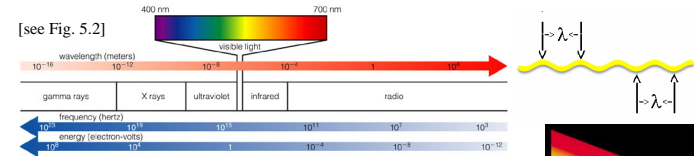


Missouri Club for Homework 1

- Rule: You must ask a directed question.
 - "How do you do question #1" is not allowed.
 - "How do you do R³" is a good question.
1. If a planet has an orbital period of 98 years, what is the length of the semi-major axis? Give your answer to the nearest whole astronomical unit.
21 AU
 2. For the northern hemisphere, summer is a few days longer than winter. The reasons for this are found among statements 1-4. Please select the correct pair or reasons. 1) The northern hemisphere is closer to the sun. 2) The earth is closest to the sun in January. 3) Kepler's law of equal areas. 4) Kepler's 3rd law.
 - a. 1&3
 - b. 1&4
 - c. 2&3
 - d. 2&4
 3. When Galileo saw Venus in full phase he
 - a. disproved Ptolemy's Earth-centered model
 - b. proved Copernicus' sun centered model
 - c. disproved Ptolemy's model and proved Copernicus' model
 - d. none of the other answers are true.

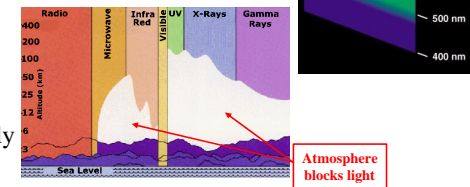
The Electromagnetic Spectrum

- Light is given different names according to its wavelength λ



- In visible passband, different λ = different color.

- Blue = smaller λ
- Red = larger λ



- Only visible light and radio waves pass freely through Earth's atmosphere.

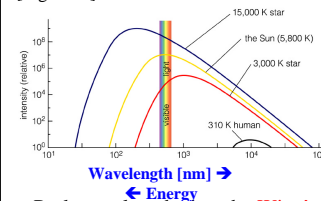
Thermal Radiation (Blackbody Radiation)

- Heat up hot plate
 - It glows more brightly as it gets hotter
 - It changes color as it gets hotter

	Temperature			Color
	$^{\circ}\text{K}$	$^{\circ}\text{C}$	$^{\circ}\text{F}$	
Completely cold.	0	-273	-459	Does not emit light
Body temperature.	310	37	99	Infrared
Blowtorch.	4000	3727	6740	Red-hot
Blast furnace.	6000	5727	10,340	White-hot
Hotter still.	7500	7227	13,040	Blue-hot

Black-Body Spectrum

[Fig. 5.10]

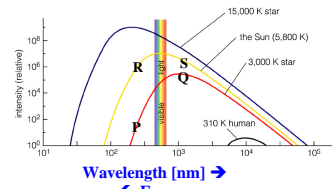


- Intensity distribution depends only on
 - Temperature
 - Emissivity=Light absorbed/Light incident
 - Mirror: $e=0$
 - Black: $e=1$
- Characteristic shape
 - Sharp drop towards higher energy.
 - Slow drop towards lower energy.
- Star is an approximate black body.
 - Sun is an approximate 5800-K black body.
- The Big Bang is an exact 2.7-K black body.
- Peak wavelength given by **Wien's Law**.
 - $\lambda_{\text{max}} = 0.0027\text{m}\cdot\text{K} / T$
 - hotter objects have peak at smaller λ .
- Total energy emitted per *s per unit surface area* is given by **Stefan-Boltzmann Law**:
 - $E = \sigma T^4$
 - Increase with temperature is very steep: factor of 2 for a factor of 1.2 in temperature

[interactive Wien's law](#)

Black-Body Spectrum

[Fig. 5.10]



- Peak wavelength given by **Wien's Law**.

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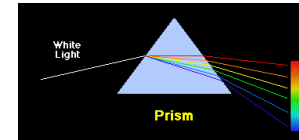
- $E = \sigma T^4$
- Increase with temperature is very steep:
factor of 2 for a factor of 1.2 in temperature

- There is light in a dark room. The plausible reason is
 - It is impossible to cover the windows completely
 - My eyes see blotchy light in a dark room
 - Everything in the room emits infrared light, which our eyes cannot see.
- A hot object emits more infrared radiation than a cool object. An example of this is
 - Q & S
 - P & R
 - R & S
 - R & Q
- S1: A hot star always emits more light than a cool star. S2: The sun is pretty bright at infrared wavelengths of 10,000nm.
 - S1 is true; S2 is true.
 - S1 is true; S2 is false.
 - S1 is false; S2 is true.
 - S1 is false; S2 is false.

[interactive Wien's law](#)

Light is the atom's fingerprint – Spectroscopy

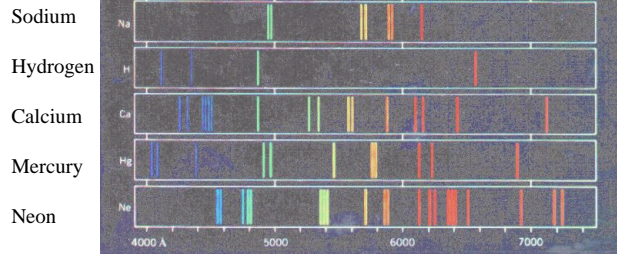
- Spectrograph**. Instrument that measures how bright the light is at each individual wavelength.
 - Prism spreads light by color
 - Grating does the same
- Each element emits a unique set of spectral lines, its fingerprint
 - A spectrum of starlight reveals what elements are in the star.



Detector measures brightness of light at each point in vertical direction.

[demo](#)

Light is the atom's fingerprint



[demo](#)