Introduction to PHY207

Dr. Fly

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Course Objectives

The objectives of this course are to:

1. Guide students to investigate physics problem by designing an experiment.
2. Introduce student different kinds of sensors used in experiment.
3. Train students work together in group to solve a problem.

Course Learning Outcomes

At the end of this course, students will be able to:

1. Adapt an experimental setup to investigate physical problems or scenarios (P5,PLO3)
2. Work together in pairs or a group to plan, setup and implement the experimental investigation (A3, PLO4)
3. Work together in pairs or a group to plan, setup and implement the experimental investigation (A5,PLO5)
4. Construct charts and graphs using graphical software for the analysis of experimental findings(P4,PLO6)
5. Organize a functional team with diverse roles to tackle different aspects of the experimental investigation(A4,PLO8)

Assessment

Method of Assessment	Total
• Instructor's Observation	40%
• Lab Report	30%
• Viva Voce(Progress/Final Presentation)	30%
•	
TOTAL	100%

Roles of group members

Manager: Hosting meeting, Planning project and budget, Purchasing

Engineer: Designing and assembling equipment, setting up and conducting experiment

Programmer: Developing Apps for controlling equipment, collecting and analyzing data,

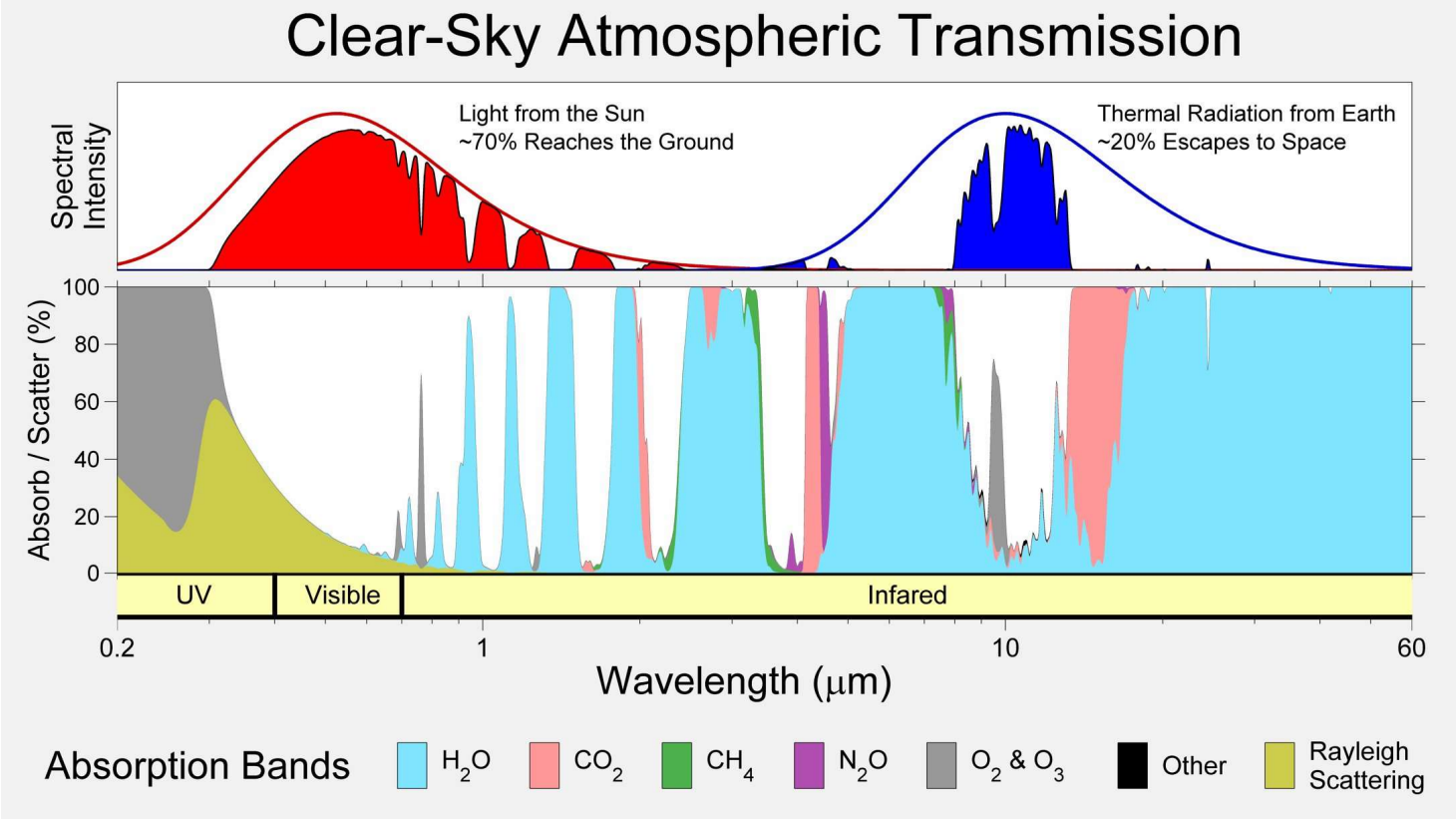
Week 1	**Online meeting** **Introduction to the course and Project** - Spectroscopy and its applications. - Preparation of materials. - Suggestions: 1. Determine the grating constant for different brands of cd or dvd. 2. Beer-Lambert Law 3. Measurement of Planck's constant 4. Absorption spectrum 5. Solar Spectrum
Week 2	Online meeting Microsoft Teams Group meeting 1(~ 30 minutes) - Hosted by each group in English - To brainstorm the project direction - To distribute the work
Week 3	Online meeting Introduction to - Error analysis - Scientific report writing * Each group should have got the essential parts for the project. * Each group can add on any tools or devices subjected to the budget.
Week 4	Online meeting Microsoft Teams Group meeting 2(~ 30 minutes) -Hosted by each group in English - Finalized the project direction with a preliminary design
Week 5	Progress Report -hosted by the lecturer -Students should have all the essential parts and a preliminary design. - Online meeting
Week 6	Microsoft Teams Group meeting 3(~ 30 minutes) -Hosted by each group

Spectroscopy

(Electromagnetism + Modern Physics)

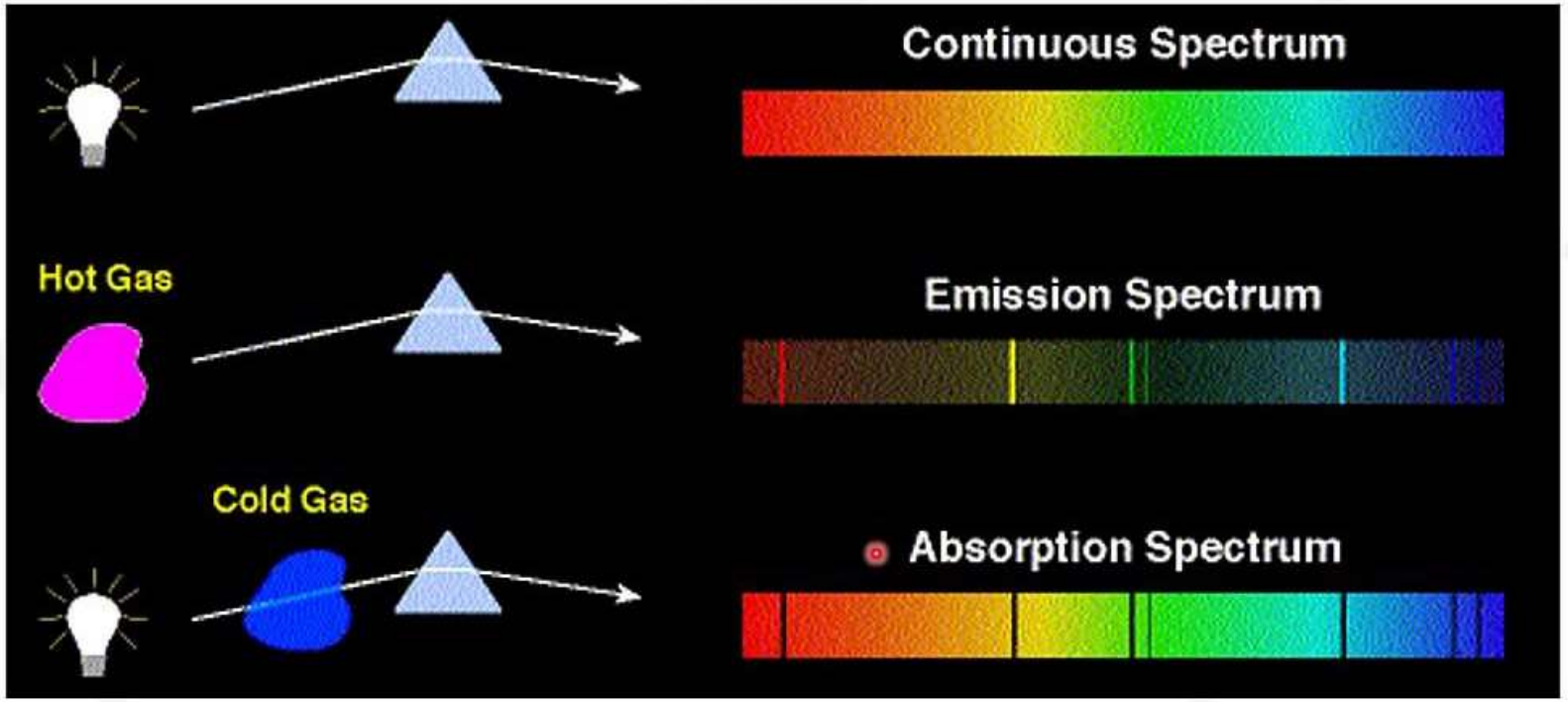
Dr. Fly

Importance of Spectroscopy



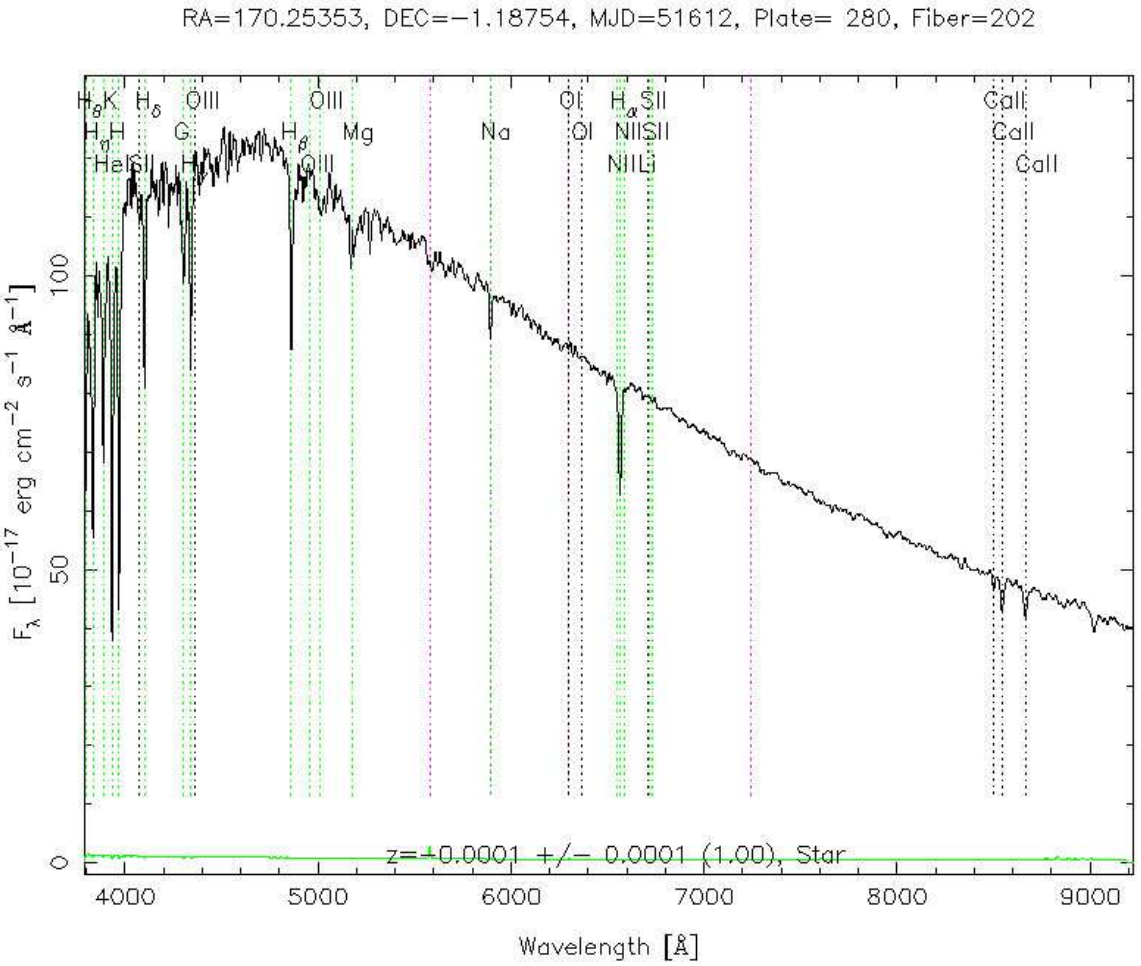
absorption line spectrum - Google

Continuous, emission, and absorption spectra

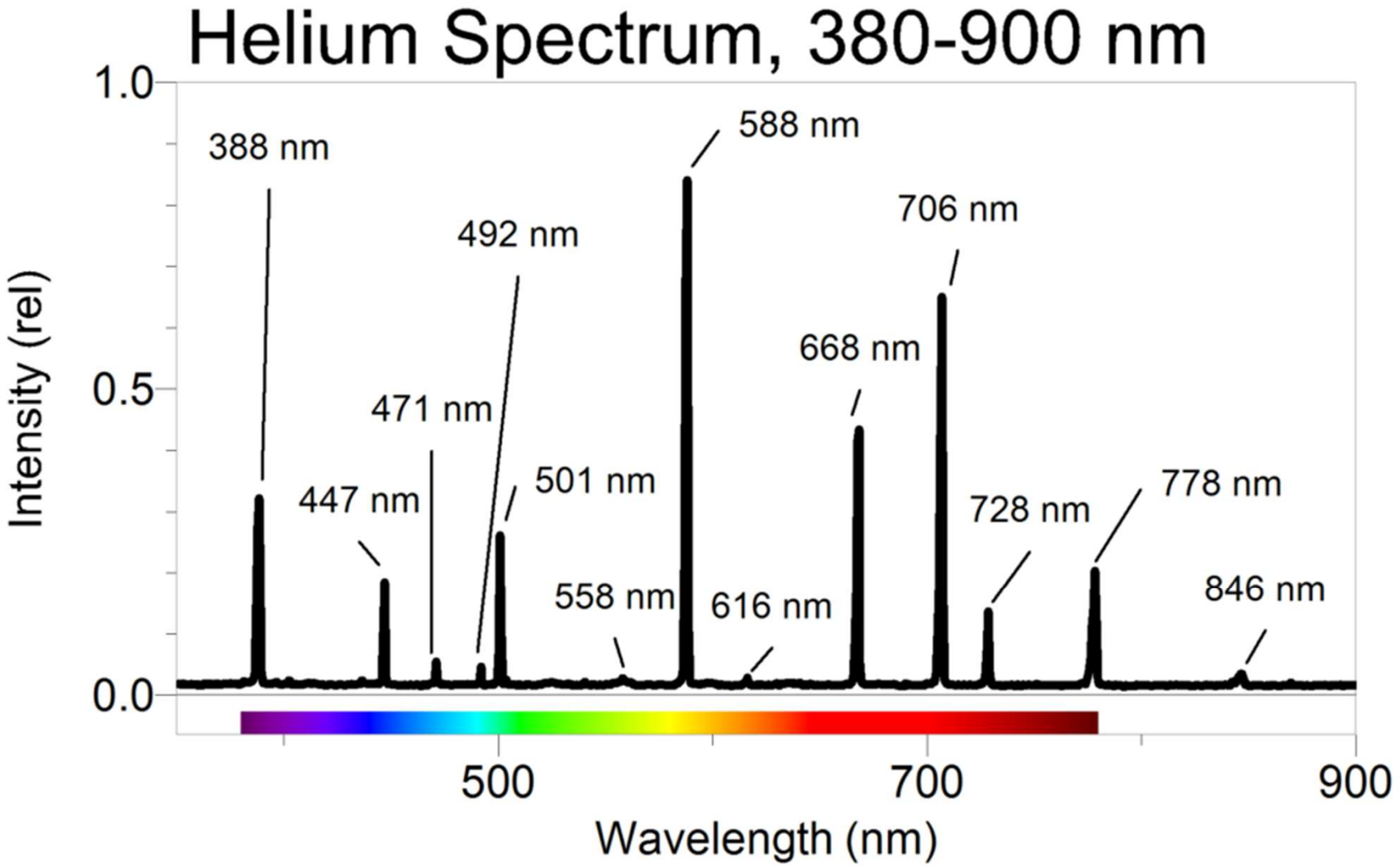


absorption line spectrum - Google

Spectrum of a Star



absorption line spectrum - Google

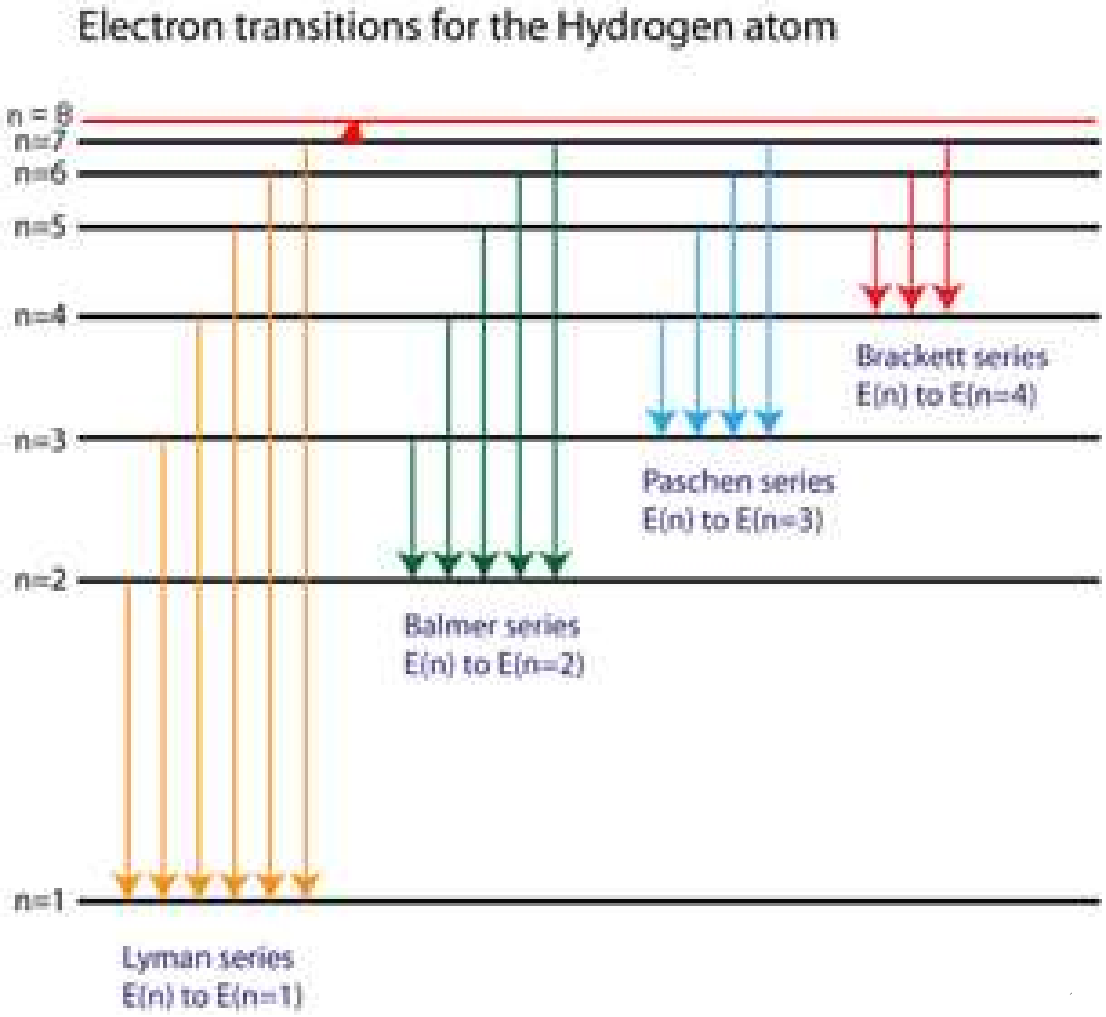


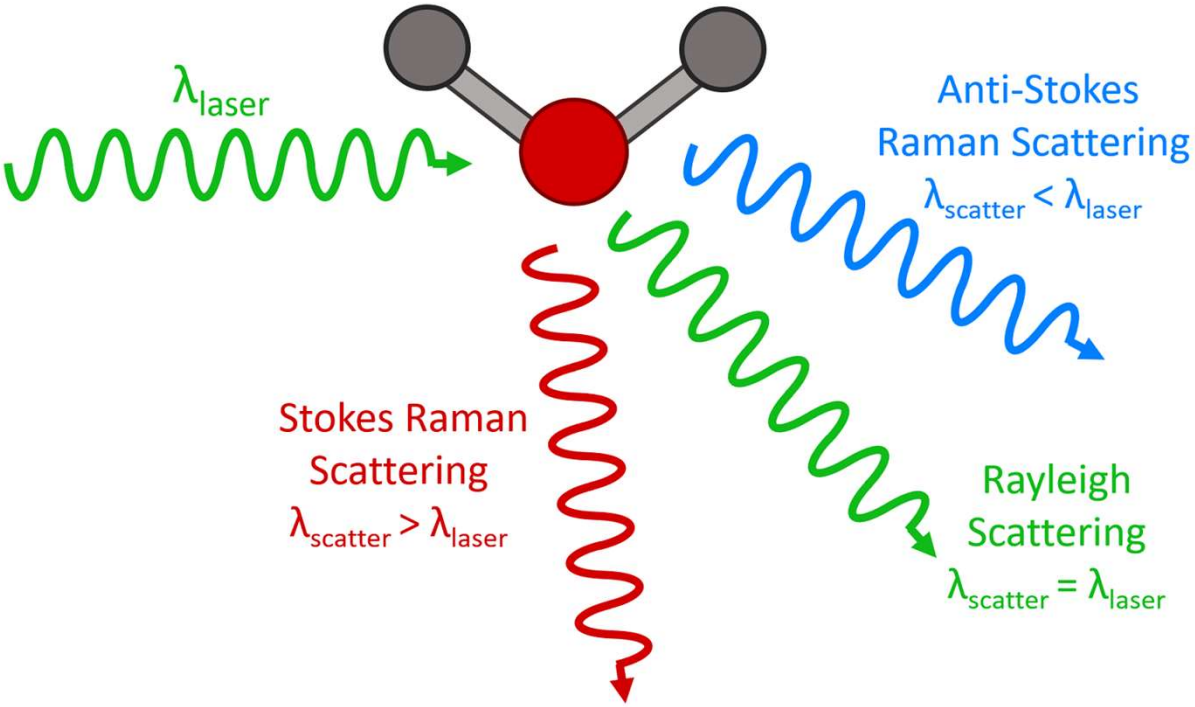
absorption line spectrum - Google

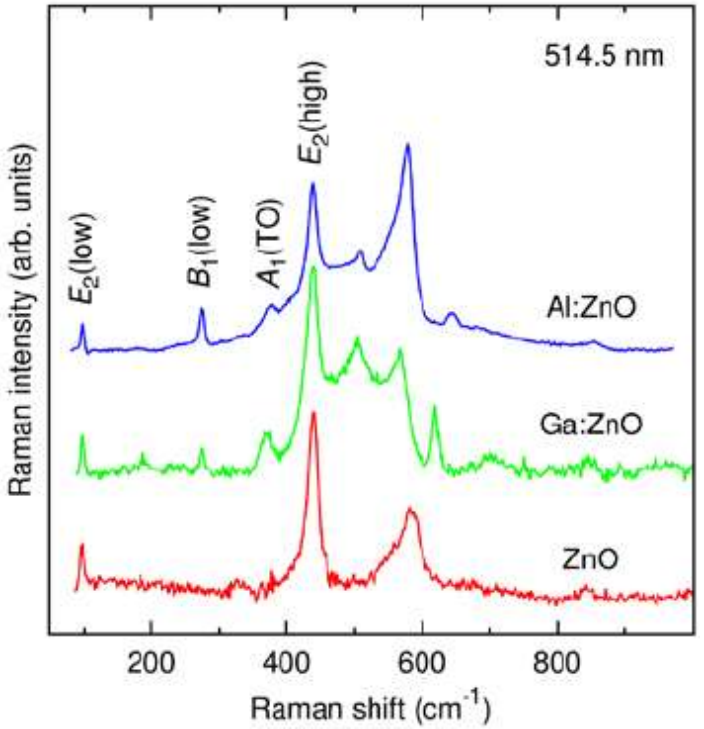
Absorption and Emission

$$L = rmv = \mathrm{n}\hbar$$

$$E = \frac{1}{2}mv^2 - \mathrm{K}\frac{\mathrm{e}^2}{\mathrm{r}} = -\frac{\mathrm{E}_0}{\mathrm{n}^2}$$







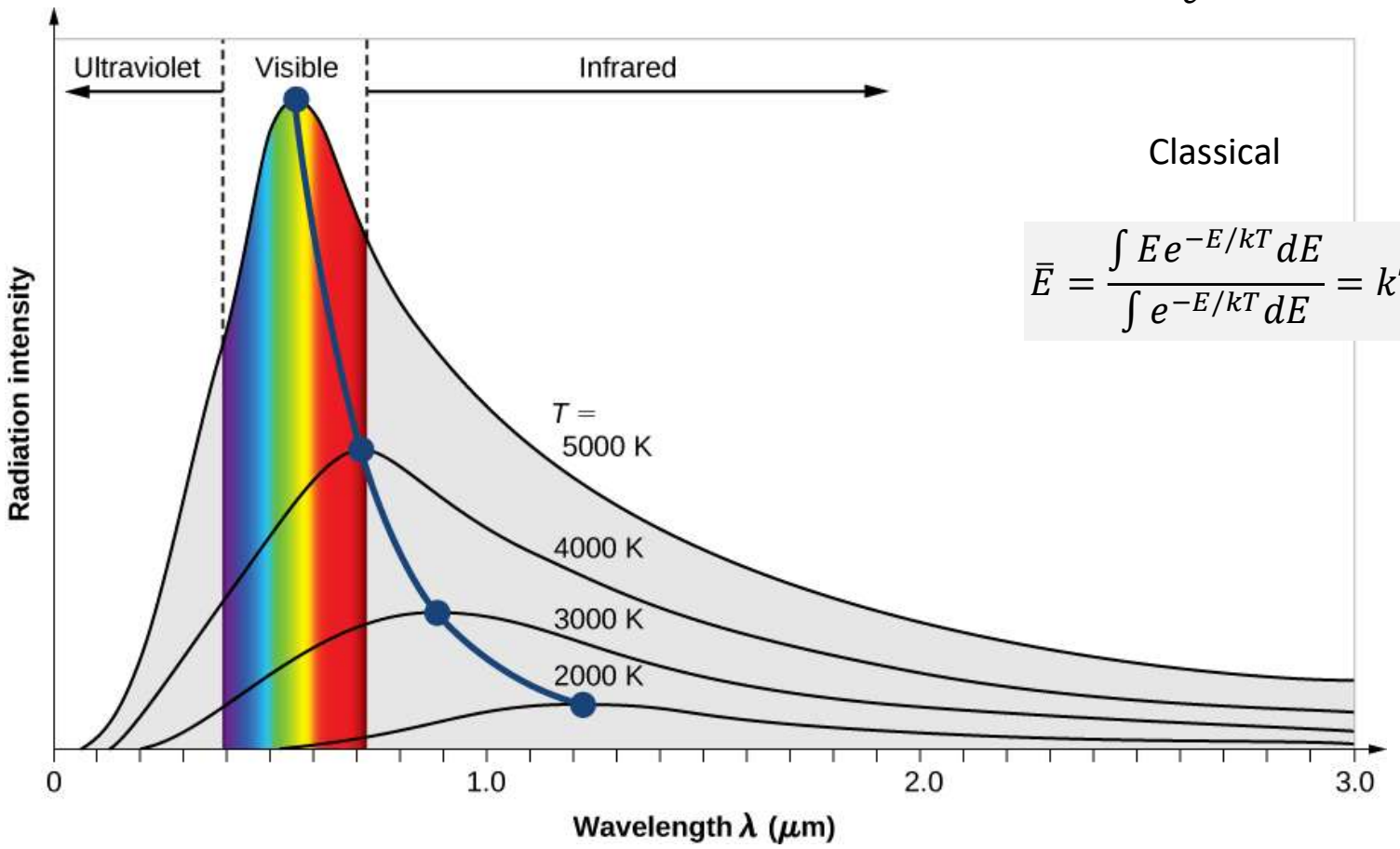
Rayleigh and Raman Scattering

[Nanostructure of ZnO, Ga:ZnO and Al:ZnO films on silicon (researchgate.net)]

Black body spectrum

Number of modes

$$N = \frac{8\pi f^2}{c^3}$$



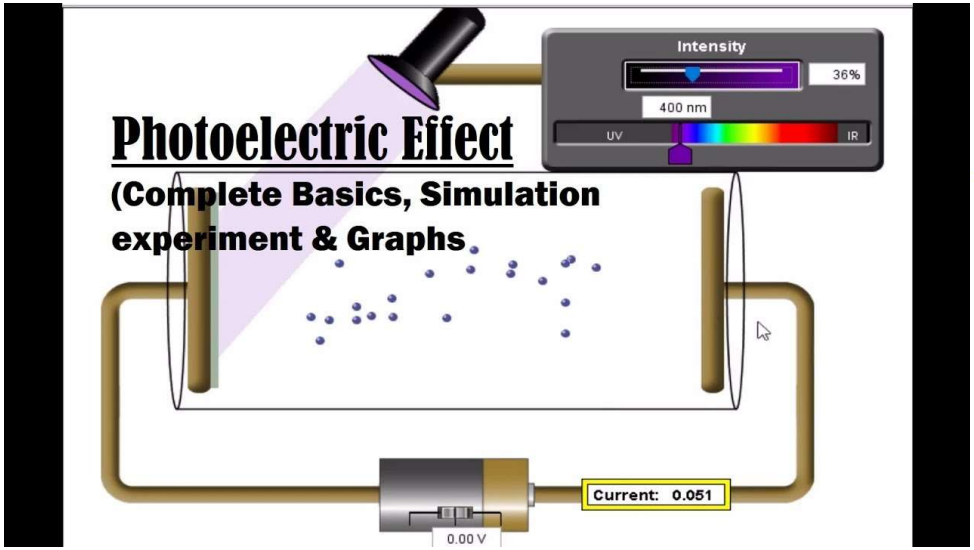
Classical

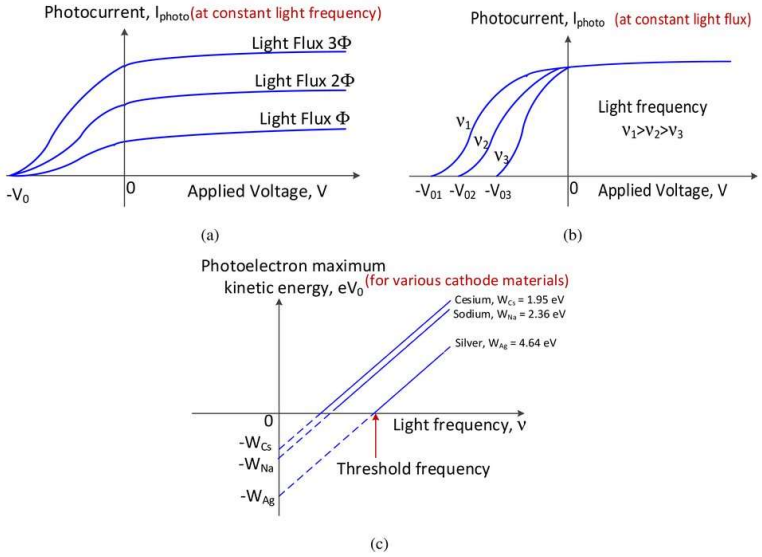
$$\bar{E} = \frac{\int E e^{-E/kT} dE}{\int e^{-E/kT} dE} = kT$$

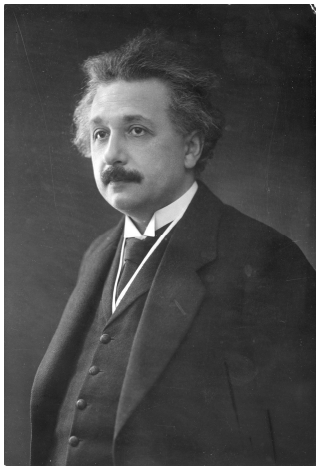
Planck

$$\bar{E} = \frac{\sum nhf e^{-nhf/kT}}{\sum e^{-nhf/kT}} = \frac{hf}{e^{hf/kT} - 1}$$

Photoelectric experiment



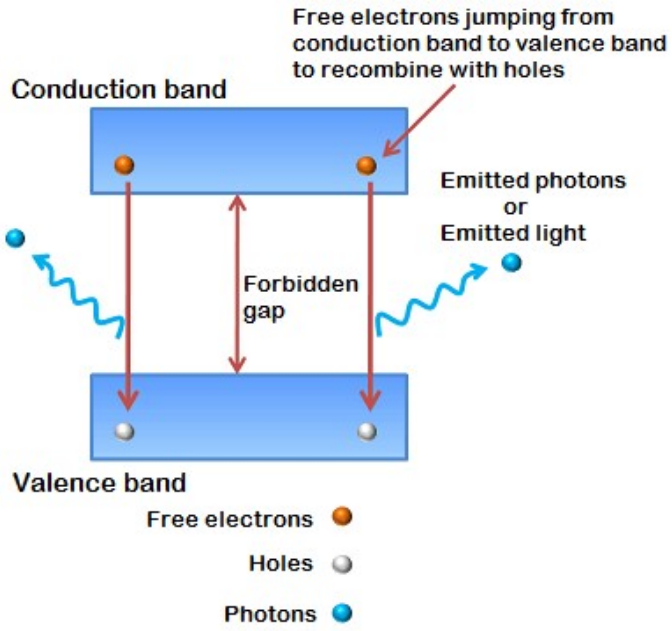




$$eV = hf - W$$

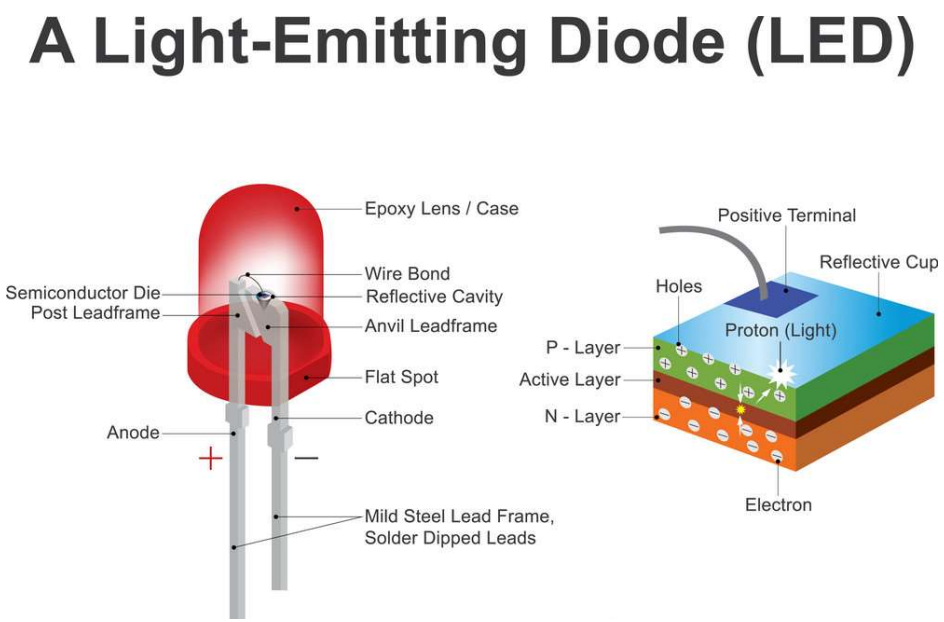
$$h = \frac{\Delta V}{\Delta f}$$

LED

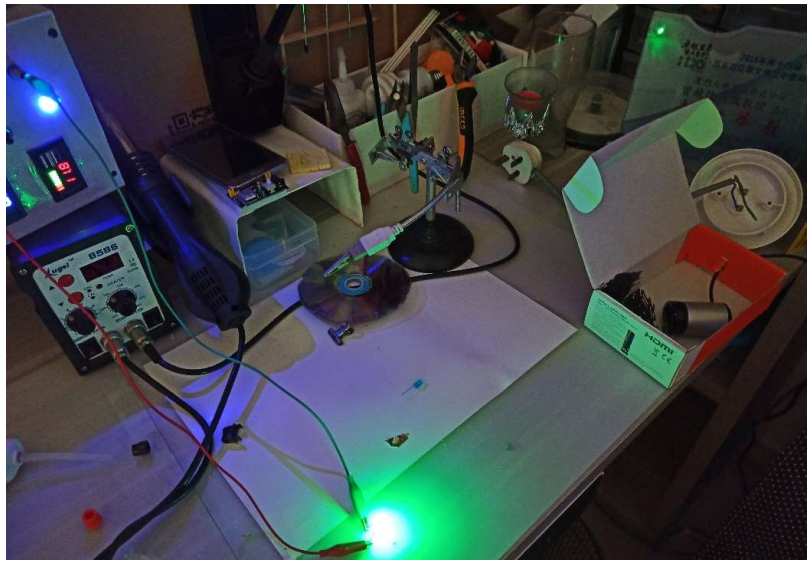


Process of light emission in LED

Physics and Radio-Electronics



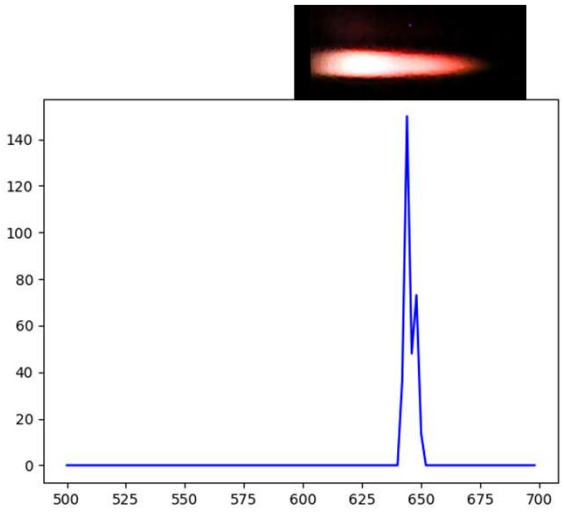
DIY spectrometer

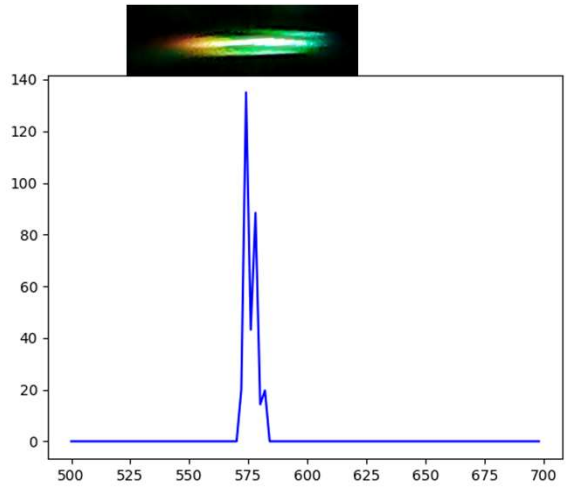


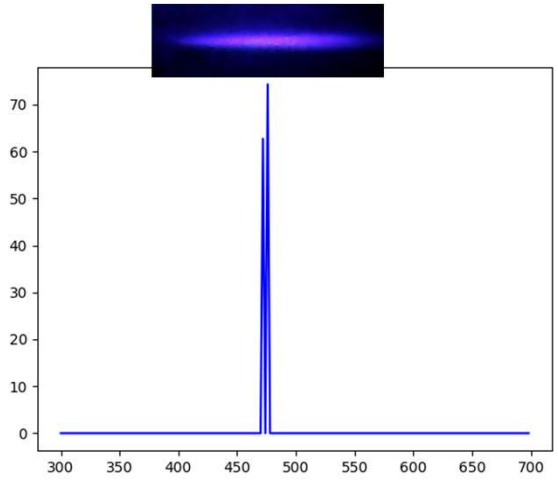
[(54) How to build a spectrometer from the College of Natural Sciences - CSU Online - YouTube]

[(54) DIY Spectrograph - YouTube]

Calibration with LED

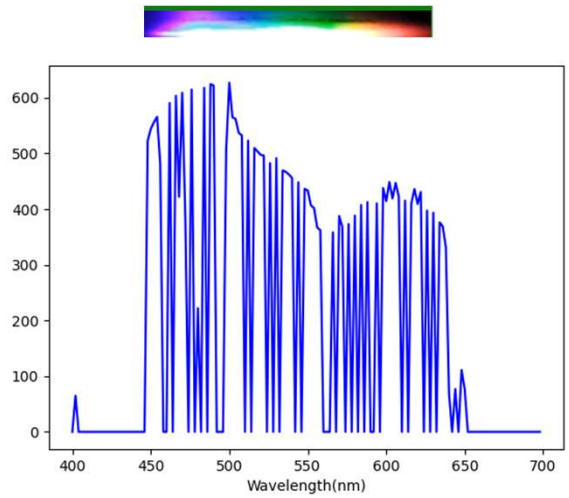




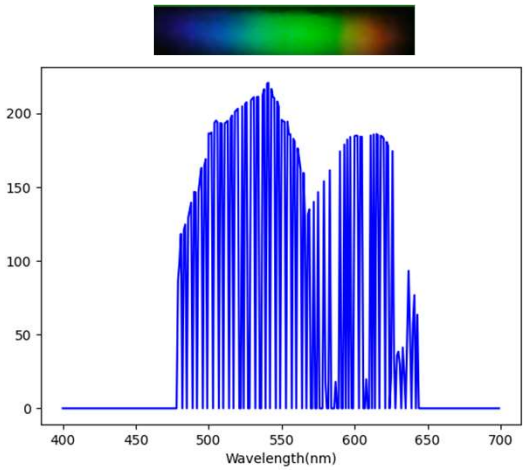


$\mathrm{h} \approx 7.0 \times 10^{-34}\ Js$

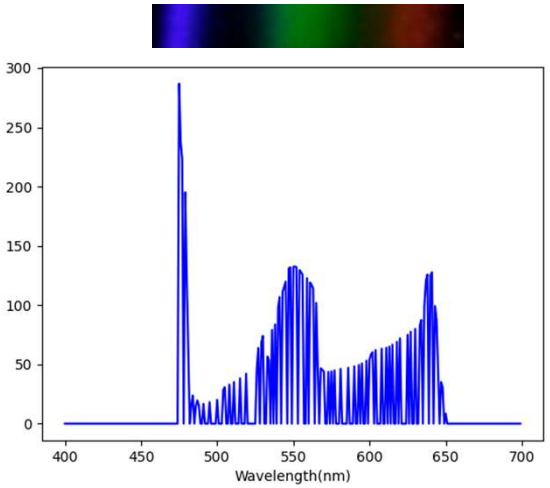
White LED



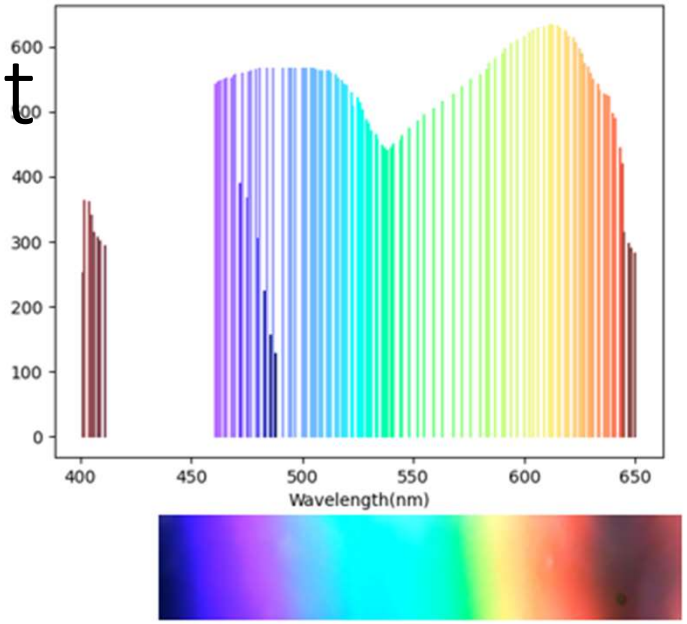
Candle



LED monitor



Sunlight



Solar Panel