November

일	월	화	수	목	금	토
	1 TEST 2	2	3 T2 Review	4	5	6
7	8 Lect. 17,18	9	10 Lect. 19	11	12	13
14	15 Lect. 20,21	16	17 Lect. 22	18	19	20
21	22 Lect. 22,23	23	24 Lect. 24	25	26	27
28	29 TEST 3	30				

December

일	월	화	수	목	금	토
			1 T3 Review	2	3	4
5	6 Presentation	7	8 Presentation	9	10	11
12	13 Presentation	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Final Exams

● English Presentation

Each student is expected to choose a topic related to optoelectronics and make a 15 min. in-class presentation in English. The presentation will be evalued based on following: relevance to the selected topic to the course, the knowledge of the student on the topic, presentation skills. A sign-up sheet is available.

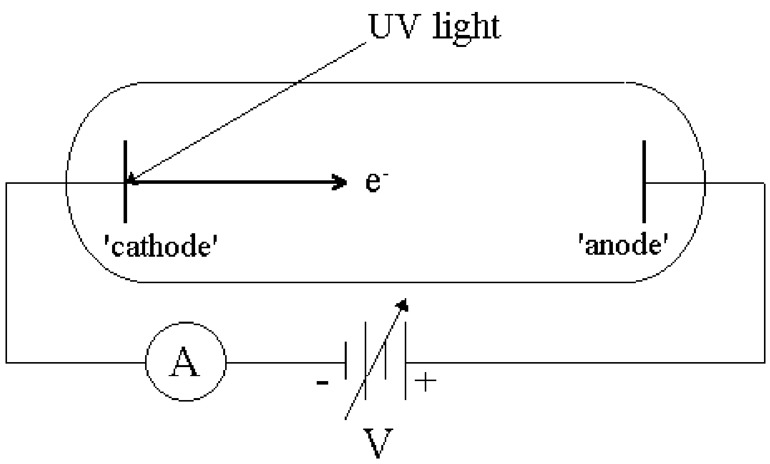
Submission of presentation title and one-paragraph summary required on Nov. 22 (Mon.) during class.

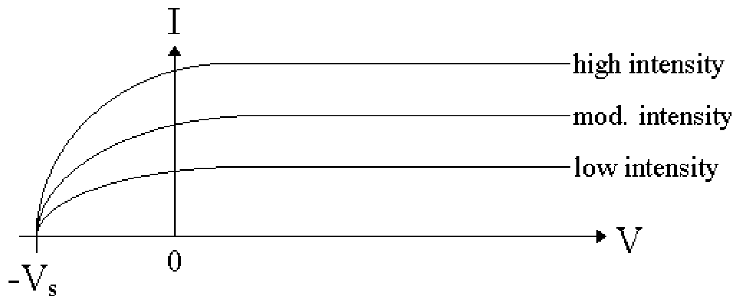
Lect. 17: Light as a Particle (Photon)

Wave properties for light: interference, diffraction, waveguide

But certain things cannot be explained by wave nature of light.

Photoelectron effects: electron emission when light shines on metal





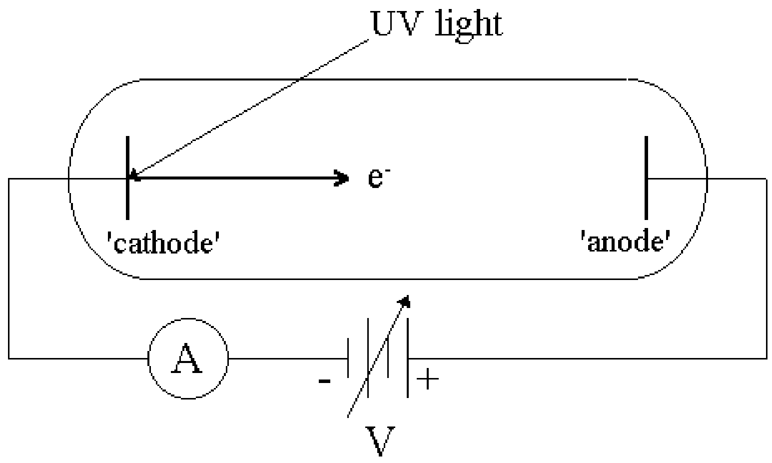
– Amount of emitted electrons depends on light intensity

– Same minimum voltage for current flow regardless of light intensity

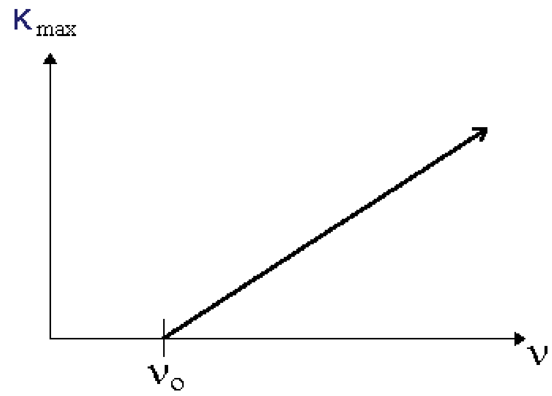
➔ Same max. kinetic energy for emitted electrons regardless of light intensity?

➔ What determines the max. kinetic energy of emitted electrons, or Vs?

Lect. 17: Light as a Particle (Photon)



(Max. kinetic energy of emitted electrons)



This results cannot be explained by wave nature of light.

Einstein's explanation: Light delivers energy in chunks (photon)

$$E_{photon} = h\nu \cong \frac{1.24}{\lambda[\mu m]} \text{ eV}$$

(h: Planck's constant =6.63×10^{-34} Joule-sec)

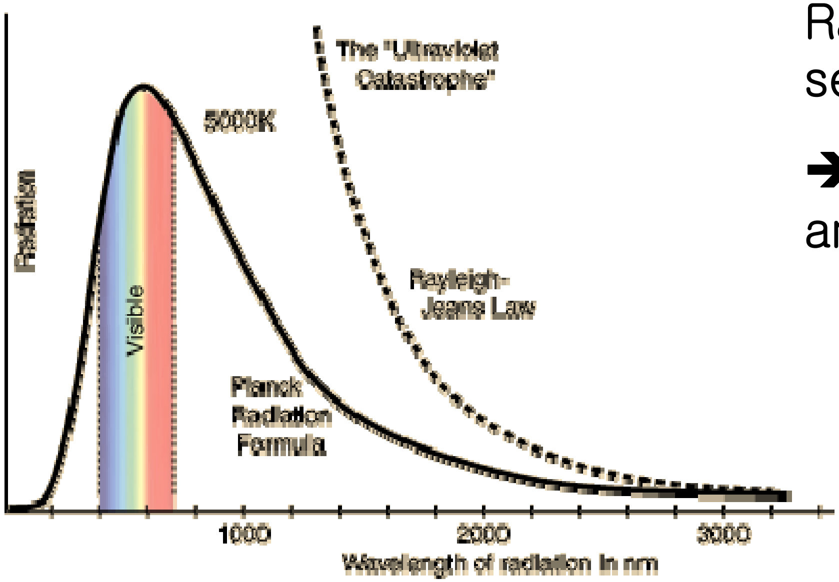
Lect. 17: Light as a Particle (Photon)

The spectrum of light emitted from an heated object

heat => oscillation of charges inside the object => EM radiation (Black Body radiation)

Very detailed analysis is possible for black body radiation (Rayleigh-Jeans Law)

➔ Determines the max. EM emission from a heated object at a given temperature



Rayleigh-Jeans law did not make sense at high frequencies.

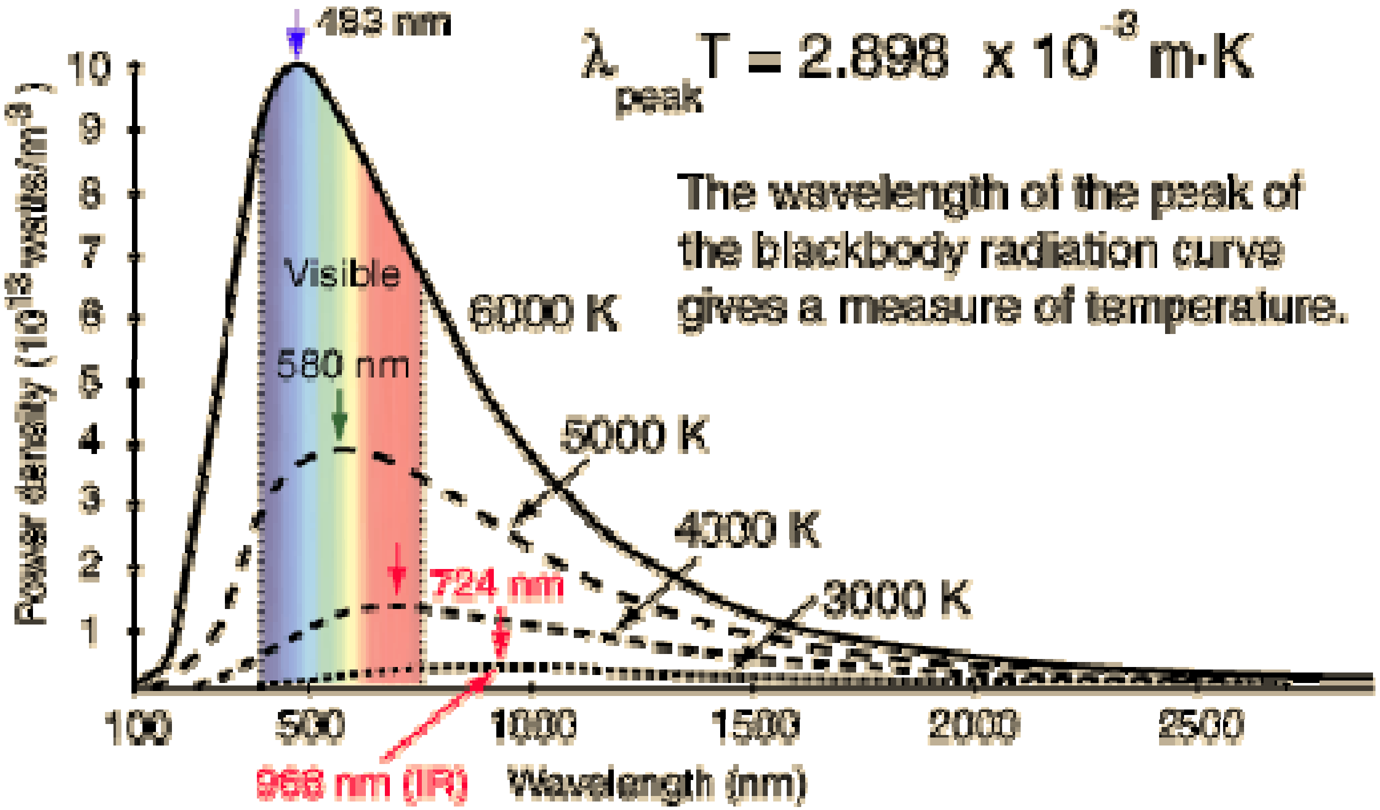
➔ Planck suggested that EM energies are quantized (photon) $E_{photon} = h\nu$.

Classical	Rayleigh-Jeans Law	Planck Law	Quantum
	$\frac{8\pi\nu^2}{c^3} kT$	$\frac{8\pi\nu^2}{c^3} \frac{h\nu}{e^{\frac{h\nu}{kT}}-1}$	

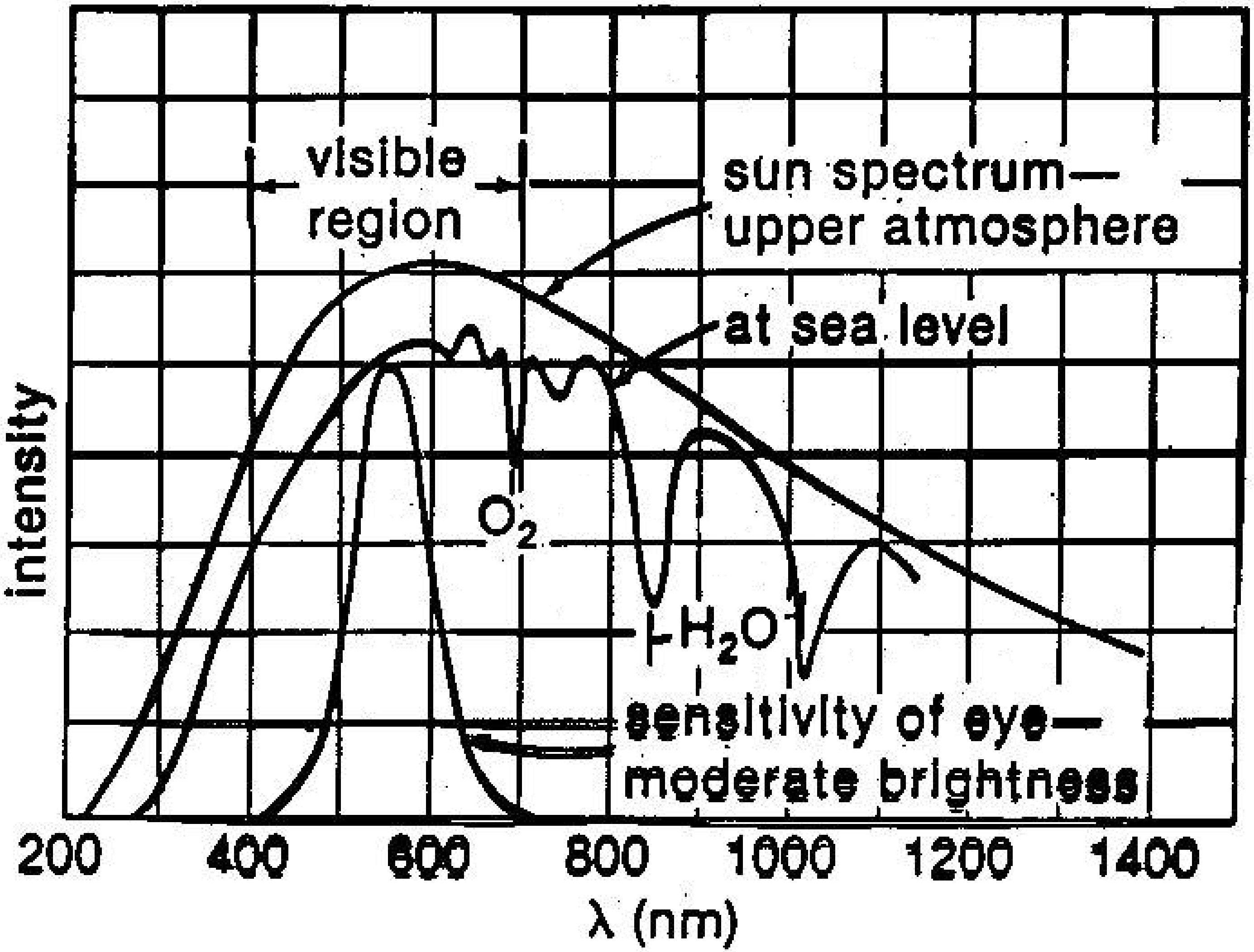
Planck Law approaches R-J Law when $h\nu \ll kT$.

W.-Y. Choi

Lect. 17: Light as a Particle (Photon)

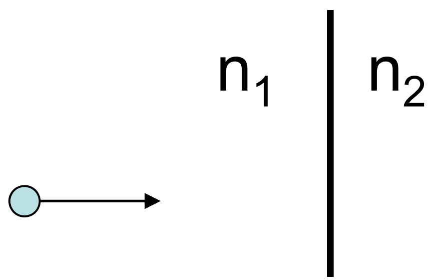


Lect. 17: Light as a Particle (Photon)



Lect. 17: Light as a Particle (Photon)

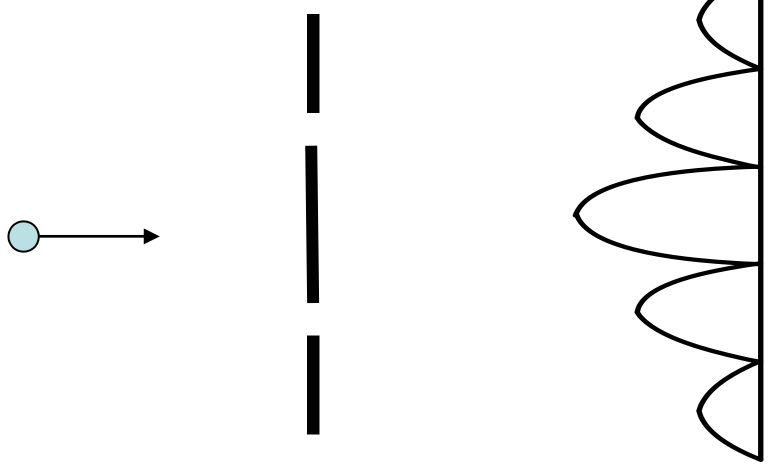
How can photons explain what we have learned: reflection, interference ....



$$R = \left(\frac{n_1 - n_2}{n_1 + n_2}\right)^2$$

Probabilistic Interpretation:

light intensity represents
probability for detecting a photon



We will choose to use whichever (wave or photon) is more convenient to use

Duality can be applied to everything (Quantum Physics)