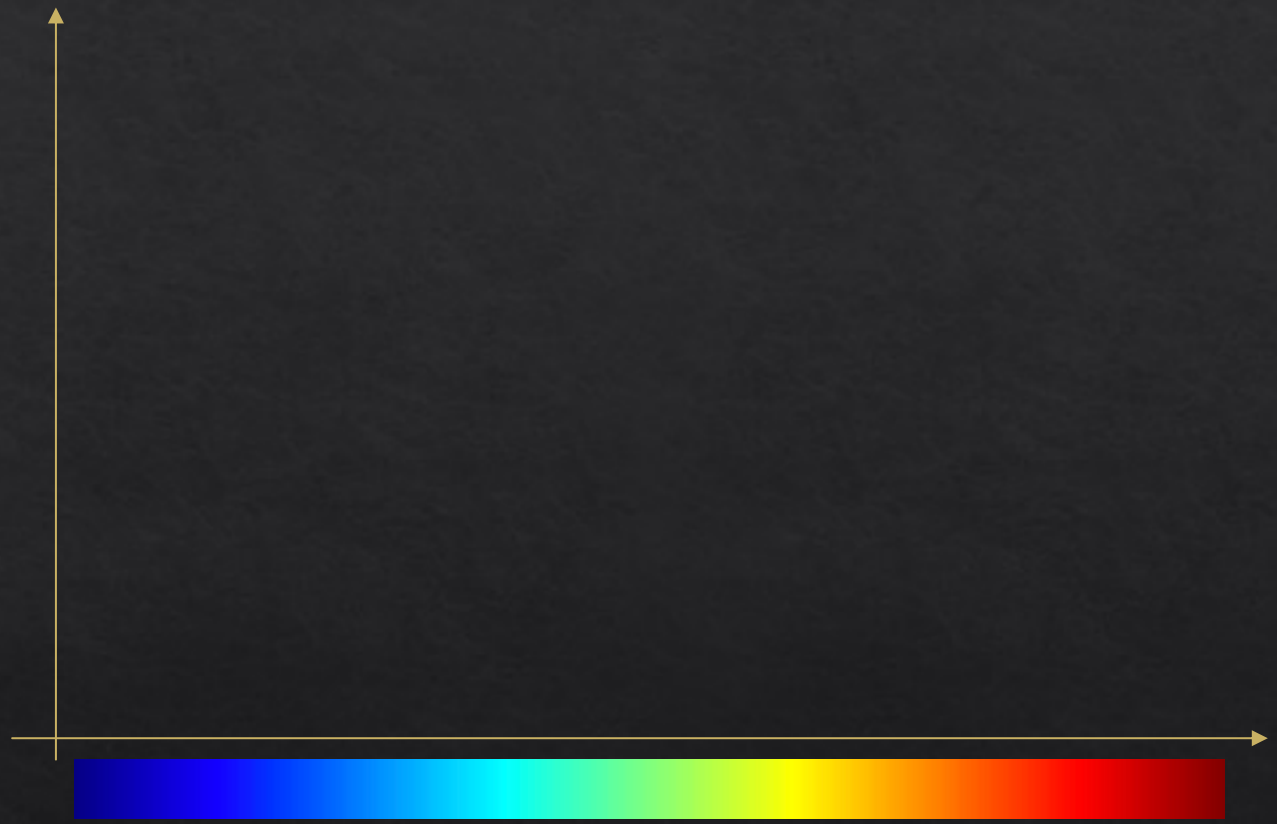
Power

Power/unit area

Power/unit area/direction

Energy in a scene -- Radiometry

Energy in a scene across colours - spectrometry



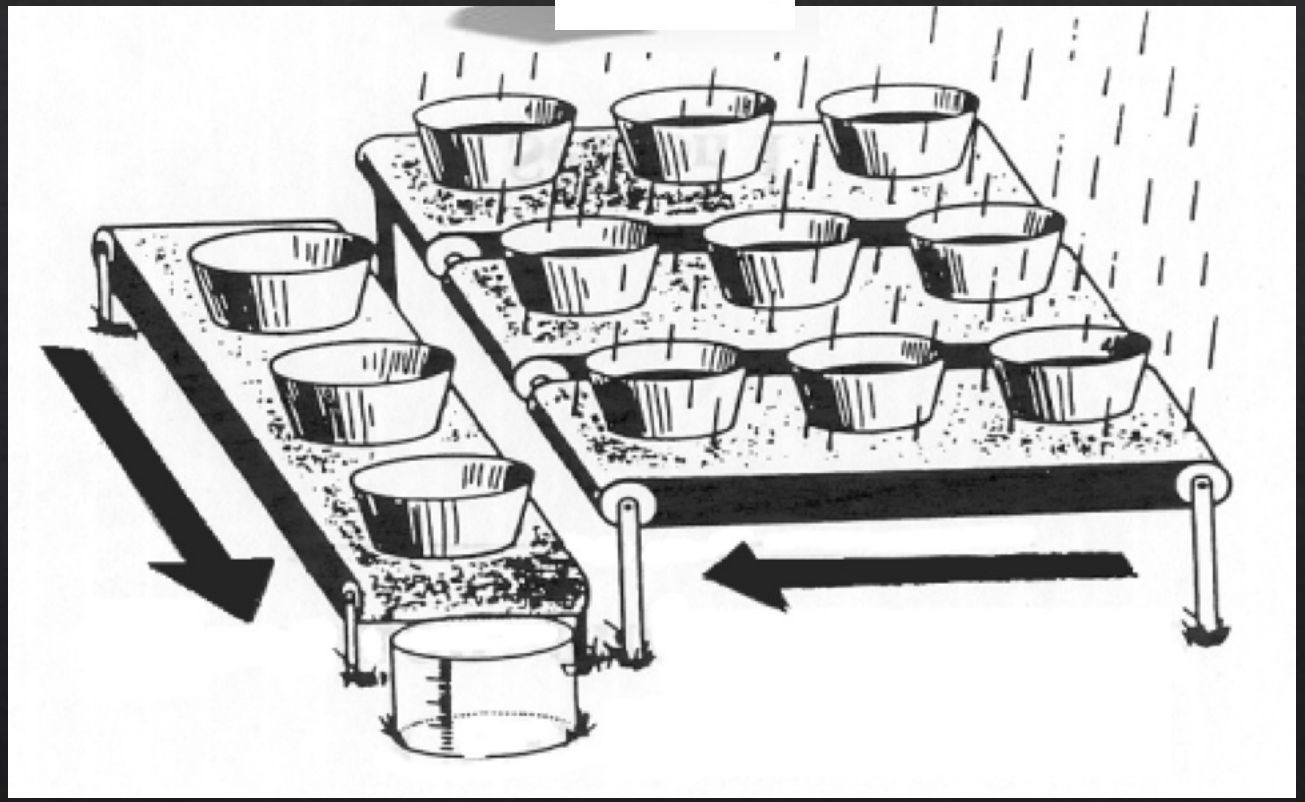
The big picture!

Cameras

Cameras – thin lens

https://graphics.stanford.edu/courses/cs178-10/applets/thinlens.html

Cameras – sensors



https://www.visiononline.org/userassets/aiauploads/file/cvp_the-fundamentals-of-camera-and-image-sensor-technology_jon-chouinard.pdf

Sensor Sensitivity

Sensor Response

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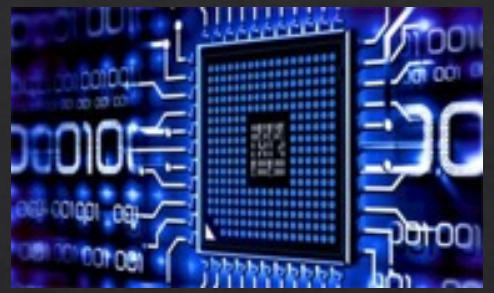
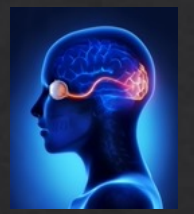
informatics

The big picture!

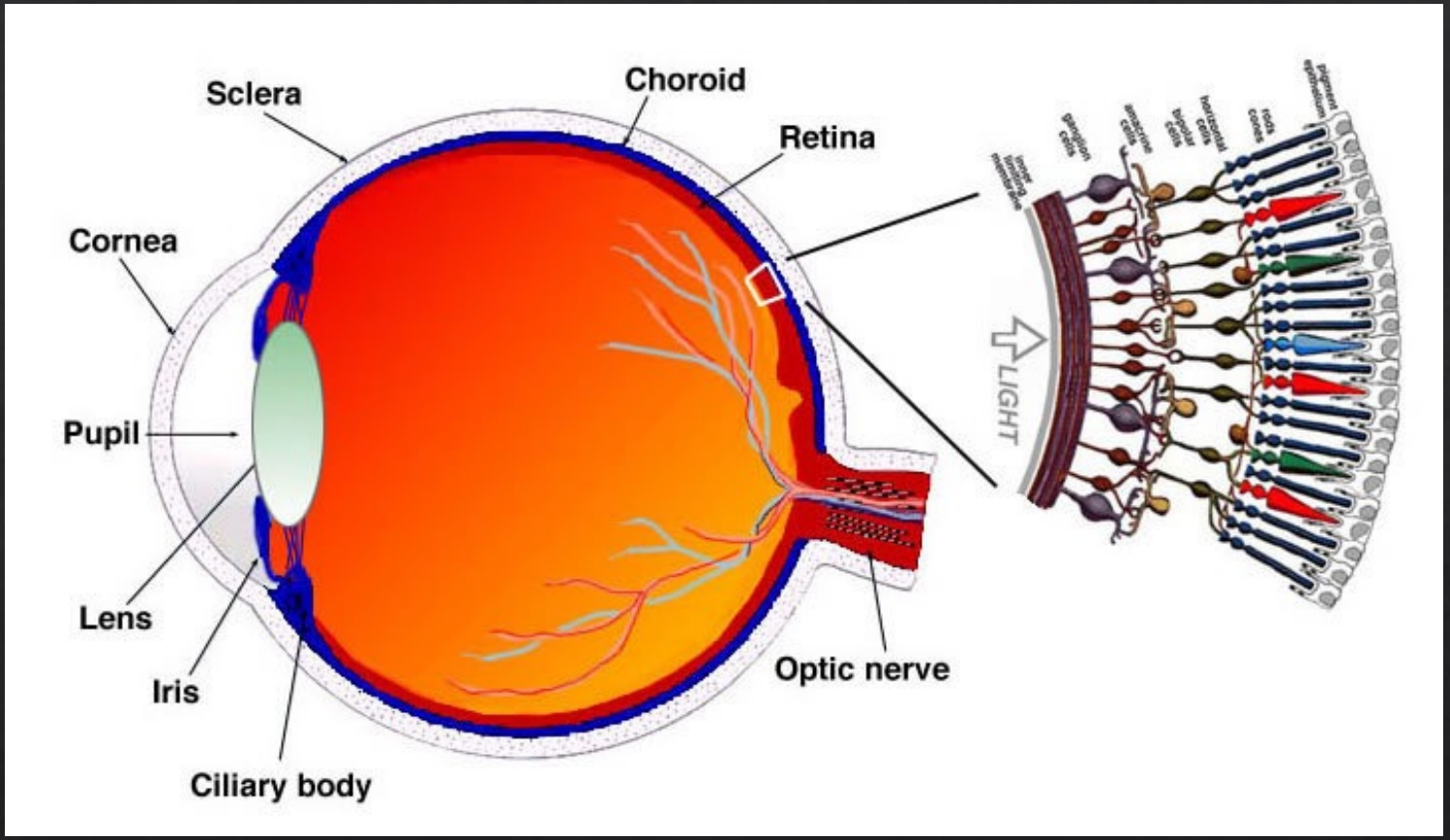


Displays



Displays

Human vision -- optics



http://www.cs.cmu.edu/afs/cs/academic/class/15462-s16/www/lec_slides/23_color.pdf

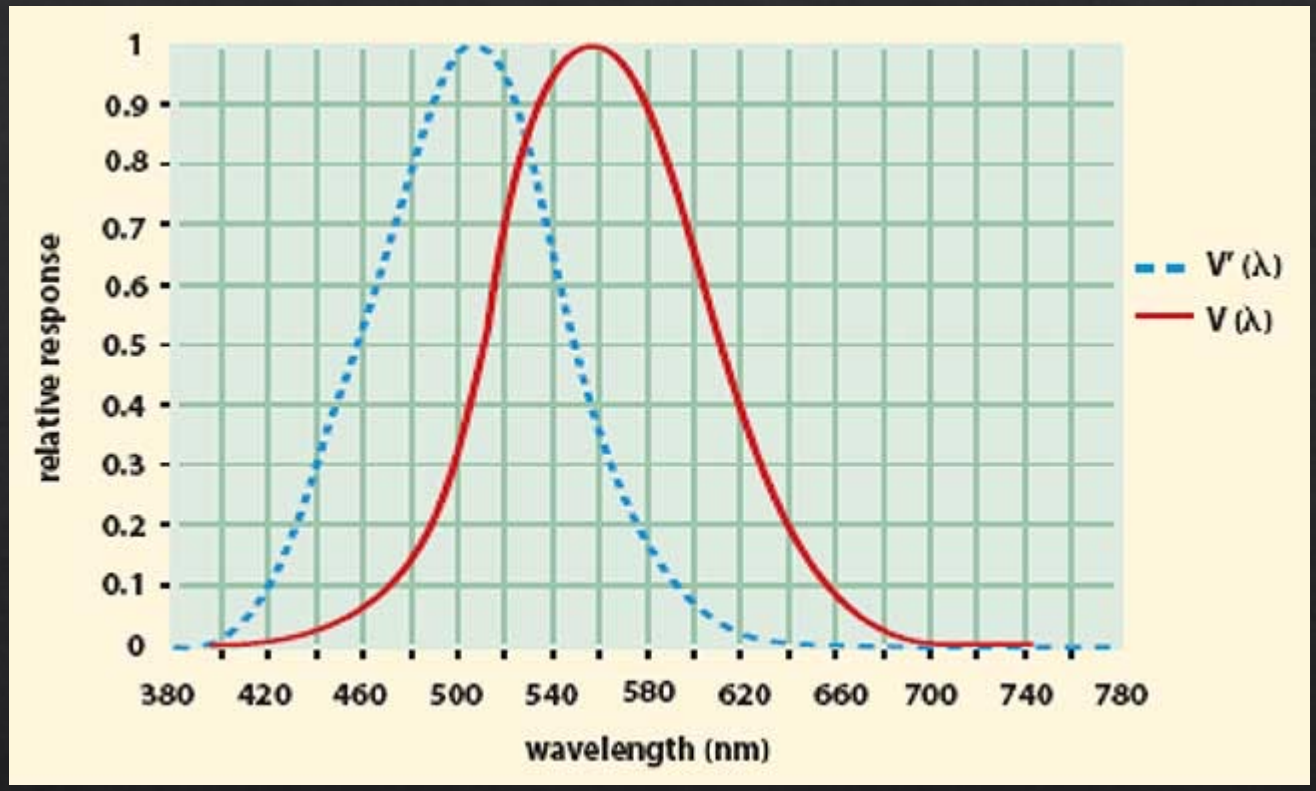
Human vision -- perception

http://persci.mit.edu/gallery/checkershadow

Human vision -- perception

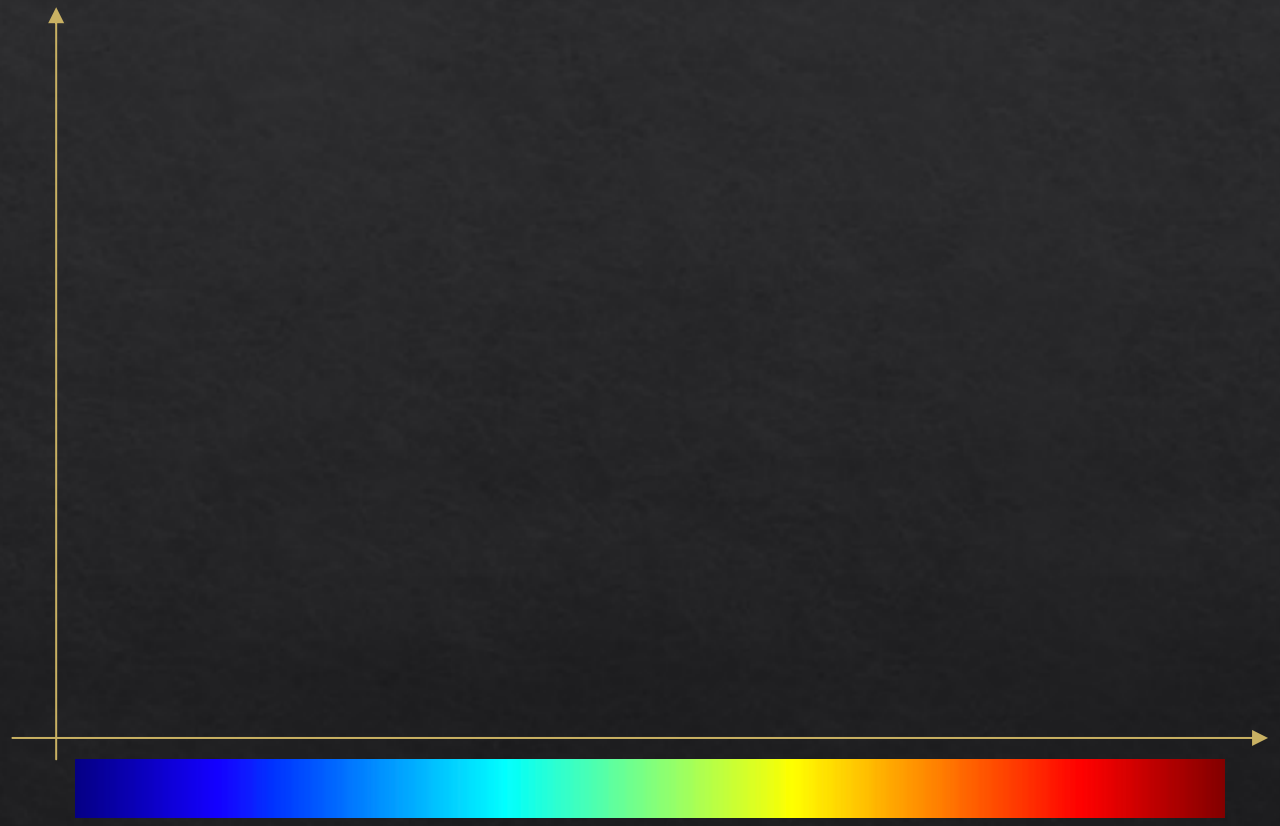
http://persci.mit.edu/people/adelson/checkershadow_proof

Perceived energy -- photometry

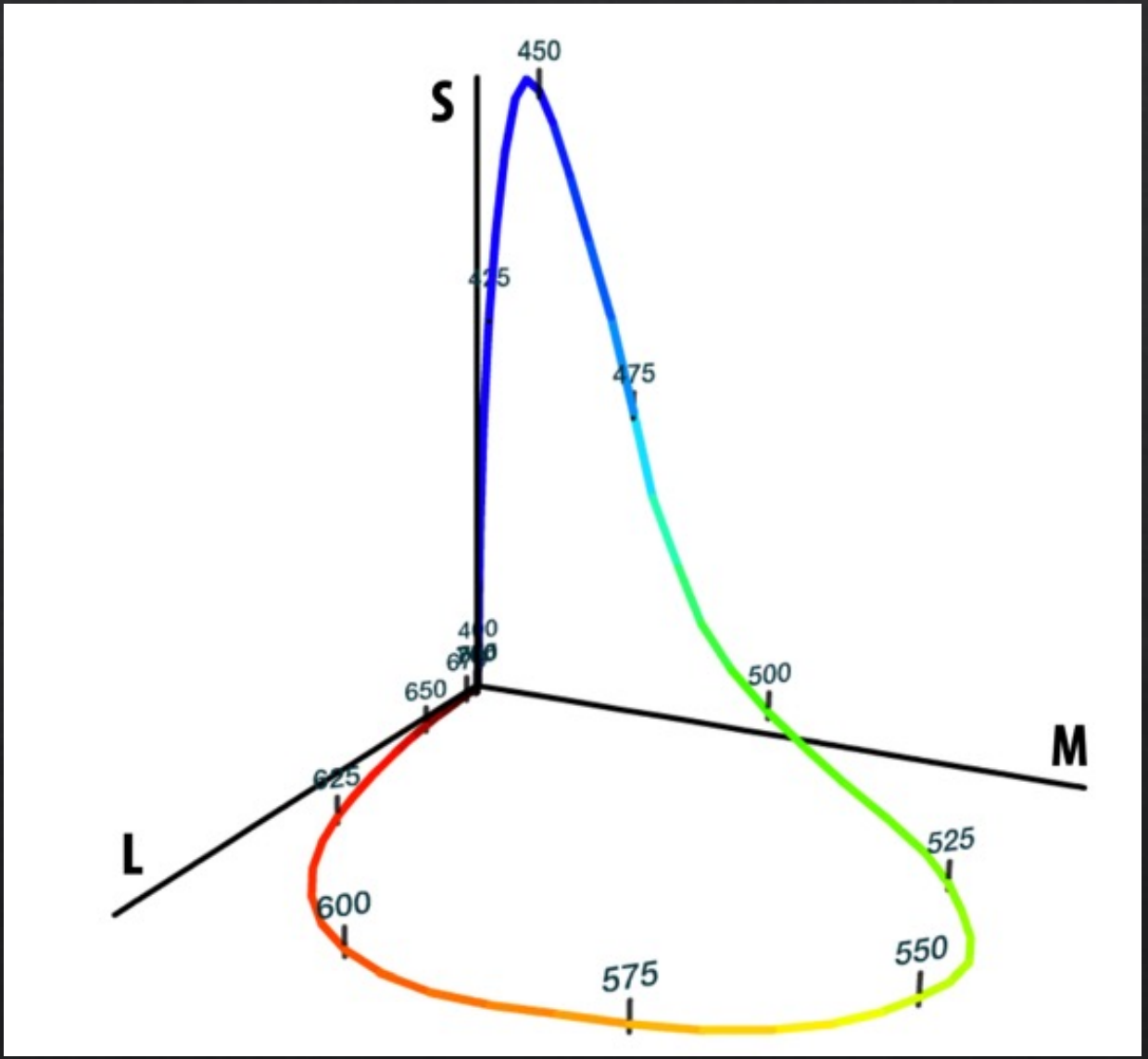


https://graphics.stanford.edu/courses/cs178-10/applets/colormatching.html

Rods, cones, etc.

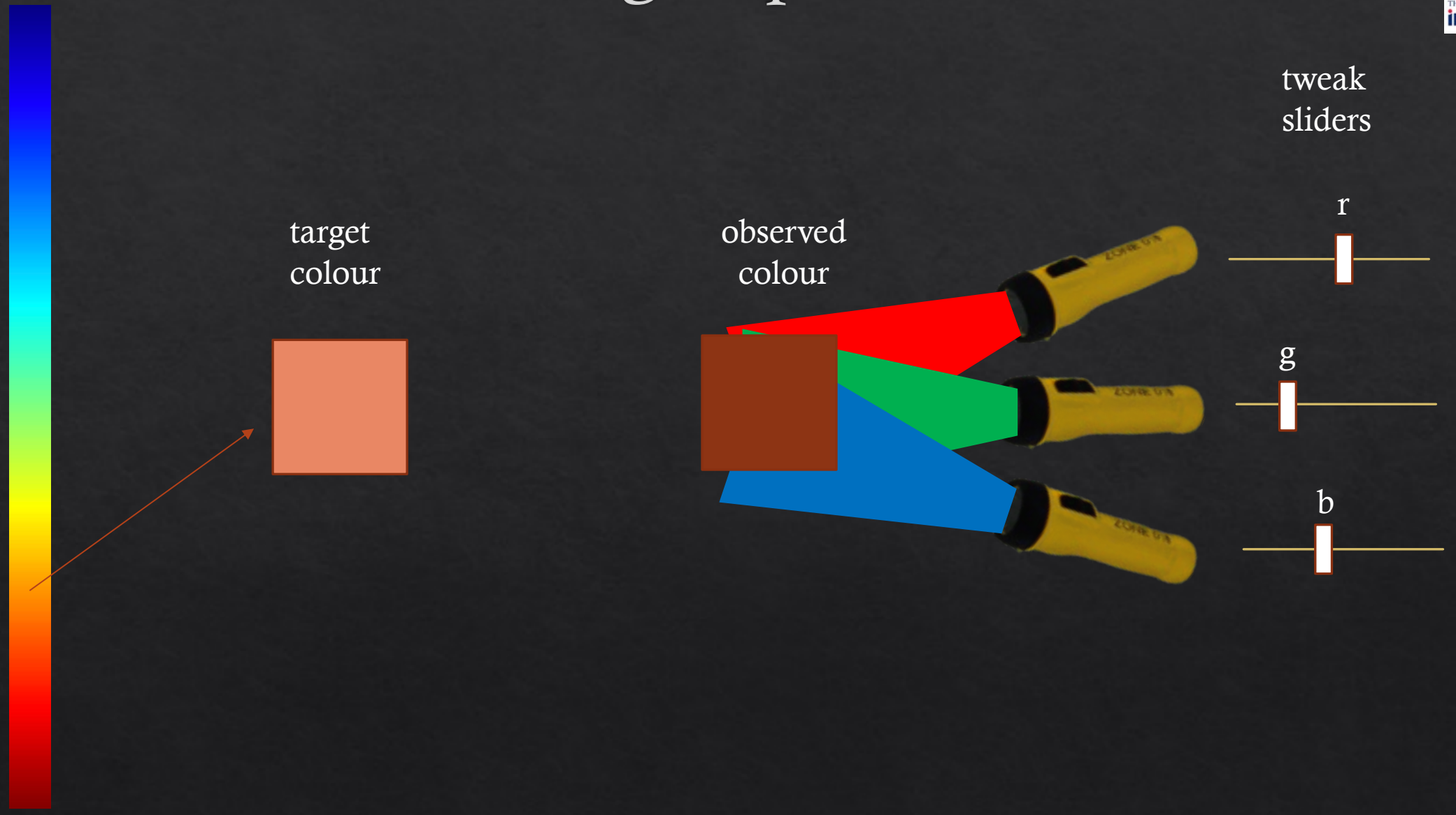


plotting S,M,L as 3D points as a function of wavelength

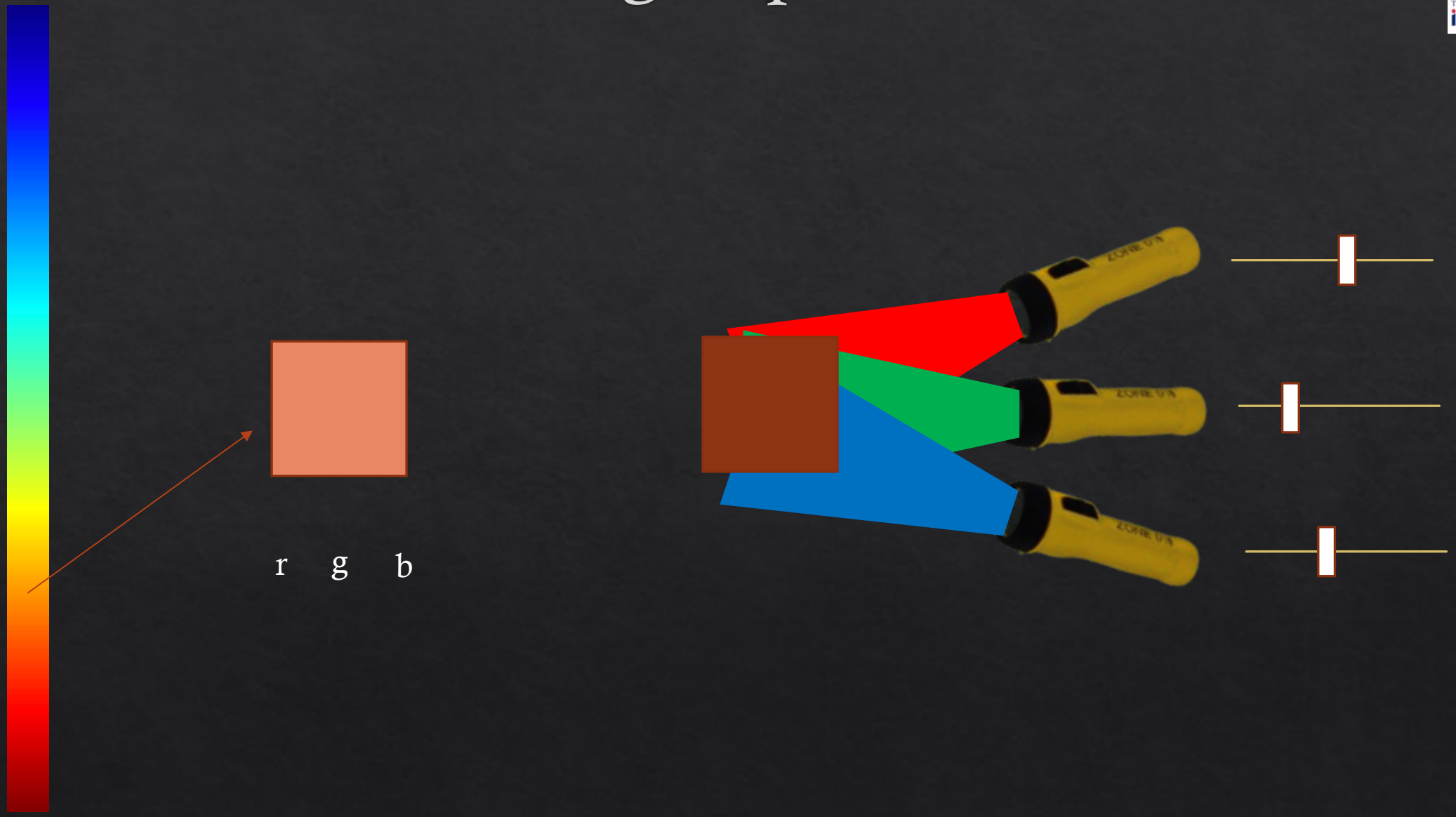


Metamers

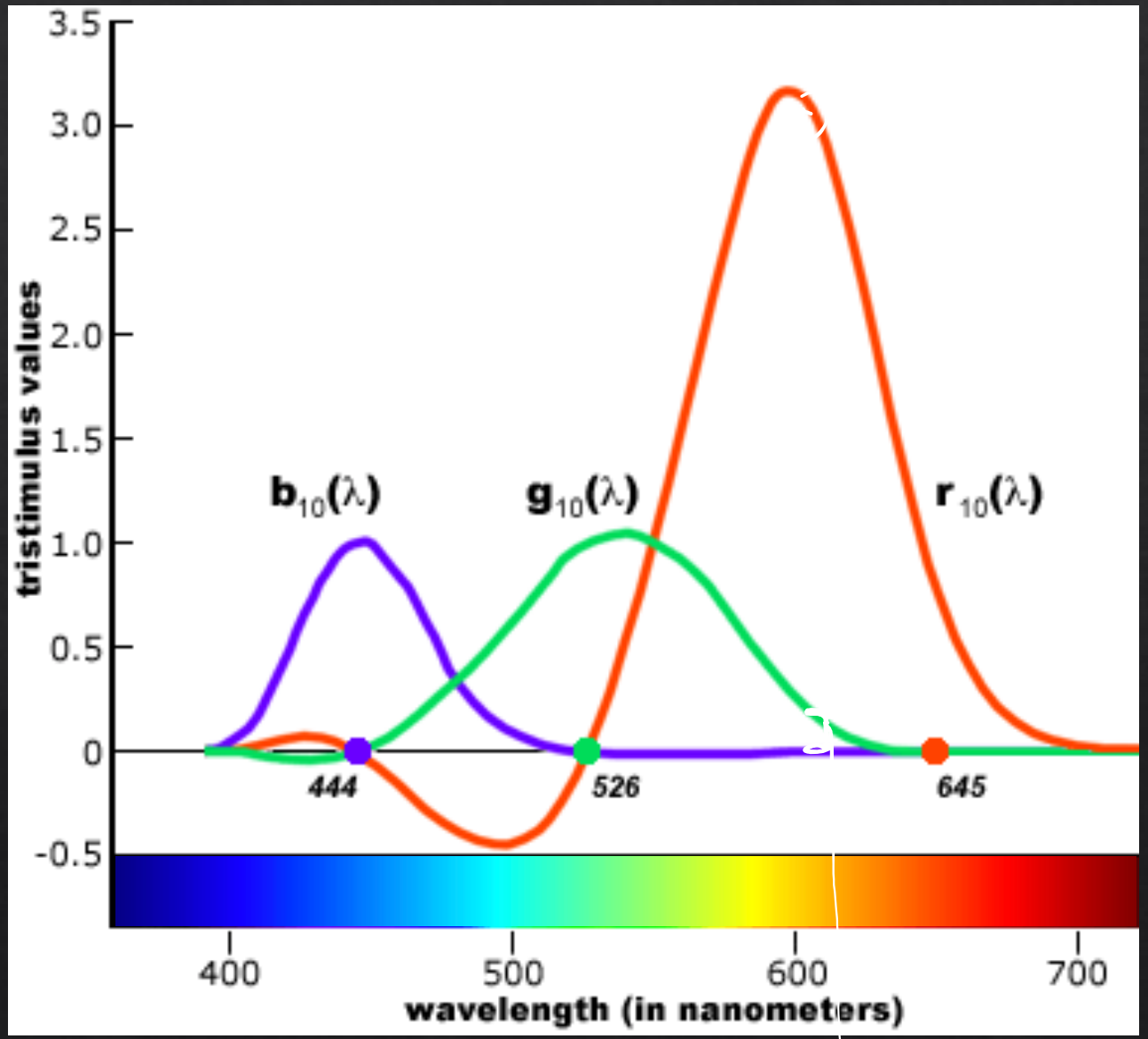
Matching Experiment



Matching Experiment



Tristimulus values



CG – account for all factors!