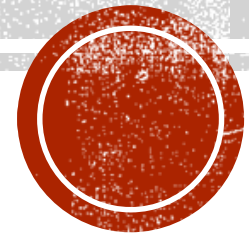# PHOTOELECTRIC

Experimental Collaboration From University of Colorado Denver

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Associate Professor:

LIGHT AND MATTER

Light behaves both as a particle and a wave.

$E = hf$

Incident light transfers energy to matter as a particle

- Electrons enter excited quantized states, allowing them to eject from the metal. This is what causes our observed current.
- This contradicted early scientists' expectations that light would transfer energy as a function of intensity. What we find is that intensity corresponds to current.

It will generally require the least amount of energy to excite a new electron instead of further exciting the first electron, so we see many electrons excited, inducing a current, rather than one electron in a higher state.

WORK FUNCTIONS

- The overall accounting of energy exchange includes the existence of "work functions" that describe energy needed to free electrons from energy states within a metal. A complete interpretation of the experiment requires consideration of more than one work function. A deeper analysis would relate these work functions to band structures and density of states within the solid

LIGHT SOURCE

We used a light source with a range of wavelengths and used filters to limit the incoming light to a single wavelength.

- Convenient to only require one light source

- Simple to set up – no angle calculations necessary and little room for error.

Rotating Prism and Slits

- Can select any wavelength of light as long as it's part of the light source. (Works with natural light)

- Smaller angles than a diffraction grating

Grating Monochromator
- Reflects wavelengths that prisms may not refract.

Set of collimated monochromatic light sources
- No other wavelengths from the source removes room for wavelength-related error.
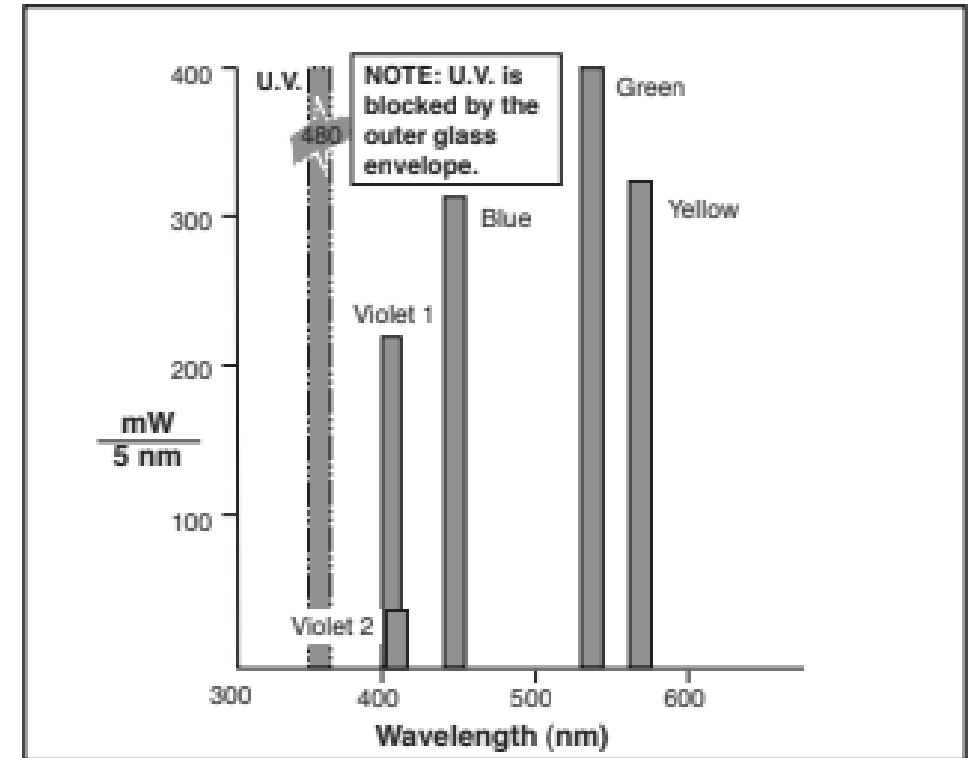
Spectral Power Distribution per 1000 Lumens

PICOAMMETER WITH BUILT IN CAPABILITY TO SWEEP BIASING POTENTIALS.

DATA ANALYSIS

	Planck's Constant	Work Function
Measured	3.8673*10^-15[eVs]	1.595[eV]
Expected	4.1357*10^-15[eVs]	2.29[eV]
%Difference	6%	30%