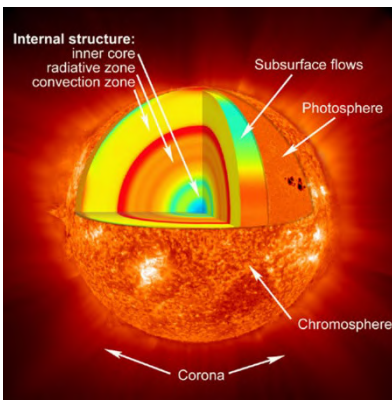


# Sunlight Spectroscopy

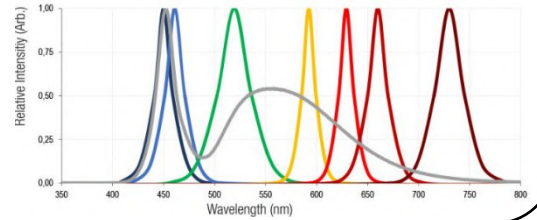
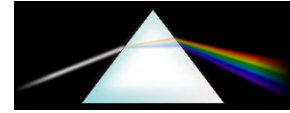


## The Sun

- We see the sun every day, but do we know the spectrum that makes up the sunlight we see?
- We know what the sun is made from, but how does that affect what we see on earth?

## The Spectrometer

- Through a device known as a **Spectrometer** we can take light and split it into its different light components
- This is similar to putting white light through a prism
- We can calculate the separation or **diffraction** of light and record each light wavelength on the detector



## Spectrum of Lightbulbs

Bulb Type	Least Efficient		Most Efficient	
	Incandescent	Halogen	CFL	LED
450 Lumens	40w \$4.82/yr	29w \$3.49/yr	11w \$1.32/yr	9w \$1.09/yr
800 Lumens	60w \$7.23/yr	43w \$5.18/yr	13w \$1.57/yr	12w \$1.44/yr
1100 Lumens	75w \$9.03/yr	53w \$6.38/yr	20w \$2.41/yr	17w \$2.05/yr
1600 Lumens	100w \$12.09/yr	72w \$8.67/yr	23w \$2.77/yr	20w \$2.41/yr
	1 Year	1-3 Years	6-10 Years	15-20 Years

- Since their invention in **1878**, light bulbs have continued to replicate the **light of the sun** in our homes
  - Incandescent lightbulbs (1878)
  - Halogen lightbulbs (1882)
  - CFL lightbulbs (1927)
  - LED lightbulbs (1962)



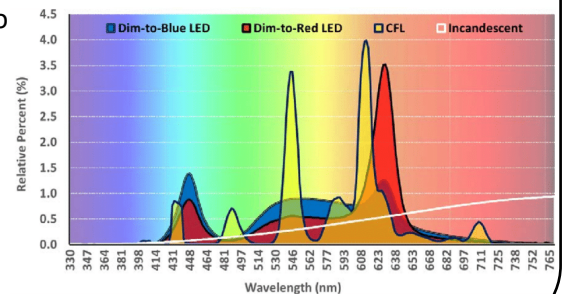
## Problem

- How does the spectrum from each light differ?
- How do lightbulbs compare to the sun?

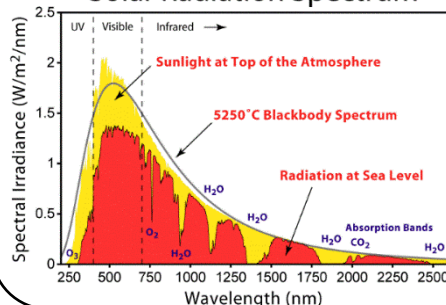


## Results

- Incandescent and halogen bulbs **heat** a filament in the bulb, causing it to burn and emit light like a **blackbody radiator**
- CFL bulbs are filled with gas that creates invisible **UV light** when heated, which excites a phosphor mixture that emits specific bands of **visible light** (sharp peaks) which mix together to create white to our eyes
- LED bulbs consist of a **blue LED** (sharp peak to the left) with phosphor coatings that partially convert the emitted blue light to **red and green frequencies** which mix together to create white



## Solar Radiation Spectrum



## Answer

- Although we would expect the sun to be a simple **blackbody radiator** like **Incandescent and halogen bulbs**, its spectrum here on earth is very different!
- Due to strong absorption processes of elements in the atmosphere, much of the light from the sun **above 700 nm is absorbed** before it can reach our eyes
- Instead, although not blackbody radiators, **LED bulbs are said to be the closest to the sun due to their spectral shape**